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# The increased cases of dengue fever in the early phase of covid-19 pandemic in denpasar

## Abstract

At the beginning of the covid-19 pandemic in Denpasar, restrictions on community activities have been imposed in March 2020 and we find there has also been a spike in cases of dengue fever that showed an increase in January 2020 by 59 cases to 110 cases in February 2020 and 142 cases in the first week of March 2020. The purpose of the study was to find out the relationship between restrictions on community activities and dengue fever cases in Denpasar. This research uses qualitative method by interviews to 11 dengue fever program holders and 46 mosquito larva monitor officers in each village. Quantitative method by analysis of the secondary data of dengue fever case reports. Result shows if the people of Denpasar have good knowledge and behavior in managing mosquito larvae in their homes. The result of interviews due to the covid-19 pandemic, it can be known if the community is more often self-quarantined at home and cannot go out to public places to clean the environment that can be breeding habitats for Aedes aegypti mosquitoes. Therefore, during restrictions on community activities, we need to make a team to clean the environment like village water irrigation, tree holes etc.

**Keywords:** dengue fever, water reservoir, mosquito larvae

Volume 16 Issue 1 - 2023

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**Received:** January 17, 2023 | **Published:** January 30, 2023

## Introduction

Dengue hemorrhagic fever (DHF) is a viral infectious disease transmitted by the Aedes aegypti mosquito. Dengue fever is still one of the diseases that are a health problem in Indonesia. Almost all districts/cities in Indonesia are endemic to this disease. Since it was first discovered in 1968 in Jakarta and Surabaya, now its spread has expanded to all provinces in Indonesia (34 provinces). This disease often causes outbreaks and causes death (Guidelines for Investigation and Management of Outbreaks, 2017).[1–5]

DHF outbreaks are determined as referred to in Article 4 of the Minister of Health No. 1501/2010, namely if one or more of the following conditions are found where the emergence of a certain infectious disease (DHF) that previously did not exist or was not known in an area, there is an increase in the incidence of morbidity two or more times compared to the previous period within hours, days or an increase in the case fatality rate of a disease (Case Fatality Rate) in 1 (one) period of time indicates an increase of 50% (fifty percent) or more compared to the case fatality rate of a disease in the previous period in the same period.

In Indonesia, observations of dengue virus conducted since 1975 in several hospitals have shown that all four serotypes are found and circulate throughout the year. The DEN-3 serotype is the dominant serotype and it is assumed that many show severe clinical manifestations. DHF was first reported in Indonesia in 1968 in Jakarta and Surabaya with a total of 58 cases (Illness rate, Incidence rate (IR): 0.05 per 100,000 population) with 24 cases of death (Death rate, Case fatality rate (CFR): 41.3%). With improved means of transportation and urbanization, currently DHF cases are found in all provinces and more than 450 districts/cities.

At the beginning of the covid-19 pandemic in Denpasar, restrictions on community activities have been imposed in March 2020. On restrictions on community activities, there has also been a spike in cases of dengue fever.

DHF cases in Bali Province have experienced a quite drastic spike as soon as March 2020 entered, reaching 2,231 DHF cases as of March 2020 compared to the same period in 2019, only 639 cases. Until March 2020, 7 cases of death had been confirmed, one of which was in the city of Denpasar (Bali Provincial Health Office).Besides that, there has been an increase in DHF cases in the city of Denpasar from January 2020 of 59 DHF cases to 110 DHF cases in February 2020. Meanwhile on March 1-8 2020 there were 142 DHF cases. This increase in spikes coincided with the initial phase of limiting community activities due to COVID-19.

Outbreaks need to be detected early and followed up with quick and appropriate action. It is necessary to identify the threat of outbreaks and vulnerable conditions that increase the risk of outbreaks so that awareness and preparedness for possible outbreaks can be increased. The purpose of the study was to find out the relationship between restrictions on community activities and cases of dengue fever in Denpasar.

