Optimization of Aedes Aegypti Mosquito Nest Eradication (MNE) to Control the Incidence of Dengue Hemorrhagic Fever (DHF) Cases in Bukittinggi Tourism City-Indonesia

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Abstract

This study aimed to establish a correlation between Education, mobility, efforts to eradicate mosquito nests (MNE), and the presence of mosquito larvae with the incidence of DHF. This analysis is a quantitative analysis performed from a case-control point of view. In 2015-2019 there were 632 patients. The large samples, the box and the control, for example, were 490 pieces. Data collection tools through questionnaires. Random sampling technique achieved. This study is quantitative analysis research with a case-control approach. The population of DHF sufferers in 2015-2019 was 632 cases. Large samples as case and control amounted to 490 pieces. Data collection instruments using questionnaires. Sampling technique using a disproportionate stratified random sampling technique. There was no significant relationship between Education and the incidence of DHF cases. (P = 0.543), there is no essential relationship between population mobility and DHF events (P value = 0.860); there is a significant relationship between MNE activity and the incidence of DHF cases (P value = 0.001) with an OR of 14.20, meaning that there is a risk of 14.20 times respondents who do not do MNE activities experience DHF events compared to respondents who do MNE activities. MNE activities carried out by respondents are related to controlling the incidence of DHF cases and are at risk of experiencing DHF cases. Managing the DHF case incident program requires optimizing MNE activities through cross-program, cross-sect cooperation and empowering religious and traditional leaders.

Keywords: DHF, Education, Larvae, MNE, Mobility.

The bite of the Aedes aegypti mosquito spreads the dengue virus. This has led to many cases of dengue fever. Dengue Hemorrhagic Fever (DHF) is still one of the health difficulties

in the world. Each year, dengue disease exceeds 390 million people worldwide (Bhatt et al., 2013;Kiang et al., 2021). The World Health Organization reported a more than eightfold increase in the incidence of dengue disease in 2020. Indonesia ranks 4th with 22,331 cases and the 2nd highest number of deaths, with 229 reported deaths(Triana et al., 2023).

A person's Education affects the affected cases of dengue fever in an area. A person's Education is one factor that needs to be considered in making it easier for someone to behave healthily, including behavior to control fever cases. Someone educated will be easier to invite to prevent DHF cases. Not all educated people are quickly invited to participate in DHF control. Highly educated people should understand something more easily, including experience controlling DHF.

However, a person's level of Education cannot always guarantee better behavior in DHF control. A person with low Education can also behave well in DHF control if he has received non-formal Education about DHF. Health workers provide Education to people in an area not yet maximal. Community education will assist health workers in transferring knowledge of DHF. Education about DHF given to elementary school children has not worked well.

The results of achieving the target of the DHF case incidence control program in Bukittinggi City, West Sumatra province, Indonesia, have not reached the mark, the larvae-free rate has not reached 95%, and the DHF endemic areas.

Some of the results of previous education studies that have been approved available related to the incidence of DHF cases, including (Sun et al., 2017), prove that the number of instances and impacts has increased in recent years. The incidence of DHF is still an imported disease and has not become a national trend in China. Limited human cross-border mobility may have been the cause of the significant decline in the number of malaria and dengue cases between the time before and after the pandemic (p = 0.003/0.002) (Hibiya et al., 2023). Research (Ghani et al., 2019). To Effectively combat dengue outbreaks, people with educational backgrounds and low household incomes should be provided with public health knowledge more frequently, especially in hotspot areas. The study conducted (Jayawickreme et al., 2021). showed that only 5.3% of patients showed the most excellent level of score about high awareness for the management of dengue cases, the most significant scoring category with 62% in understanding in preventing dengue cases, 54% in dengue burden awareness, and 51% in dengue management. The average KAP score for all questions is 55%. Research (Schaber et al., 2019). that understands how human mobility changes during disease will recover sympathetic of how the disease affects DENV broadcast propensity and help understand surveillance data grounded in public health. The results of the study (Surendran et al., 2022). too examined the connection amid dengue fever cases, restrictions on populace drive, and course larval collection from May 2021 to July 2022. This period coincides with the gradual lifting of movement restrictions, which ended in November 2021. The findings of research conducted (Whiteman et al., 2020). indicates that socioeconomic conditions are related to the infectious disease Aedes aegypti, depending on geographic location.

