ISSN : 2775-3859
E-ISSN : 2775-3840

Jurnal JOUBAHS
Volume 3, No. 1, February 2023, pp. 19-26

EFFECTIVENESS OF FOGGING WITH SPATIAL ANALYSIS IN THE WORKING AREA OF THE EAST BOGOR HEALTH CENTER

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) is a disease transmitted by the Aedes aegypti mosquito. DHF is a frightening disease because its transmission can take place quickly in an area. Even in one month, the number of dengue cases in endemic areas can reach tens of people infected with dengue virus. Maximizing the DHF control program at the local health office and puskesmas is the main key in tackling the spread of DHF. However, it is a current obstacle that has made the DHF control program ineffective in Bogor City, namely the absence of scientific predictions about the location of DHF vulnerable areas in Bogor City, including in the working area of the East Bogor Health Center. So that DHF control programs such as fogging have not been able to significantly reduce DHF cases. This study used observational analysis with a cross-sectional design. The data collected was then analyzed using spatial analysis with the buffer method. The results showed that DHF cases were almost spread throughout the working area of the East Bogor Health Center. Based on interviews with puskesmas officers, the fogging radius is around 200 meters from the fogging location. After carrying out a spatial analysis using the buffer method, it was found that the fogging radius only reached a small part of the East Bogor Health Center work area which was indicated to be a DHF-prone area. Implementation of fogging programs that are not based on DHF vulnerable areas results in ineffective prevention of DHF. Therefore, spatial-based DHF mapping is needed to identify areas that are vulnerable to DHF so that it can be used as a reference in determining fogging locations.

Key Word: *Fogging; Dengue; Spatial*

ABSTRAK

Demam Berdarah Dengue (DBD) merupakan penyakit yang ditularkan oleh nyamuk *Aedes aegypti*. DBD menjadi penyakit yang menakutkan karena penularannya dapat berlangsung cepat dalam suatu wilayah. Bahkan dalam satu bulan, jumlah kasus DBD pada wilayah endemik bisa mencapai puluhan manusia yang terinfeksi virus *dengue*. Pemaksimalan program pengendalian DBD di dinas kesehatan dan puskesmas setempat menjadi kunci utama dalam menanggulangi penyebaran DBD.Namun menjadi kendala saat ini sehingga membuat belum efektifnya program pengendalian DBD di Kota Bogor yaitu belum adanya prediksi ilmiah tentang letak wilayah rentan DBD di Kota Bogor, termasuk di wilayah kerja Puskesmas Bogor Timur. Sehingga program pengendalian DBD seperti *fogging* belum mampu mengurangi kasus DBD secara signifikan. Penelitian ini menggunakan analisis observational dengan desain *cross sectional*. Data yang dikumpulkan kemudian dianalisis dengan menggunakan analisis spasial dengan metode *buffer*. Hasil penelitian menunjukkan bahwa kasus DBD hampir tersebar di seluruh wilayah kerja Puskesmas Bogor Timur. Berdasarkan wawancara dengan petugas puskesmas, radius *fogging* sekitar 200 meter dari tempat pelaksanaan *fogging*. Setelah dilakukan analisis spasial dengan metode *buffer* maka didapatkan radius fogging hanya menjangkau sebagian kecil wilayah kerja Puskesmas Bogor Timur yang terindikasi wilayah rawan DBD. Pelaksanaan program *fogging* yang tidak berdasarkan pada wilayah rentan DBD mengakibatkan tidak efektifnya pencegahan DBD. Oleh karena itu, dibutuhkan pemetaan penyakit DBD berbasis spasial untuk mengetahui wilayah yang rentan DBD sehingga dapat menjadi acuan dalam penentuan lokasi fogging.

Kata Kunci: Fogging; Dengue; Spasial

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is an endemic disease throughout the tropics and parts of the subtropics. The disease, which is transmitted by the Aedes aegypti mosquito, is a frightening specter because transmission can take place quickly in an area. Even in one month, the number of dengue cases in endemic areas can be up to tens of people who are infected with the dengue virus.

The Ministry of Health of the Republic of Indonesia noted that in 2016, there were 201,885 DHF sufferers in all regions of Indonesia, of which 1,585 patients died as a result of dengue virus attack which was transferred to the human body through the bite of the Aedes aegypti mosquito (Kementerian Kesehatan Republik Indonesia, 2017). Even in several provinces, the number of DHF cases tends to increase or fluctuate, but the number of cases is still quite high.

One of the provinces that has felt the impact of the dengue outbreak is East Bogor, especially Bogor City. The East Bogor Health Office once recorded the number of DHF cases in 2013 as many as 606 sufferers spread across all sub-districts in Bogor City (Dinas Kesehatan Provinsi Jawa Barat, 2018). Three years later, there was a significant increase in the number of 2,814 DHF sufferers (Dinas Kesehatan Kota Bogor, 2018). Even though in 2017 it has decreased, the number is still quite high, including in the working area of the East Bogor Health Center (Dinas Kesehatan Kota Bogor, 2017).