## Methodology

Epidemiological investigations began in Denpasar City on April 1 2020 in all Denpasar City Health Centers. Investigations on the increase in 329 DHF cases were carried out quantitatively to determine the distribution of incidence rates and spatial analysis to determine the ecological factors causing the increase in cases, while to identify other risk factors which were the cause of the increase in cases was carried out qualitatively by interviewing 11 DHF program holders at puskesmas and 46 jumantik officers.[6–11]

## Results and discussion

### Situation analysis

#### Geographical location

The city of Denpasar has an area of 127.78 km$^2$ which is located at positions 08035'31" to 08044'49" south latitude and 115000'23" to 115016'27" east longitude with a height of 500 meters above sea level which indicates that the city of Denpasar is an area with lowlands. The boundaries of Denpasar City in the North, South and West are bordered by Badung Regency, while in the east it is bordered by

Gianyar Regency. The map of the Denpasar City area is shown in the following Figure 1.


**Figure 1** Denpasar Mapping.

Administratively, Denpasar City consists of 4 sub-districts divided into 27 villages and 16 sub-districts. Of the four districts, based on area, South Denpasar District has the widest area, namely 49.99km$^2$ (39.12 percent). North Denpasar has an area of 31.12 km$^2$ (24.35 percent), and West Denpasar has an area of 24.13km$^2$ (18.88 percent). The district with the smallest area is East Denpasar District with an area of 22.54 km$^2$ or 17.64 percent (Denpasar City Profile, 2018).

## Topography and climate

The topography of Denpasar City is mostly lowland which stretches from South to North. The length of the beach is ± 11 Km, in the form of sea waters which include Padang Galak beach, Sanur beach, and Serangan Island beach. The area of Denpasar City in general has a tropical marine climate which is influenced by monsoons. As a tropical area, the city of Denpasar has a dry season and a rainy season which are interspersed with the transitional seasons, with rainfall ranging from 1 – 437 mm. The lowest rainfall occurred in September, which was 1 mm, while the highest rainfall occurred in January, which was 437mm. The maximum temperature ranges from 29.90C – 33.90C and the minimum temperature ranges from 22.70C – 25.60C. The highest temperature occurs in December and the lowest occurs in September with air humidity ranging from 73 to 82 percent (Denpasar City Profile, 2018).

## Epidemiological analysis

### Epidemiological overview according to people

The results of case tracking and interviews with surveillance officers conducted from 1 April 2020 to 16 April 2020 show that the distribution of cases by gender at Figure 2 and Incident rate at Table 1. Figure 2 and Table 1 show that the distribution of DHF cases and Incident rate/100,000 population was greater for men, namely 36.83 (181 cases), but the CFR was found to be higher for women, namely 0.68%. Theoretically, it is believed that women are more at risk of disease caused by the dengue virus to get more severe clinical manifestations than men. This is based on the assumption that the capillary walls in women tend to increase capillary permeability compared to men (Peters, 2001).

Table 2 shows that the highest increase in DHF cases was in the productive age groups (25-44 years) with 95 people (22.8%) and in the elementary school age group (5-12 years) with 67 people. This grouping of cases by age group shows that the productive age group has high cases because during the Covid-19 outbreak this group did not carry out quarantine and did most of the mobility to work outside the home. While the age group of 5-12 years is a group of children who are vulnerable to DHF cases.