About the results of previous studies, the author conducted a study that was different from earlier studies by the author's knowledge about factors related to other DHF events, namely analyzing and proving the relationship between Education, mobility, MNE activity, and the attendance of Aedes aegypti mosquito larvae with the occurrence of DHF cases.

Material And Methods

This study employs a case-control design to investigate the relationship between educational level, mobility, Mosquito Nest Eradication (MNE) of Aedes aegypti, and the presence of

Aedes aegypti larvae with the incidence of Dengue Hemorrhagic Fever (DHF). The research was conducted in Bukittinggi City, West Sumatra Province, Indonesia, from January 2015 to December 2019.

The study population consisted of reported DHF cases during this period, totaling 632 cases. Eligibility criteria for the study included individuals diagnosed with DHF between 2015 and 2019, confirmed through medical records. Control participants were selected from individuals who did not contract DHF during the same period and were matched based on age, gender, and residential area. The sample size was determined using Slovin's formula, resulting in 245 cases and 245 controls, making a total of 490 study sample.

Data were collected using structured questionnaires administered to both cases and controls. Information on educational level, mobility, and MNE of Aedes aegypti was obtained through interviews and secondary data. Data on the presence of Aedes aegypti larvae were gathered through field surveys.

Adjustments were made based on age, gender, and residential area to address potential biases. Data collectors were trained to ensure consistency and accuracy in data collection. Any discrepancies or missing data were addressed through follow-up interviews. Quantitative variables such as educational level and mobility were categorized into groups based on predetermined criteria. Statistical analysis was conducted using the Chi-Square ($\chi 2$) test to examine the relationship between exposure variables and the incidence of DHF cases.

Subgroup analysis was performed to examine interactions between variables such as age and gender. Missing data were handled using multiple imputation methods. Sensitivity analysis was conducted to assess the robustness of the findings by varying inclusion criteria and analytical methods.

Results And Discussion

Frequency Distribution of Social and DHF Cases

The 490 respondents (cases and controls), 244 (49.8%) respondents did not suffer from DHF. A total of 328 (66.9%) respondents were in the higher education category. More than half of the respondents had performed Mosquito Nest Eradication (MNE), 269 (54.9%), and more than half of the respondents did not perform mobility, 436 (89.0%). The presence of mosquito larvae was more dominant in the no larvae category with 416 (84.0%).

Analysis of the Relationship between Education, Mobility, MNE Activities, and the Presence of Flies with DHF

The results of the analysis show:

a. Education: There remained no significant association between education level and DHF incidence (P = 0.543, 95% CI: 0.786 - 1.669). There was no difference between low education (≤ high school) and high education (> high school) categories.

b. Mobility: There was no significant association between mobility and DHF incidence (P = 0.860, 95% CI: 0.518 - 1.605). Mobility was differentiated between respondents who moved frequently (more than once a week) and those who moved infrequently (less than once a week).

c. Behavioural hygiene activities: There was a significant association between MNE activity and DHF incidence (P = 0.001, 95% CI: 9.130 - 22.091) with an Odds Ratio (OR) of 14.202. This indicates that respondents who do not practice MNE have a 14.202 times greater risk of experiencing DHF than respondents who do MNE.

d. Presence of mosquito larvae: There was no significant association between the presence of mosquito larvae and DHF incidence (P = 0.272, 95% CI: 0.829 - 2.245). The presence of larvae category was divided into presence of larvae and absence of larvae.

Other Analysis

a. Subgroup and Interaction Analysis: Subgroup analysis was conducted based on age and gender, but no significant interaction between these variables and DHF incidence was found.

b. Sensitivity Analysis: Sensitivity analysis was conducted with variations in inclusion criteria and analysis methods. Results consistently showed that MNE activity is a significant factor in reducing DHF risk.

Table 1: Analysis Result

No	Variable	DHF	Total	P Value	OR	95% Confidence Interval
		Case	Control			Lower
1	Education	85 (34,6%)	77 (31,6%)	162 (33,1%)	0,543	1,145
2	Mobility	26 (10,6%)	28 (11,5%)	54 (11,0%)	0,860	0,912
3	Activities on MNE	181 (73,6%)	40 (16,4%)	221 (45,1%)	0,001	14,202
4	Presence of larvae	42 (17,1%)	32 (13,1%)	74 (15,1%)	0,272	1,364

Source: Prepared by author (2024).

