

# Environmental Sanitation and Incidence of Dengue Hemorrhagic Fever (DHF) in Indonesia

<sup>1</sup>Yulianti, <sup>1</sup>Wuri Ratna Hidayani\*

Corresponding Author: \*[wuri.ratnahidayani@gmail.com](mailto:wuri.ratnahidayani@gmail.com)

<sup>1</sup> Sekolah Tinggi Ilmu Kesehatan Respati, Tasikmalaya, Indonesia

## ARTICLE INFO

## ABSTRACT

### Article history

Received 26 August 2022

Revised 16 October 2022

Accepted 4 December 2022

Dengue Hemorrhagic Fever (DHF) is a disease caused by the dengue virus belonging to the Arthropod-Borne Virus, transmitted through the bite of mosquitoes of the genus *Aedes*, mainly *Aedes aegypti*. The emergence of dengue disease was related to environmental conditions and community behaviour. The research is aimed to know the relationship between ecological sanitation and dengue hemorrhagic fever incidence (DHF) in Indonesia. It was secondary research with a literature review design by searching Google Scholar through the stages of study according to the eligibility criteria. This research found seven journals discussing environmental sanitation related to dengue hemorrhagic fever (DHF) incidence. Of the seven journals discussing water reservoirs, three were for garbage disposal and 4 for 3M plus action. The results showed a relationship between when the variable and the occurrence of dengue hemorrhagic fever (DHF). There was a relationship between environmental sanitation (water storage, garbage disposal, and 3M Plus measures) with the incidence of dengue hemorrhagic fever (DHF).

### Keywords

Dengue Hemorrhagic Fever

Environmental sanitation

Landfill

Garbage

This is an open-access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



## Introduction

Based on the Indonesian Ministry of Health records, cumulatively in Indonesia on June 21 2020, there were 68,753 cases. Then it experienced an increase in the 49th week of 2020. There were 95,893 cases, with a total of 666 deaths. Then as of November 30 2020, there were an additional 51 cases of DHF and 1 case of death spread across 472 districts/cities in 34 provinces in Indonesia. As many as 73.35% or 377 communities/cities have achieved an Incident Rate (IR) of less than 49/100,000 population [1].

The highest proportion of DHF based on the age group of 15-44 years was 37.45%, and the lowest was at the age less than one year of 3.13%. The DHF mortality rate was based on the age group, the highest proportion was aged 5-14 years at 34.13%, and the lowest at age <1 year was 10.32%. There are five regencies/cities (Buleleng, Badung, Bandung City, Sikka, and Gianyar) with the highest dengue cases, namely in Buleleng, with 3,313 people [1].

DHF cases are still a threat of death. Mild dengue fever can cause high fever, rash, and muscle and joint pain. Meanwhile, severe dengue fever, also known as dengue hemorrhagic fever, can cause severe bleeding, a sudden drop in blood pressure, and even death [2]. The government has carried out various control and prevention efforts to reduce the prevalence of DHF so that it is reduced. The Ministry of Health of the Republic of Indonesia developed a strategy to strengthen health services through a family approach by prioritizing promotive and preventive efforts, including efforts to prevent and control arbovirus diseases, especially DHF. PSN movement using the 3M Plus method requires the participation of all levels of society because places that have the potential to become breeding grounds for DHF-transmitting mosquitoes (*Aedes aegypti* and *Aedes albopictus*) are usually found in residential areas both inside and around houses. Therefore the role of the family needs to be increased to monitor, inspect and eradicate larvae. This concept is called "Household *Jumantik* (Larva Monitoring Agent) or One *Jumantik* (Larva Monitoring Agent) One House" [3].

A concrete manifestation of the government's concern for DHF is issuing an appeal to all local governments through a circular letter from the Minister of Health. In a circular on preparedness for an increase in DHF cases, the Minister of Health appealed to local governments to increase community movement efforts to eradicate mosquito nests through draining, closing and reusing used goods, plus preventing mosquito bites (3M plus) by implementing Movement 1 House 1 *Jumantik* (Larva Monitoring Agent) (*Gerakan Satu Rumah Satu Jumantik* or G1R1J). Then increase case surveillance and risk factor surveillance for dengue hemorrhagic fever, including through periodic larva monitoring activities and activating larva monitoring agents (*Jumantik*). Then reactivate the DHF Operational Working Group at various levels, village, sub-district, district/city, and province. Then increase the capacity of resources for prevention and control of DHF, including increasing the capacity of

human resources, costs, and materials and equipment. Then issue a Governor's Circular Letter to the Mayor in the framework of preparedness for an increase in DHF cases.

Implementing the Dengue Infectious Disease Prevention and Control Program is essential because this disease is endemic, a preventive vaccine has not yet been found, and the intermediary vector for this disease is widespread in the community. The Ministry of Health of the Republic of Indonesia urges all levels of society to participate in efforts to prevent the spread of DHF, including by maintaining environmental cleanliness and carrying out minimal mosquito nest eradication (*Pemberantasan Sarang Nyamuk* or PSN) in their respective environments, workplaces, schools and places of worship. To realize this requires commitment and extraordinary efforts from the local government, private sector and community participation to jointly take steps to prevent dengue transmission [4].

Several factors can influence the occurrence of DHF, including physical environmental sanitation, biological environment, and social environment. The physical environment includes the distance between houses, the house's layout, the type of container, altitude, and climate. The biological environment includes many ornamental plants and garden plants. Moreover, the social environment includes the habits of people who pay less attention to environmental cleanliness, such as hanging clothes and cleaning the garbage place or TPA [5].