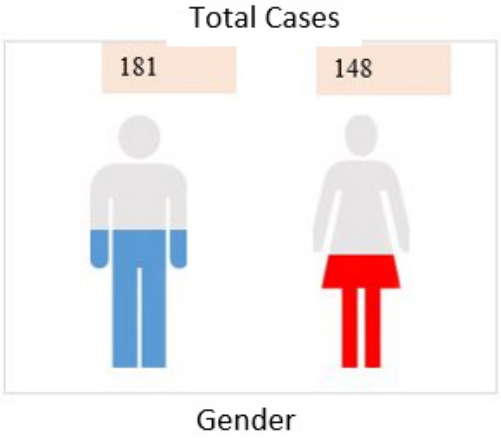


**Figure 2** Description of DHF Cases in March by Gender in Denpasar 2020 Year.

**Table 1** Incident Rate of DHF Cases in March by Gender in Denpasar City in 2020

| Gender | Total population | Number of Dengue Cases | IR Cases of DHF/100,000 | Death | CFR% |
|---|---|---|---|---|---|
| Man | 491,500 | 181 | 36,83 | 0 | 0 |
| Woman | 471,400 | 148 | 31,40 | 1 | 0.68 |
| Total | 962,900 | 329 | 34,17 | 1 | 0.3 |

**Table 2** Distribution of DHF Cases in March by Age and Gender in Denpasar City in 2020

| Age group | Gender | | Total Cases | Percentage |
|---|---|---|---|---|
| | Man | Woman | | |
| **<5 Years** | 7 | 6 | 13 | 3.9 % |
| **5-12 Years** | 25 | 42 | 67 | 20.4% |
| **13-18 Years** | 40 | 22 | 62 | 18.8% |
| **19-24 Years** | 31 | 21 | 52 | 15.8% |
| **25-44 Years** | 56 | 39 | 95 | 28.9% |
| **≥45 Years** | 22 | 18 | 40 | 12.2% |

### a. Epidemiological overview by place

Incidence of increased cases of DHF in the Denpasar City area March 1-31 2020 mostly in the Sanur Village area as illustrated in the Figure 3. Based on the mapping and incident rate (IR) of the cases above, it can be seen that the areas that experienced the highest increase in DHF and IR cases were in the Sanur sub-district with 27 cases (IR: 175.42) and in Sanur Kaja village with 20 cases (IR: 142.66).

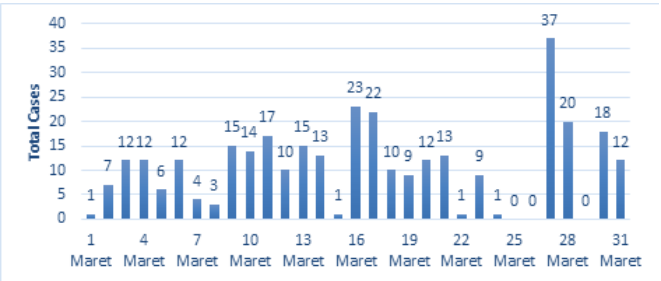


**Figure 3** Overview of DHF Cases in March 2020 Based on Time of Event (Days).

**Citation:** Sridyantari LV, Adi PD, Subrata IM. The increased cases of dengue fever in the early phase of covid-19 pandemic in denpasar. *Int J Complement Alt Med.* 2023;16(1):37–40. DOI: 10.15406/ijcam.2023.16.00629

**b. Epidemiological features by time**

Incidence of increased cases of DHF in the Denpasar City area March 1-31 2020 is illustrated in Figure 4 below, where the highest cases occurred on March 27 2020. Figure 4 also illustrates the type of epidemic curve with a propagated epidemic. This can be seen from the presence of several peaks separated by the incubation period. Its spread and decline in cases is slow and occurs in several places.

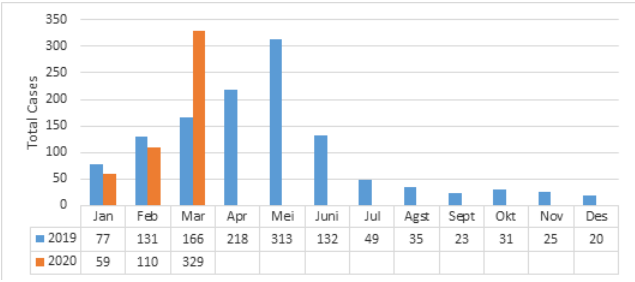


**Figure 4** Comparison of the Number of Monthly DHF Cases in 2019 and 2020.

## Case DHF before and after COVID-19 in Denpasar city

At the start of restrictions on community activities in Indonesia, there was a significant spike in cases in March, as illustrated in the Figure 5. If we review monthly cases between 2019 and 2020, there is a significant spike in cases from 166 cases in March 2019 to 329 cases in March 2020. This shows that there has been an increase in cases of more than 100% from the previous period in the same one. Meanwhile, when compared to weekly cases, the Figure 6 will appear.