In some areas, the increase in DHF cases is influenced by rainfall and humidity (Zubaidah, 2012). In fact, in some cases, the peak of dengue incidence occurs at the peak of the rainy season (Iriani, 2012). Therefore, careful planning is needed to control the spread of DHF, especially during the rainy season. Maximizing the DHF control program at the local health office and puskesmas is the main key in tackling the spread of DHF.

Even the implementation of ineffective fogging can cause Aedes aegyti mosquitoes to become resistant to insecticides. For example, in Depok City, West Java, it was found that Aedes aegyti mosquitoes were resistant to Malathion and Lambdacyhalotrin with a mortality rate of only less than 70% (Ferial, 2021). If this problem is not resolved immediately, the resistance to Aedes aegyti mosquitoes will continue to increase in the West Java region, especially in Bogor City, including in the working area of the East Bogor Community Health Center, Bogor City.

Therefore, this study aims to analyze the effectiveness of the implementation of the

fogging program in the working area of the East Bogor Public Health Center using mapping of DHF vulnerable areas. Research with a spatial analysis design on measuring the effectiveness of the fogging program is a recent study conducted in Bogor City. Therefore, this research is expected to provide new information to health workers and the public regarding effective methods of controlling the spread of DHF.

METHOD

This research was conducted in the working area of the East Bogor Public Health Center, Bogor City. Data collection activities were carried out in September - December 2022. The data collected was in the form of a fogging program and coordinates for the addresses of DHF sufferers' houses. Fogging program data was collected by interview, while the coordinates of the DHF patient's house addresses were collected using GPS.

This study used observational analysis with a cross-sectional design. The data collected was then analyzed using spatial analysis with the buffer method. The result of the buffer analysis is a map of the fogging program's coverage of DHF events.

RESULTS AND DISCUSSION

Based on the results of interviews conducted with East Bogor Health Center staff, the DHF control program will be carried out in 2020-2022, namely counseling, giving abatement, and fogging programs. Outreach programs for the community regarding how to prevent DHF transmission were only carried out during posyandu activities in East Bogor and South Bogor.

From the 2020-2022 range, the fogging program will be carried out in February and May 2019. The fogging program will be carried out in February at Cipaku RT 2, Citereup RT 3, and Cigeulis RT 3 and RT 4. Meanwhile, in May 2019, it will be implemented in Ciharupan RT 2, 5, 6, and 7. Based on the coordinates of the fogging location and the address of the DHF sufferer, the results of spatial analysis using the buffer method are as follows:

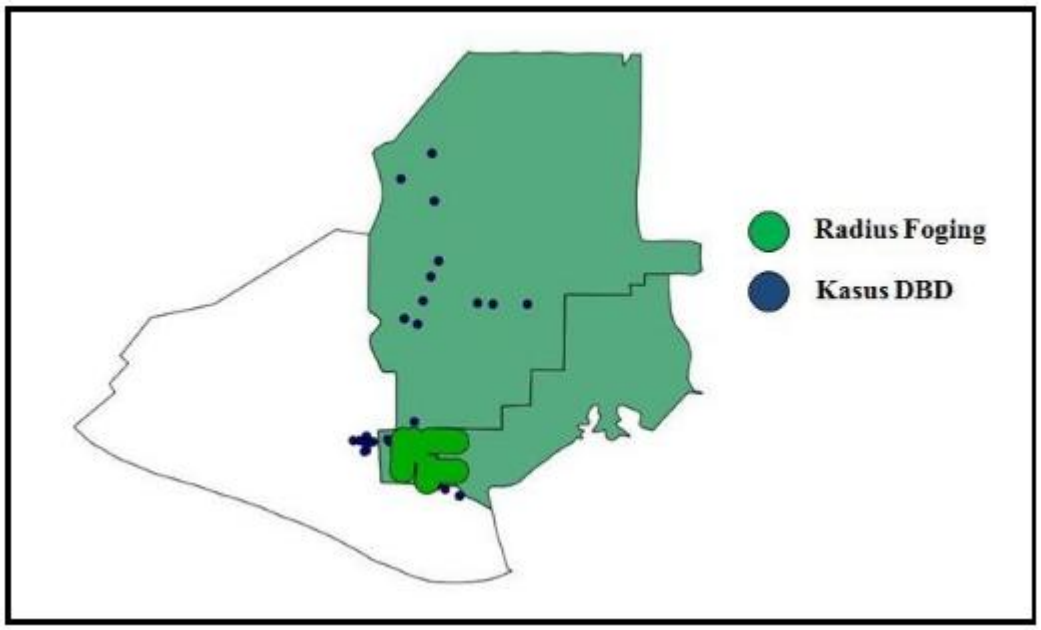

Figure 1. Map of the Effectiveness of Fogging Implementation in the Work Area of the East Bogor Health Center

DHF cases are almost spread throughout the working area of the East Bogor Health Center and parts of the East Bogor Health Center work area (in white). Based on interviews with health center staff, the radius of the fogging smoke is around 200 meters from the place where the fogging is carried out. After carrying out a buffer analysis, the fogging radius (green color on the map) only reaches a small part of the East Bogor Health Center work area which is indicated as a DHF prone area.