Environmental sanitation is an effort to control all factors in the physical environment that may cause or can cause things that are detrimental to physical development, health, and human survival [6]. Inappropriate environmental sanitation may be related to the occurrence of DHF, such as water reservoirs that are not cleaned so that they have the potential to become mosquito breeding grounds, the absence of landfills, and the absence of 3M Plus measures.

Ref. [7] revealed that the analysis results show a significant relationship between clean water storage facilities, provision of waste disposal sites, and 3M Plus measures with the incidence of dengue hemorrhagic fever in the Working Area of the Kenali Besar Health Center.

The government reminds all parties to be aware of an increase in dengue cases. The efforts that the government has made in making appeals have been made. However, in reality, the community has yet to fully care about environmental health, especially in eradicating the problem of DHF. A more in-depth study of the relationship between environmental sanitation and the Incidence of DHF in Indonesia is essential to explain this phenomenon. This study aims to explain the relationship between environmental sanitation and the Incidence of DHF in Indonesia. This goal is linked to clean water storage, landfills, and 3M Plus actions.

## **Methods**

This research is a secondary research type of literature review from the results of research in several regions in Indonesia. The selected journal meets the following eligibility criteria:

- The journal is original research, not a literature review, and is published in Indonesian.
- The journal spans the last three years (2018-2020).
- The research location in the journal is conducted in Indonesia.
- The journal search examines the relationship between environmental sanitation and DHF incidents.
- This type of research in journals tests the relationship with the cross-sectional method.

The source of the search for journal references is the online database Google Scholar. The selection of literature that the author will carry out includes the following:

- The keywords used in the search for journals include DHF, Environmental Sanitation, TPA, Garbage, and PSN.
- The researcher then filtered the journals based on the year of publication.
- The researcher then filtered the journals based on location in Indonesia (obtained by reading the title).
- Researchers then filter journals based on research objectives (obtained through reading abstracts).
- The researcher then filtered the journals based on the research method (obtained through reading the abstract).
- Researchers screen journals by reading the entire text.
- Researchers then grouped according to the eligibility criteria.

## **Results**

Journal searches were carried out on the Google Scholar online database with the keywords used in the journal search, namely DHF, Environmental Sanitation, TPA, Garbage, and PSN, with a range of 2018-2020, and found 209 journals. Furthermore, the researcher sorted by the specified eligibility criteria and obtained as many as seven journals that met the criteria. Furthermore, the researcher analyzed according to the eligibility criteria for seven journals. The data is presented in tabular form, which contains: the researcher's name, year of publication, location, journal title, purpose, method, and results.

**Table 1.** Analysis of Literature Search Results

No	Reference	Journal Title	Objectives	Method
1.	Sinta [8]	Relationship between 3M Plus Community Behavior and Dengue Fever Incidence	Knowing the relationship between 3M plus community behaviour and the Incidence of DHF in the working area of the Gambirsari Surakarta Health Center	Using an analytic observational design with a cross-sectional design
2.	Khairiyah [9]	Relationship Between Environmental Sanitation and DHF Incidence in the Work Area of the Karang Mekar Health Center, Banjarmasin City, in 2020	To find out the relationship between environmental sanitation and the Incidence of DHF in the working area of the Karang Mekar Health Center, Banjarmasin City, in 2020.	The research method uses quantitative research with a cross-sectional study approach.
3.	Dompas et al [10]	Are the Physical Environmental Factors of the House Associated with the Incidence of Dengue Hemorrhagic Fever?	Knowing the relationship between the physical environmental factors of the house and the Incidence of DHF in the working area of the East Likupang Health Center	This research is analytically observational, using a cross-sectional research design.
4.	Girsang et al. [11]	Determinants of DHF Mosquito Larvae in Dwikora Village	Knowing the relationship between mosquito nest eradication behaviour (PSN), artificial breeding places, and solid waste with the presence of Aedes aegypti larvae in Environment VIII Dwikora Subdistrict in 2017	The research design used was a cross-sectional study
5.	Sasongko & Sayektiningsih [12]	Factors Associated with the Incidence of Dengue Hemorrhagic Fever (DHF) in Krajan Hamlet, Barurejo	Knowing several factors related to the Incidence of Dengue Hemorrhagic Fever in Krajan Hamlet,	This type of research is analytically observational, using survey methods and

No	Reference	Journal Title	Objectives	Method
		Village, Siliragung District	Barurejo Village, Siliragung District	giving questionnaires with a cross-sectional study approach
6.	Ariyanti et al. [13]	The relationship between 3M Plus Actions and Environmental Factors with DHF Incidence in the Working Area of the Berangas Inpatient Health Center, Alalak District, Barito Kuala Regency in 2020	determine the relationship between 3M Plus actions and environmental factors with the Incidence of DHF in the working area of the Berangas Inpatient Health Center, Alalak District, Barito Kuala Regency, in 2020	Analytic survey research method with the cross-sectional approach
7.	Fatimah et al. [14]	The Relationship between Knowledge and Actions of 3M Plus and the Incidence of Dengue Hemorrhagic Fever (DHF) in the Work Area of the Cempaka Putih Health Center, Banjarmasin City, in 2020	Knowing the relationship between Knowledge and Actions of 3M Plus with the Incidence of Dengue Hemorrhagic Fever (DHF)	This type of research uses an analytic survey research design with a cross-sectional approach design

## Discussion

### A. Relationship Between Clean Water Reservoirs and Dengue Hemorrhagic Fever (DHF)

Clean water reservoirs are essential and must always be considered. Routine drainage must always be carried out at least two times a week so that cleanliness is always maintained and does not become a breeding ground for *Aedes aegypti* mosquitoes. Most people who have experienced DHF incidents have a water reservoir but do not meet the requirements, or the containers are rarely drained. The existence of containers or water reservoirs in the home environment will significantly contribute to the density of *Aedes aegypti* mosquito larvae because the more containers or water reservoirs, the more breeding places and the denser the population of mosquitoes for breeding. The denser the population of *Aedes* mosquitoes, the higher the risk of being infected with the dengue hemorrhagic fever virus (DHF) with a faster spread time [15]. Based on the results of the review, it is known that from the seven journals reviewed three journals discussed TPA, and the three journals stated that there was a relationship between clean water reservoirs and the Incidence of Dengue Hemorrhagic Fever (DHF).