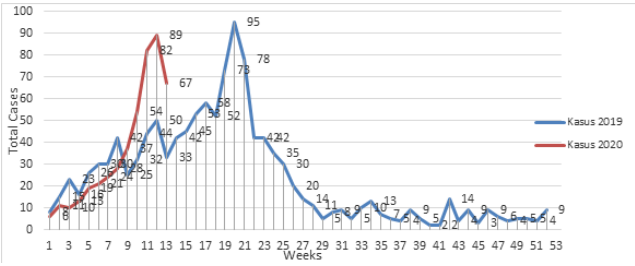


**Figure 5** Comparison of the Number of Weekly Dengue Cases in 2019 and 2020.

DHF incident in the city of Denpasar cannot be classified as an outbreak. Even though it doesn't include outbreaks, we need to be aware of the surge in cases that occur ahead of the peak of DHF cases in the 20th week as an anticipatory plan.

The concurrence of COVID-19 and dengue fever ought to be carefully detailed and followed with improved reconnaissance. The affect of COVID-19 control measures on other infectious infections is still obscure. Be that as it may, a bounce back top of dengue may be watched after control wraps up due to the recharging of helpless people with low exposure to the infection (Wilder, 2020). The investigate that conduct from Jaime at all (2020) too discover on the off chance that There are basic concerns that the section of COVID-19 is right presently covering with other contaminations, particularly dengue, in numerous endo epidemic locale over South America. In Colombia during the essential 20 epidemiological weeks of 2020. From January 1st to May 16th, 2020 (epidemiological weeks, EW, 1-20), a include up to of 52,679 cases of dengue and 14,943 cases of COVID-19 have been confirmed in Colombia. As both conditions may possibly lead to deadly comes about, especially in patients with unremitting co-morbidities, covering infections and co-occurrence may increase the number of patients requiring seriously care and mechanical ventilation. In regions such as Valle del Cauca, heightens planning for such scenarios need to be considered, and help considers have to be performed.

## Identification of risk factors of incresed DHF during restriction on community activity (quantitative method)

**Denpasar's larvae-free number**

The larva-free number can be used as an indicator of the community's ability to carry out 3M (Ekaputra, 2013). If the ABJ is high, it can be assumed that the community has good knowledge in 3M management for dengue fever (DHF). ABJ in the city of Denpasar is classified as very good, namely 97.13 (Dengue City Health Service DHF report, 2020), this shows that the people of Denpasar have good knowledge and behavior in managing DHF with 3 M in their home environment.

**Landfill**

Landfill is a water reservoir both natural and for daily needs which has the potential to be a breeding ground for Aedes aegypti mosquitoes. In the city of Denpasar itself, the most commonly found landfills for larvae are flower vases, unused bathtubs, used tires, jars, and buckets. For natural landfills, which consist of leaf midribs, coconut shells, tree holes, and wells, there are fewer mosquitoes containing mosquito larvae (Monthly report of the puskesmas in Denpasar city, 2020). As a result of the COVID-19 pandemic, people are more often self-quarantining at home, and tend not to carry out mutual cooperation in their environment to clean up places that are likely to become breeding grounds for Aedes aegypti mosquitoes (interview with mosquito larva monitor officers officer at East Denpasar Health Center I April 27 2020).

**Height**

The highest cases in the city of Denpasar were in the Sanur sub-district with 27 cases and in the Sanur Kaja village with 20 cases. Sanur Village and Sanur Kaja Village are located at an altitude of 0-7 meters above sea level. The following is a mapping of DHF cases based on the height of the area in Figure 1.