In maximizing DHF disease control programs such as fogging, the strategy that must be carried out is to determine DHF vulnerable areas. To determine the vulnerability of an area to DHF, what must be done is to identify the presence of Aedes aegypti larvae and mosquitoes. Knowledge of larval habitat succession can make it easier to cut the life cycle of mosquitoes around the house (Kweka et al., 2021).

However, it is not an easy matter to determine which areas are vulnerable to DHF. Accurate and consistent analysis of the presence of DHF vectors is needed to determine the level of vulnerability of an area to DHF transmission. One technology that can be applied to determine the level of vulnerability of an area to DHF is to use a Geographic Information System (GIS) or also known as spatial analysis.

Determining DHF vulnerable areas using GIS is based on DHF case data from puskesmas and hospitals which are then entered into mapping-based software such as QGIS and ArcGIS. It can even be entered into the web with multiple users and data can be compiled to make it easier to determine the status of an Extraordinary Event (KLB) in the area (Masrochah et al., 2016).

The use of GIS or remote sensing systems in determining DHF vulnerable areas will provide convenience in determining fogging locations that are right on target (Ridwan et al., 2020). If the mapping of DHF vulnerable areas is not carried out before fogging, it is feared that it will actually cause new problems such as an increase in mosquito resistance to insecticides given during fogging.

In several areas in Samarinda City, it was found that Aedes aegypti mosquitoes were resistant to several types of insecticides such as Malathion, Lambdasihalothrin, Permethrin and Bendiocarb (Boewono et al., 2012). Several cities in Indonesia also showed similar symptoms, such as what happened in Semarang City, which showed that Aedes aegyti mosquitoes were found to be resistant to insecticides such as Pyrethroid and Malation (Widiarti et al., 2012).

Not only in Indonesia, the implementation of fogging with the aim of eradicating the presence of mosquitoes which are disease vectors has actually made mosquitoes in several parts of the world become resistant to the insecticides given. As happened in the Benin region, West Africa, it shows that mosquitoes are resistant to DDT and pyrethoroid insecticides (Aïzoun et al., 2014). A similar incident also occurred in Cihideung Village, where several types of mosquitoes have become resistant to the insecticide DDT (Matowo et al., 2014).

This does not mean that the fogging program does not have a positive impact on preventing DHF. However, careful planning is needed in choosing the fogging location and it is not carried out with frequent frequency. The health office must develop natural alternatives for preventing DHF (Susanti & Boesri, 2012). As explained in Permenkes no. 374/MENKES/PER/III/2010 concerning Vector Control, which explains that vector control must consider ecological principles and economic principles that are environmentally sound and sustainable (Kementrian Kesehatan Republik Indonesia, 2010). For example, the use of Serai Wangi plant extracts and Legundi leaves as mosquito repellents (Medikanto & Setyaningrum, 2013; Susanti & Boesri, 2012).

The 3M campaign (draining, closing and hoarding) must continue to be encouraged throughout society. In fact, the provision of new innovations related to dengue prevention must

be carried out massively. For example, making larvicides with natural ingredients such as Metharrizium mushrooms so that people do not have to wait for the abate distribution program from the puskesmas (Yasmin et al., 2012). In addition, the provision of understanding regarding the causes and ways of preventing DHF to the public, especially housewives, must continue to be maximized. There are still many housewives who have the perception that the Aedes aegyti mosquito is only a nuisance animal, not interpreted as a vector for DHF (Pujiyanti et al., 2020).

CONCLUSION

Implementation of fogging programs that are not based on DHF vulnerable areas results in ineffective prevention of DHF. Therefore, spatial-based DHF mapping is needed to identify areas that are vulnerable to DHF so that it can be a reference in determining fogging locations.

It is hoped that the puskesmas in Bogor City can use the GIS application to map DHF vulnerable areas. The use of DHF vulnerable area mapping is expected to maximize DHF control programs such as fogging

ACKNOWLEDGMENTS

Thank you and highest appreciation to the Bogor City Health Office for providing information related to this research, so that this research can run smoothly without significant obstacles.

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