The first research was conducted by Ref. [9] in the Working Area of the Karang Mekar Community Health Center, Banjarmasin City. The results of his research stated that there was a relationship between water reservoirs and the Incidence of DHF in the Working Area of the Karang Mekar Health Center with a *p-value* = 0.032 less than a significance  $p = 0.05$ . It is known that from a sample of 87 respondents in the Working Area of the Karang Mekar Health Center, 81 people or 77.6% of respondents, had a water reservoir that did not meet the requirements and as many as six people or 22.4% of respondents who had a water reservoir had met the requirements.

The second study was conducted by Ref. [10] in the Working Area of the East Likupang Health Center, North Minahasa Regency. The results stated that the water reservoirs with the incidence of DHF obtained a *p-value* of 0.002. It means that there is a relationship between the water reservoirs and the Incidence of DHF because the *p-value* is  $<0.05$ . The OR (Odds Ratio) value obtained is 6.417. This finding shows that respondents who have a water reservoir and do not meet the requirements can be 6.417 times more likely to get DHF.

The third study conducted by Ref. [13] in the Working Area of the Berangas Inpatient Health Center, Alalak District, Barito Kuala Regency, stated that there was a relationship between the presence of a water reservoir (TPA) and the Incidence of DHF (*p-value* = 0.000). Water reservoirs are one of the factors that have an essential role in the high and low Incidence of DHF in an area. If the water reservoir is not considered, the water's cleanliness and the container's appropriateness will become a breeding ground for *Aedes Aegypti* mosquitoes, the primary vector of Dengue Hemorrhagic Fever (DHF). Dengue fever is transmitted to humans through the bite of a female *Aedes* mosquito infected with the dengue virus. Dengue-transmitting mosquitoes are found in almost all corners of Indonesia except in places with an altitude of more than 1000 meters above sea level [4].

Ref. [13] stated that there is a relationship between the existence of a water reservoir (TPA) and the Incidence of DHF in the Working Area of the Berangas Inpatient Health Center, Alalak District, Barito Kuala Regency in 2020. A water reservoir is one of the most potential breeding grounds for *Aedes* sp mosquitoes. Draining water reservoirs more than once a week can allow *Aedes* sp eggs to become adult mosquitoes. Meanwhile, we know that egg development in adult mosquitoes ranges from 7-14 days. The *Aedes aegypti* mosquito prefers to lay its eggs in water reservoirs that are indoors rather than outdoors. Dark indoor conditions cause this, making the air more humid. Dark and humid conditions will provide a sense of security and calm for mosquitoes to lay eggs. So the *Aedes aegypti* mosquito will lay more eggs, and the number of

larvae will automatically increase. The dark atmosphere in the room will cause the larvae to become invisible, making it difficult to clean [16].

According to Ref. [17], the environment where the *Aedes aegypti* mosquito breeds are clean water that is not in direct contact with the ground and is not exposed to direct sunlight. The existence of used goods such as used tires, bottles, plastics, and other items that can hold water is a means that can make it possible for mosquitoes to breed. The more used goods that can hold water, the more places for mosquitoes to lay eggs and breed, which can further increase the risk of DHF incidents.

This is in line with Ref. [7]. Based on the results of the research analysis, it was stated that there was a significant relationship between clean water reservoirs and the incidence of dengue hemorrhagic fever (DHF) in the Kenali Besar Health Center Work Area with  $p\text{-value} = 0.006$  ( $p \leq 0.05$ ). Water reservoirs are one of the factors that play an essential role in the high and low Incidence of DHF in an area. Suppose the water reservoir does not pay attention to the water's cleanliness and the container's feasibility. In that case, it will become a breeding ground for the *Aedes aegypti* mosquito, the leading cause of DHF. Dengue fever is transmitted to humans through the bite of a female *Aedes* mosquito infected with the dengue virus [9].

If a person has a clean water reservoir with poor quality, he will have a 3.6 times greater risk of contracting DHF than respondents with suitable quality water reservoirs. In addition, if the respondent has poor drainage of the water reservoir, there is a 4.09 times greater risk of contracting DHF than respondents with good drainage of the TPA. Factors such as temperature and nutrient content in broodstock influence the development speed. During optimum conditions, the eggs will drip into larvae within 1-2 days. Then the larvae become pupae within 4-9 days; then the pupa becomes an adult mosquito which takes 2-3 days. This is in line with other studies showing a significant relationship between the cleanliness of water reservoirs and the presence of mosquito larvae. The water reservoir's cleanliness is related to drain it, which is carried out at least once a week. Drainage, in this case, is cleaning water reservoirs by brushing and replacing TPA water with clean water [18].

In their research by Ref. [13], it is known that most of the respondents have water reservoirs, both inside and outside the house, where mosquito larvae are present. In addition, it is supported by the lack of someone's 3M Plus action to maintain the cleanliness of water reservoirs which will cause people to experience dengue incidents. The water reservoir used by most respondents was in the form of a bathtub made of cement, open and lacking in lighting. Water reservoirs that have no lid and are protected from sunlight are places favoured by the *Aedes aegypti* mosquito. Therefore, preventive measures should be taken, namely by diligently draining the water reservoirs at least once a week so that mosquitoes do not breed.