Discussion

Education

A person's education level can make it easier for someone to behave healthily in everyday life and control the incidence of DHF cases. Still, not everyone is educated to get used to applying healthy living behaviors in their daily lives. This study's results prove no association amid the level of Education and the occurrence of DHF cases. It is assumed that there is no association amid Education and the incidence of DHF cases because Bukittinggi City is a small city with an area of 25.95 km2, is DHF Endemic, and is supported by cities and districts adjacent to Bukittinggi City, which the government has also designated as a DHF endemic area. The location of Bukittinggi City is on a transportation route that connects several provinces, so the incidence of DHF cases can occur due to the mobility of residents both from cities or regencies, as well as areas heading to or transiting in Bukittinggi City.

The Education in question is formal Education attended by both individuals and groups of people Pradana et al. (2021), Teaching is a thoughtful and conscious effort to establish an environment and process for learning in which students actively cultivate their abilities in religious spirituality, self-discipline, personal growth, intelligence, moral character, and the necessary skills for oneself, society, nation, and state.

This result is corroborated by the research conducted which demonstrates that groups residing in non-hotspot regions had superior knowledge and abilities compared to those living in hotspot locations. However, exercise has no distinction, suggesting that Education ought to be over-effective. The study's findings Shafie et al. (2023). Advocate strategies for protective measures against dengue cases in areas where issues are consistently present, which includes Education, vaccination, and multi-pronged vector control, can lower the burden of dengue and improve outcomes. Health education in non-clinical settings can help empower populations to improve health behaviors (Llorente-Pérez et al., 2023).

Meanwhile, dengue attitudes and practices related to respondents' education level ($P < 0.01$). To achieve results, it should implement action plans that focus on raising public awareness through educational initiatives on community and patient involvement in dengue case-control (Bakhsh et al., 2018). research on Education, family, adults, income, and perception proves a significant relationship with dengue fever (Arsin et al., 2020). there is a relationship between respondents who know the burden of dengue and those who see the patient's role in dengue

control. Research (Nguyen-Tien et al., 2021). proves that dengue patients have low knowledge and practice in dengue prevention. According to the study's results(Alghazali et al., 2020). show that knowledge is not about DF and The know. Hence, the prevention of this disease is often not carried out. The multi-pronged strategy for dengue case protection includes r environmental and public health experts, parliamentarians, policymakers, health professionals, and community leaders to collaborate on educational intervention activities.

Mobility

Population mobility can be connected to the occurrence of DHF cases, or preferably. The respondent's car was not related with the occurrence of DHF cases in Bukittinggi City. Research conducted (Kesetyaningsih et al., 2020). provides evidence that travelling outside the village increases the incidence of DHF. On the contrary, there is no danger of contracting dengue fever while travelling outside the province, which will likely reduce the risk. Research proves that in controlling DHF. Monitoring climate patterns, especially average temperature, relative humidity, and mobility, is necessary, provinces in Thailand that are far away and highly connected by human travel have a higher incidence rate of dengue compared to weakly connected areas of the same distance. This suggests that conventional time series forecasting methods are better if mobility data are combined. Research proves that the mobilization of people throughout the COVID-19 epidemic has significantly reduced the frequency of emergency calls by affecting the dynamics of human-edges interaction. Dengue control programs focusing on human mobility can succeed better (Kumanan et al., 2019). The study suggests that public policy controlling DENV transmission should focus on local population mobility centers, especially during weeks of high information and areas of high dengue incidence (Johansen et al., 2021).

The conclusions of funding the previous hypothesis that implementing populace program limitations during the COVID-19 epidemic effectively decreased the broadcast of dengue fever by examining the dynamics of human-edges vector interactions. Learning from the endemic incidence of covid 19, the bulk happened in Wuhan and adjacent cities in Hubei Province, China. One of the preventive measures taken by the Chinese government to reduce transmission is imposing travel mobility (Ye et al., 2023). Research suggests that limited human mobility may be responsible for a significant decrease in dengue cases and malaria incidence before and after the pandemic.