Altitude is an important factor limiting the spread of Aedes aegypti in India. Aedes aegypti is spread from 0 to 100 meters above sea level (Sukamto, 2007). Denpasar City is a lowland area (less than 500m) with moderate to high mosquito population levels. In addition, the Aedes aegypti mosquito does not breed well at a height of less than 3 meters (Joni, 2015). This proves why the attack area with a height of 0-3 meters above sea level does not have dengue cases.

**Temperature**

Air temperature is one of the environmental factors that affect the life of Aedes aegypti. The Aedes aegypti mosquito will lay its eggs at temperatures around 20o – 30 °C. Eggs laid in water will hatch in 1 to 3 days at 30 **°C**, but at 16 **°C**.it takes about 7 days (Sukamto, 2007). The overview of the increase in DHF based on air temperature can we see at Figure 5. In Figure 5, mosquitoes tend to lay their eggs at 30°C, if the temperature is more than 30oC, the growth of mosquitoes will be delayed so that it takes more than 10days to become adult mosquitoes. This will give the impression, if the air temperature is more than 30°C.then the DHF cases will tend to decrease. However, when tested statistically, there is no effect between temperature and the incidence of increased DHF cases.

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**Precipitation**

The Aedes Aegypty mosquito lives in standing water that doesn't flow (Wurisastuti, 2012). With high rainfall, the water will flow, including in areas where water reservoirs can become breeding grounds for mosquitoes. The following is an overview of rainfall with an increase in dengue cases on Figure 8. From the picture above it can be seen, if the higher the precipitation, the DHF cases tend to decrease and the lower the precipitation, the DHF cases will increase. Based on the person correlation test, there was no relationship between precipitation and the incidence of DHF cases.

**Other risk factors**

In addition to the environmental (ecological) factors above, there are several other factors that are explored based on information from key informants that may play a role in the increase in DHF cases in the city of Denpasar. Based on interviews conducted with DHF program holders at the health center and larva monitoring officers (jumantik) on April 20-27 2020, it can be concluded that several things could be the cause of the increase in DHF cases in the city of Denpasar, including:

a. The city of Denpasar is the capital of the province of Bali with a fairly high population mobility, so that many migrants come to the city of Denpasar to work and live in boarding houses. Most cases of DHF in the city of Denpasar are imported cases from outside the area.

b. Due to the Covid-19 outbreak, the movement of jumantik in monitoring larvae is limited, especially for quarantined areas, so that awareness is needed from independent mosquito larva monitor in monitoring larvae in their home environment.

c. Monitoring of larvae in the boarding house area is only monitored in one room as a sample for one boarding house, monitoring of larvae in boarding houses should be done per room, not one room representing one boarding house.

**Limitation**

This investigation has several weaknesses including:

1. The investigation time coincided with the COVID-19 pandemic, so interviews with the public could not be carried out. Investigators only use secondary data from data from puskesmas, Denpasar city health office and related documentation, so that tracking identification of risk factors becomes less accurate.[2,3]
2. The results of key informant interviews were only based on the perspectives of medical staff (DHF program holders) and trained officers (mosquito larva monitor officers).

## Conclusion

1. There has been an increase in cases and deaths due to DHF in the city of Denpasar which has the potential to cause outbreaks
2. Dengue fever, which has become endemic in the city of Denpasar, has experienced an increase in cases, aside from environmental factors, it is also due to Jumantik's difficulties in monitoring larvae during the Covid-19 pandemic. Besides that, during the Covid-19 pandemic, community movements were limited and tended to focus more on tackling Covid-19 than working together to clean up natural and artificial landfills.
3. Monitoring of larvae in boarding houses is less accurate because they only take them

### Recommendation

1. Jumantik Mandiri activation in the family environment to help monitor mosquitoes in each other's homes.
2. Door to door for reminding about DHF in residents' homes
3. Lavarsidation for larvae + (as much as 20%) around the patient's house.

## Acknowledgments

None.

## Conflicts of interest

We declare there are no conflicts of interest.

## Funding

None.

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