Because if you drain the water reservoir more than once a week will give the eggs a chance to breed into adult mosquitoes.

Based on the analysis of the three journals, it can be concluded that variable water storage (TPA) has a direct relationship with the Incidence of Dengue Hemorrhagic Fever (DHF). TPA, one of the environmental sanitation variables, cannot be separated from a clean and healthy life. The *Aedes aegypti* mosquito, as a vector for dengue fever, prefers to live and breed in clean standing water in landfills. The more landfills, the greater the potential for DHF vector mosquitoes to breed and the denser the population. It is known that the dengue vector mosquito lays its eggs in standing water in used cans, water reservoirs, bathtubs, used tires and so on. The *Aedes aegypti* mosquito prefers indoor TPA because indoor conditions are dark, so the air is more humid. Dark and humid conditions will provide a sense of security and calm for mosquitoes to lay eggs. So the *Aedes aegypti* mosquito will lay more eggs, and the number of larvae that will form will be increased. The dark atmosphere in the room will cause the larvae to become invisible, making it difficult to clean [16].

The researcher recommends that the community should always carry out regular TPA cleaning activities at least once a week so that there is no opportunity for mosquitoes to breed. Apart from that, people can sprinkle abate powder on water and close water reservoirs (TPA) to prevent the emergence of mosquito larvae. As for the government, to improve coordination with the community and cadres in checking mosquito larvae regularly by maximizing the defence program so that it can eradicate the DHF vector. Then for health workers, it is necessary to pay attention to the community's knowledge, attitudes and practices regarding DHF prevention by conducting regular and equitable education and participating directly in the field in examining larvae and eradicating mosquito nests.

## **B. Relationship Between Garbage Disposal Sites and Dengue Hemorrhagic Fever (DHF)**

Garbage disposal is an important place and must be considered to prevent the occurrence of DHF. Garbage dumps can be a resting place for *Aedes aegypti* mosquitoes. Whether or not waste management is present will significantly affect the Incidence of DHF because waste not sorted between organic and inorganic, which is then immediately disposed of in the yard, will create stagnant water which mosquitoes can use to lay their eggs [19]. Inorganic waste such as plastic, metal, glass, used beverage cans, etc., when not managed and disposed of carelessly, will have the potential to collect water and become a breeding ground for mosquitoes.

In order to prevent used items from becoming breeding grounds for *Aedes aegypti* mosquitoes, we can eradicate them by burying or burning them and by recycling these used items. These include: Reduce, namely reducing the use of products that will generate waste.

Reuse is to reuse, sell or donate items that can still be used. Recycle, namely recycling waste to be changed into new goods. Many breeding places in the form of water reservoirs are due to poor solid waste management. Garbage that is not managed correctly, for example, used glass or cans. If the waste is disposed of carelessly, it can collect water which is a breeding ground for mosquitoes [20].

According to WHO, vector control efforts must encourage effective waste management and pay attention to the environment around us by increasing the basic rules of reducing, reusing and recycling. Solid, dry waste such as cans, bottles, buckets or the like that are scattered around the house must be removed immediately and preferably buried in the ground. Then house equipment and garden tools such as buckets, bowls and sprinklers must be stored upside down to prevent rainwater from being collected. Furthermore, used car tires are the main breeding ground for *Aedes aegypti* mosquitoes in urban areas, so the presence of used tires around the house will cause health problems. The results of the study from the seven journals reviewed two journals discussed waste disposal sites, and the two journals stated that there was a relationship between landfills and the Incidence of Dengue Hemorrhagic Fever (DHF).

Ref. [9] stated that the *p-value* = 0.15 less than the significance of  $p = 0.05$ , which means that there is a relationship between the respondents' garbage dumps and the Incidence of DHF in the working area of the Karang Mekar Health Center. There are several environmental factors in the working area of the Karang Mekar Health Center. Environmental factors related to the DHF case include the first, namely the condition of the environment where there are many slum residents' houses and under the slum residents' houses. There is a lot of garbage which then collects water, and the larvae live there. Secondly, there is a water reservoir usually in front of residents' houses which will provide opportunities for mosquito larvae to live there; third, the bathtub is rarely drained because they love that the water is still clean.

The home environment is the closest thing to our daily lives, which of course, if it is not taken care of properly, will become a problem. Dengue fever vector mosquitoes usually breed in stagnant rainwater, which then pools in used containers such as cans or other things that can hold water. The home environment should be clean and protected from anything that can collect rainwater which, of course, will become a breeding ground for the *Aedes aegypti* mosquito, which is the cause of dengue fever. This is in line with Ref. [7] stated that there was a significant relationship between the provision of landfills and the incidence of dengue hemorrhagic fever in the Kenali Besar Health Center Work Area, Jambi City, with a value ( $p$ -value=0.002;  $p \leq 0.05$ ). Vector control efforts should promote effective and environmentally responsible waste handling by enhancing the essential reduce, reuse and recycling rules.

The second study was conducted by Ref. [10] in the Working Area of the East Likupang Health Center, North Minahasa Regency. The results of his research stated that the test of the relationship between garbage dumps and DHF incidents obtained a p-value of 0.002, which means there is a relationship between garbage dumps and DHF incidents in the Work Area of the East Likupang Health Center. Garbage disposal is very vulnerable to becoming a breeding ground for bacteria and viruses and can even become a breeding ground for *Aedes aegypti* mosquitoes. It should be noted that there is no stagnant water in the trash can, which is a breeding ground for mosquitoes. Garbage such as used cans, bottles, drums, and used tires can become a breeding ground for *Aedes aegypti* mosquitoes because these used items can hold water or become puddles if waste management is not carried out correctly and adequately [9].

The incidence of DHF is very closely related to environmental factors that lead to the availability of breeding places for the *Aedes aegypti* mosquito vector. Breeding Place is a factor that can support the increase in dengue vectors. The more places for mosquitoes to lay eggs and breed, the risk of DHF incidents will also increase [21]. Many breeding places in the form of water reservoirs are due to poor solid waste management. In this case, the garbage that is not appropriately managed is used as drinking glasses or cans. If disposed of carelessly, it can hold water which will later become a breeding ground for mosquitoes.

Garbage is closely related to public health because, from this waste, various micro-organisms that cause disease and insects as disease vectors will live. The most dangerous waste is inorganic waste, which cannot or is difficult to decompose. One of the inorganic waste that is a problem is containers made of plastic. Plastic waste is one type of waste that is classified based on the chemicals contained in it, which generally do not decompose. Plastic material is an organic material that bacteria cannot decompose. Plastic waste is a problem that is considered severe for environmental pollution, especially for the risk of disease.

Based on the analysis of research results from the two journals compared to the theory above, it can be concluded that the variable landfills have a direct relationship with the Incidence of Dengue Hemorrhagic Fever (DHF). Garbage disposal is essential to pay attention to. Garbage, such as used cans, bottles, drums, and tires, can become breeding grounds for the *Aedes aegypti* mosquito. This is because these used goods can hold water if waste management is not carried out properly and correctly. One of the inorganic waste that is a problem is containers made of plastic. Plastic waste is one type of waste that is classified based on the chemicals contained in it, which generally do not decompose. Dengue fever mosquitoes usually breed in stagnant rainwater, which pools in used containers such as cans or other things that can hold water.

The community should carry out activities to clean trash bins regularly and check used items around the house. It could be that there are used items that can collect rainwater, which can then cause stagnant water so that *Aedes aegypti* mosquito breed. Then the government should emphasize policies and sanctions for those who do not comply with existing regulations. As well as for health workers, it is better to continue to educate the public regarding the importance of keeping the environment clean. So that we avoid various diseases, especially DHF and community empowerment in efforts to process waste, it does not become a breeding ground for DHF vectors.

### **C. Relationship Between 3M Plus Actions and Dengue Hemorrhagic Fever (DHF) Incidence**

The 3M Plus action is a community and government activity to prevent and control DHF by continuously and continuously eradicating mosquito nests. The 3M Plus movement effectively prevents dengue and demonstrates environmental cleanliness and healthy living behaviour. DHF PSN activities can be carried out chemically and biologically. This method is not much that can be done. Chemically, DHF PSN is carried out by sprinkling abate powder on water reservoirs. However, Abate powder cannot be obtained easily, so it cannot be carried out chemically. Of course, this can also increase the risk for *Aedes aegypti* mosquito larvae to live and breed in water reservoirs. DHF PSN is biologically carried out by keeping fish in water reservoirs.

3M plus activities consist of draining bathtubs, closing water reservoirs, burying or recycling used goods plus (plus) sprinkling abate powder on TPA, changing the water in flower vases, bird drinking places or other places once a week, repairing channels and gutters that are not smooth/damaged, avoiding the habit of hanging clothes in the room, seeking adequate lighting and room ventilation and using mosquito nets and using drugs that can prevent *Aedes aegypti* mosquito bites. Based on the results of the review, it is known that from the seven journals reviewed included four journals that discussed 3M Plus actions. All of these four journals stated that there was a relationship between 3M Plus actions and the Incidence of Dengue Hemorrhagic Fever (DHF).

The research was conducted by Ref. [8] in the working area of the Gambirsari Surakarta Health Center. The results of his research stated that the results of statistical tests to find out the relationship between 3M plus community behaviour and the Incidence of DHF in the Working Area of the Gambirsari Surakarta Health Center in 2015 obtained a p-value = 0.000 < 0.05 and rs = 0.515. The value of rs = 0.515 is included in the range of a strong correlation coefficient so that H1 is accepted. This means that there was a relationship between 3M plus community behaviour and the Incidence of DHF in the Working Area of the Gambirsari

Surakarta Health Center in 2015. The Working Area of the Gambirsari Surakarta Health Center is a densely populated residential area. In densely populated settlements, the potential for easy transmission of infectious diseases is relatively large, especially if it is not accompanied by adequate understanding and knowledge about disease prevention, including preventing the spread of dengue disease with 3M plus.

The study conducted by Ref. [12] in Krajan Hamlet, Barurejo Village, Siliragung District found that there was a relationship between PSN activities and the Incidence of DHF in Krajan Hamlet, Barurejo Village, Siliragung District, with  $p = 0.01$  and ( $p < 0.05$ ). This is because, in general, mosquitoes lay their eggs on the walls of the water reservoir. Therefore, when draining or cleaning the water reservoir, it is advisable to scrub or brush the walls.

The third study conducted by Ref. [13] with the research title "The Relationship between 3M Plus Actions and Environmental Factors with DHF Incidence in the Work Area of the Berangas Inpatient Health Center, Alalak District, Barito Kuala Regency in 2020". The results stated that the statistical test with the Chi-square test obtained a  $p$ -value =  $0.000 < \alpha 0.05$ , meaning that statistically, there is a relationship between 3M Plus and the Incidence of DHF in the working area of the Berangas Inpatient Health Center, Alalak District, Barito Kuala Regency in 2020.

The fourth study conducted by Fatimah et al. (2020) with the research title "Relationship of 3M Plus Knowledge and Actions with the Incidence of Dengue Hemorrhagic Fever (DHF) in the Working Area of the Cempaka Putih Health Center, Banjarmasin City in 2020". The results of his research stated that the statistics using the Chi-square test between the 3M action variable plus the DHF incident obtained a  $p = 0.009 < \text{the value of } \alpha = 0.05$ , so  $H_0$  was rejected. This means that there is a significant relationship between the actions of 3M Plus and the Incidence of DHF in the Work Area of the Cempaka Putih Health Center, Banjarmasin City, in 2020. According to the data obtained, it is known that the actions of 3M plus respondents in the work area of the Cempaka Putih Health Center, Banjarmasin City, are in a suitable category. However, there is still someone who is not good at paying attention to their environment. It includes checking body temperature if a family member is suspected of having dengue disease and carrying out abatization activities, 3M activities, and waste management.

This is in line with the research of Ref. [7], which stated that there was a significant relationship between 3M Plus measures and the incidence of dengue hemorrhagic fever in the Kenali Besar Health Center Work Area, Jambi City, with a value ( $p$ -value =  $0.048 p \leq 0.05$ ). Then it is supported by a theory stating that community involvement in preventing DHF is very much needed because it is impossible to break the chain of transmission if the community is not

involved. In this case, community participation can be in the form of 3M plus activities. It includes closing water storage containers, burying or burning used items that become mosquito breeding grounds, draining or replacing water in water reservoirs around the house, eradicating mosquito nests in their environment, and taking additional actions. Furthermore, it includes using mosquito nets while sleeping, installing gauze, raising mosquito vector-eating fish, using topical mosquito repellants, using abate powder, checking mosquito larvae regularly and other actions appropriate to local conditions [7].

A significant action to prevent and reduce transmission of the dengue virus is to eradicate the *Aedes aegypti* mosquito to prevent contact between adult mosquitoes and humans, related to spending more time at home. The success of the Mosquito Nest Eradication activity can be measured by the Larvae-Free Rate (ABJ). If the ABJ is more or equal to 95%, it is hoped that the transmission of DHF can be prevented or reduced. Therefore, it is hoped that the community will carry out various activities to eradicate dengue hemorrhagic fever early and continuously so that the government's target to reduce the Incidence of DHF can be adequately achieved.

According to the Indonesian Ministry of Health, one of the main activities as a policy in controlling DHF caused by the *Aedes aegypti* mosquito is by empowering the community in the PSN DHF movement. Various efforts have been made to deal with the increase in cases, one of which is by empowering the community through the 3M movement. This mosquito nest eradication activity has been carried out intensively since 1992, and in 2002 it was developed into 3M Plus. So far, many efforts have been made to empower the community in DHF PSN activities. However, the results have not been optimal in changing people's behaviour, so they continue to carry out DHF PSN activities in their respective settings and environments.

Research conducted by Ref. [14] supports this in 2012 in the Work Area of the East Labuhanhaji Health Center, South Aceh District. The results of his research stated that the results of data analysis showed that there was an influence between 3M Plus behaviour on the risk of DHF incidents in the work area of the East Labuhanhaji Health Center in South Aceh Regency in 2012. There were five variables related to *Aedes aegypti* larvae: draining water reservoirs, burying used goods, changing water flower vases and drinking places for animals, repairing channels and gutters that were not smooth, and ensuring adequate lighting and ventilation. There is a relationship between knowledge, attitudes, and actions with the presence of *Aedes aegypti* larvae. Therefore, it is hoped that the community can carry out 3M Plus routinely so that the Incidence of DHF does not increase. Because by behaving 3M plus, the community will be comfortable at home, and the surrounding environment will be clean, healthy, and free from breeding *Aedes aegypti* mosquito nests. Thus, the PSN-DBD government program can provide optimal results in reducing the Incidence of DHF.

The intended 3M Plus actions are; First, drain and brush water reservoirs, such as bathtubs/toilets, drums, etc., once a week. The second is to seal water storage containers, such as water barrels/jars, and so on. The third is utilizing or recycling used items that can collect rainwater. Apart from that, it is added (plus) in other ways, such as frequently changing the water in flower vases, bird drinkers or other similar places once a week. Then fix the drains and gutters that are not smooth/damaged, and cover up the holes in the pieces of bamboo/trees (with soil, etc.). Next, sprinkle larvicidal powder, for example, in places that are difficult to drain or in areas where water is scarce, keep larvae-eating fish in ponds/water tanks, install wire netting, avoid the habit of hanging clothes in the room, try to light and ventilate the room adequate facilities, use mosquito nets, and use drugs that can prevent mosquito bites.

A person's behaviour to participate in eradicating DHF is not as expected because people's knowledge about DHF and 3M plus actions may still be lacking. Although based on the data shows that the respondents' knowledge about DHF is included in the excellent category, most of the respondent's actions in eradicating DHF are still not good. This is what makes a person susceptible to dengue fever. Supporting factors or conditions that allow it is needed for realizing an attitude into real action. There are four action or practice levels: perception, guided respondent, mechanism and adaptation. Residents already have good perceptions and guided respondents about PSN Plus. However, it becomes a habit for the mechanism to do the right thing, and the residents have not implemented it in their daily lives. This is seen in the many residents who still do not apply PSN Plus in their lives, such as hanging clothes, and not using mosquito nets.

This research is in line with research conducted by [14] with he results of bivariate analysis using the Chi-Square test showed that the *p value*= 0.048 was smaller than the *value* of  $\alpha = 0.05$ , so  $H_0$  was rejected. This means a significant relationship exists between PSN Plus Behavior and the Incidence of Dengue Fever (DHF) in the Basuki Rahmat Community Health Center, Bengkulu City. Action 3M plus is a way of vector control and preventing the transmission of DHF. Dengue fever is an infectious disease caused by the dengue virus, transmitted through the bite of the *Aedes aegypti* mosquito and characterized by sudden high fever accompanied by bleeding manifestations and the tendency to cause shock and even death. There is no medicine or vaccine for DHF yet, so the only way to prevent it is to break the chain of transmission of the *Aedes aegypti* vector. The PSN action effectively breaks the chain of development of the *Aedes aegypti* mosquito by carrying out the 3M Plus hygiene movement. In addition, we can protect ourselves by using protective clothing, mosquito coils, curtains and mosquito nets.

Based on the results of the research compared to the theory above, it can be concluded that the 3M Plus action variable has a direct relationship with the Incidence of Dengue Hemorrhagic Fever (DHF) because the better the 3M Plus action, the more it can prevent DHF from occurring. However, conversely the less 3M Plus action, the less effective in preventing dengue. Therefore, the efforts that we must apply to overcome and prevent the occurrence of DHF should be to take the 3M plus action, namely first to drain and scrub the water reservoirs, such as bathtubs/toilets, drums, etc., once a week. Second, tightly closed water storage containers, such as water barrels/jars and others. Third, Utilizing or recycling used items that can collect rainwater. Apart from that, it is added (plus) in other ways, such as frequently changing the water in flower vases, bird drinkers or other similar places once a week.

It is better for the community's participation, in this case, to continue to improve the implementation of 3M plus activities, namely closing water storage containers, burying or burning used items that become mosquito breeding grounds, and draining or replacing water in water reservoirs around the house and implementing eradicating mosquito nests in the environment as well as taking additional actions such as using mosquito nets while sleeping, installing gauze, raising mosquito vector-eating fish, using topical or repellent mosquito repellants, using abate powder, checking mosquito larvae regularly and other actions appropriate to local conditions. In addition, the community is also expected to be more active in 3M plus activities to reduce the presence of larvae. The community must also change behaviour patterns and protect the environment to reduce the Incidence of DHF.

Meanwhile, the government is expected to increase massive education and outreach about 3M Plus in various ways. Such as maximizing social media and attracting millennial generation youth as influencers for education on health issues, such as implementing 3M Plus so that all people are ready and alert to prevent potential DHF incidents.

## **Conclusion**

There was a relationship between clean water storage (TPA) and dengue hemorrhagic fever (DHF) incidence. There is a relationship between landfills and dengue hemorrhagic fever (DHF) incidence. There is a relationship between 3M Plus actions and dengue hemorrhagic fever (DHF) incidence. It is hoped that the government can improve coordination with the community and cadres in checking mosquito larvae regularly by maximizing the program to eradicate the DHF vector. The government should emphasize policies for those who do not comply with existing regulations by continuing to coordinate to educate the public. It needs massive education and outreach about 3M Plus in various ways. Such as maximizing social media to attract the young millennial generation as influencers (influencers) to educate on health issues, such as implementing 3M Plus so that all groups are ready and alert to prevent

potential DHF incidents. Health workers need increasing education about environmental sanitation and DHF and pay attention to knowledge, attitudes and community practices regarding DHF prevention by conducting regular and equitable education as well as participating directly in the field in examining larvae and eradicating mosquito nests.

### Conflict of Interest

The authors declare that there is no conflict of interest.

### References

- [1] Ministry of Health, (2020). *Data Kasus Terbaru DBD di Indonesia*. Accessed from <https://www.kemkes.go.id/article/view/20120300001/data-kasus-terbaru-dbd-di-indonesia.html> 2020)
- [2] Puji, A., (2021). Berbagai Gejala Demam Berdarah atau DBD yang Tidak Boleh Diabaikan. Accessed from <https://helohehat.com/infeksi/demam-berdarah/gejala-demam-berdarah-yang-diabaikan/?amp=1>
- [3] Ministry of Health, (2019). Satu Rumah Satu Jumantik Efektif Cegah DBD. Accessed from <https://www.kemkes.go.id/article/view/19013000001/satu-rumah-satu-jumantik-efektif-cegah-dbd.html>
- [4] Ministry of Health, (2022). Kasus DBD Meningkat, Kemenkes Galakkan Gerakan 1 Rumah 1 Jumantik (G1R1J). Accessed from <https://www.kemkes.go.id/article/view/22061600001/kasus-dbd-meningkat-kemenkes-galakkan-gerakan-1-rumah-1-jumantik-g1r1j-.html>
- [5] Arsyad, R. M., Nabuasa, E., & Ndoen, E. M. (2020). Hubungan antara Perilaku Sanitasi Lingkungan dengan Kejadian Demam Berdarah Dengue (DBD) di Wilayah Kerja Puskesmas Tarus. *Media Kesehatan Masyarakat*, 2(2), 15-23.
- [6] Hapsari, L. N., & Priyono, K. D. (2022). *Analisis Pengaruh Tempat Pembuangan Akhir (TPA) Putri Cempo Terhadap Kesehatan Masyarakat di Kelurahan Mojosongo Kecamatan Jebres Kota Surakarta* (Doctoral dissertation, Universitas Muhammadiyah Surakarta).
- [7] Hadriyati, A., Marisdayana, R., & Ajizah, A. (2016). Hubungan sanitasi lingkungan dan tindakan 3M Plus terhadap kejadian DBD. *Jurnal Endurance: Kajian Ilmiah Problema Kesehatan*, 1(1), 11-17.
- [8] Sinta, P. (2018). Hubungan Perilaku 3M Plus Masyarakat Dengan Kejadian Demam Berdarah. *Jurnal Ilmiah Kesehatan Media Husada*, 7(2), 89-98.
- [9] Khairiyah, N. (2020). *Hubungan antara Sanitasi Lingkungan dengan Kejadian DBD di Wilayah Kerja Puskesmas Karang Mekar Kota Banjarmasin Tahun 2020* (Doctoral dissertation, Universitas Islam Kalimantan).
- [10] Dompas, B. E., Sumampouw, O. J., & Umboh, J. M. (2020). Apakah Faktor Lingkungan Fisik Rumah Berhubungan dengan Kejadian Demam Berdarah Dengue?. *Indonesian Journal of Public Health and Community Medicine*, 1(2), 011-015.
- [11] Girsang, V. I., Tumangger, D. L., Tarigan, F. L., & Harianja, E. S. (2020). Determinan Jentik Nyamuk DBD Di Kelurahan Dwikora. *Jurnal Teknologi Kesehatan Dan Ilmu Sosial (TEKESNOS)*, 2(2), 110-121.
- [12] Sasongko, H. P. (2020). Faktor yang Berhubungan dengan Kejadian Demam Berdarah Dengue (DBD) di Dusun Krajan Desa Barurejo Kecamatan Siliragung. *Jurnal Ilmiah Kesehatan Rustida*, 7(1), 68-82.
- [13] Ariyanti, N., Indah, M. F., & Rahman, Z. H. E. (2020). Hubungan Tindakan 3M Plus dan Faktor Lingkungan dengan Kejadian DBD di Wilayah Kerja Puskesmas Rawat Inap Berangas Kecamatan Alalak Kabupaten Barito Kuala Tahun 2020. *Thesis*. Universitas Islam Kalimantan.
- [14] Fatimah, S. (2020). *Hubungan Pengetahuan dan Tindakan 3M Plus dengan Kejadian Demam Berdarah Dengue (DBD) Di Wilayah Kerja Puskesmas Cempaka Putih Kota Banjarmasin Tahun 2020* (Doctoral dissertation, Universitas Islam Kalimantan MAB).
- [15] Iin, N. K., & Hidayat, N. (2020). Keterkaitan Antara Kondisi Lingkungan Dan Perilaku Masyarakat Terhadap Keberadaan Vektor Demam Berdarah Dengue (DBD). *Journal of Borneo Holistic Health*, 3(2), 75-85.
- [16] Rau, M. J., & Nurhayati, S. (2021). Faktor yang Berhubungan dengan Keberadaan Jentik Nyamuk Aedes Aegypti di Wilayah Kerja Puskesmas Sangurara (Cross Sectional Study di Sulawesi Tengah, Kota Palu). *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, 4(2), 215-225.

- [17] Pertiwi, W. E., & Bustomi, S. (2021). Karakteristik Tempat Penampungan Air Bersih dengan Keberadaan Jentik Nyamuk Aedes Aegypti. *Journal of Health Science Community*, 2(2), 9-17.
- [18] Yuniar, V. T., Joegijantoro, R., & Cahyani, S. D. (2022). Pengaruh Tingkat Kepadatan Jentik Aedes Aegypti Terhadap Kejadian Demam Berdarah Dengue (DBD) di Desa Pandansari Kecamatan Poncokusumo Kabupaten Malang. *Jurnal Hygiene Sanitasi*, 2(2), 57-63.
- [19] Mawaddah, F., & Pramadita, S. Hubungan Kondisi Sanitasi Lingkungan dan Perilaku Keluarga dengan Kejadian Demam Berdarah Dengue di Kota Pontianak. *Jurnal Teknologi Lingkungan Lahan Basah*, 10(2), 215-228.
- [20] Rosmala, F., & Rosidah, I. (2019). Hubungan Faktor Resiko Kesehatan Lingkungan dalam Pengelolaan Sampah Padat dengan Kejadian Demam Berdarah Dengue di Kelurahan Hegarsari Kecamatan Pataruman Kota Banjar. *Jurnal Kesehatan Komunitas Indonesia*, 15(1), 23-34.
- [21] Roreng, R. Y. (2022). *Gambaran Kondisi Sanitasi Dasar dan Keberadaan Larva Aedes aegypti di Pondok Pesantren Darul Arqam Muhammadiyah Gombara Kota Makassar Tahun 2022= Description of Basic Sanitation Conditions and Presence of Aedes aegypti Larva in Darul Arqam Islamic Boarding School Muhammadiyah Gombara Makassar City Year 2022* (Doctoral dissertation, Universitas Hasanuddin).

## Authors



**Yulianti** is a student of of Public Health Study Program, Respati College of Health Sciences. She got award in 2019 on Pekan Kreativitas Mahasiswa (Student Creativity Week). Her address is Kp. Cihaur, RT.005/RW.001, Desa Tobongjaya, Kecamatan Cipatujah, Kabupaten Tasikmalaya, Indonesia. (email: [kesmasyulianti@gmail.com](mailto:kesmasyulianti@gmail.com)).



**Wuri Ratna Hidayani** is a lecturer of Public Health Study Program, Respati College of Health Sciences. She has also written 26 anthologies of short story poetry and 17 books consisting of textbooks, monographs, reference books and book chapters. In addition, he is also a Reviewer in the International Pharmaceutical Research Journal and a Reviewer in Widyaiswara Scientific Journal, Maslahat Journal ITSNU Pasuruan. She is active in the publication of national and international journals and participates in national and international seminars. She is the Editor of the Journal of Public Health Sciences at iistr.org (email: [wuri.ratnahidayani@gmail.com](mailto:wuri.ratnahidayani@gmail.com)).