Mosquito Nest Eradication (MNE) Activities

MNE is one of the recommended activities for controlling the incidence of DHF cases, but not all people know how to do so. As shown in Table 1, the results of this study were 0.001 ($P<005$) and 14.20. With the effect of dengue in the blood (9,130-22,091), it has been concluded that the implantation of the MND is clearly related to the impact of dengue in the blood and that it has a 14,202-fold probability, i.e., that people who do not perform SNP activity may have DH 14,202 times. A significant correlation was found between the implementation of 3M MNE Plus and the DHF idea ($p<0.05$ (Fauzi & Sari, 2021). Association amid the conduct of multinational companies and DHF occurrence (Daryaswanti et al., 2021). The research has aligned with Priesley et al. (2018). They find a great association amid the conduct of MNE 3M Plus and the influence of dengue in the village of Andes. This study coincides with the one carried out between the behavior of multinational companies and the DH ratio (Nursya, 2022), between 0.016 (0.05) and 5.760 ratios, which indicates that people with good MND behavior have a 5.76 times higher risk of DH pain. 3M Plus ($p<0.05$) Statistically significant correlation of MND and DH. The main goal of the community health center is to educate people around the status of implementing MNE 3M Plus to reduce dengue cases. Other studies have demonstrated the use of larva of Aedes aegypti larva (Suriami et al., 2020).

Another study is the use of abatization to eradicate larvae, that giving ablation in Bodak I Village, Salo Palaic, and Muara Budak Ilir Village by a worth of Z = 4.750 and p = 0.000 is effective in eliminating larvae.

This study and several other results suggest that MNE activity is associated with dengue disease. The cause is that the Aedes aegypti mosquito bites people infected with dengue and then bites healthy people. MNE activities carried out by respondents need to be carried out regularly because these MNE activities have a relationship and have a high chance for respondents to suffer from dengue cases, including Bukittinggi City, designated as a dengue-endemic area. The results of this study prove that MNE activities are related to the incidence of DHF cases and have a risk for respondents if they do not carry out MNE activities compared to respondents who carry out MNE activities. Based on research data that respondents have carried out MNE more than half (54.9%), this is evidenced by the absence of mosquito larvae in respondents' homes (84.9%). As described above, many factors support Bukittinggi City as an endemic dengue case. For this reason, the population density of larvae or LFN Aedes aegypti as transmission of dengue cases can be controlled at a harmless level. Optimisation of MNE implementation in Bukittinggi City can be done as well as possible with the support of good cooperation between health workers, cadres of larvae monitors, and related cross-sectoral, as well as the support of traditional and religious leaders who still have strong amid the community.

The Presence of Mosquito Larvae

The larvae of the Aedes aegypti mosquito are at risk of episodes of ESO somewhere. However, in Bukittinggi, the attendance of parasite grubs has nothing to do with the incidence of ESO cases. Many factors can cause this condition. This has nothing to do with the FFN incidence rate of Aedes aegypti and DH mosquitoes (Qonita and Saputra, 2023). This situation whitethorn be owed to the fact that the attendance of parasite grubs is not directly related to the impact of ESO. According to the LFN, mosquito larvae are found in one area and one area is believed to be at mental risk. This research has confirmed the findings (Sharif et al., 2022). This shows that there is no clear association amid the feast of dengue fever cases and the larba Aedes aegypti. Likewise, other studies found no association between the idea of dengue and the index of free labra. However, the association amid the influence of dengue fever and populace compactness. Effective management of DH cases is critical to mobilizing the community to participate in 3M activities (Nuranisa et al., 2022). Although the results of other studies do not support this research, the results of the survey (Ramayanti et al., 2022). Proof of the relationship between Aedes aegypti and the discovery of DHF cases. People are expected to always be near headquarters to keep the ships clean.

On the other hand, studies show that labra mosquitoes are in the rainy season. Analysis (Zamli et al., 2019). The presence of long-lasting mosquitoes in the rainy season tends to increase. Another study conducted (Panggabean et al., 2019) showed a significant relationship between the influence of DH in the Medan Peranakan district, in the Medan-Indonesia district, in Peranakan. Aedes aegypti mosquitoes, in their life cycle, have the ability to become Aedes aegypti mosquitoes that can further transmit the dengue virus and make people suffer. This study shows that it has nothing to do with the level of schooling in the respondents' households, the mobility and presence of Aedes aegypti mosquitoes, and the incidence of DHF cases. This is due to the districts and towns near the city of Bukittinggi, i.e. the endemic area of the fever. The Bukittinggi area is relatively small, 25,239 km2, and is a tourist destination that protects adequate access to the market, the commercial and service city, its strategic geographical location and transport to the city of Bukittinggi. The education approved by the respondents

should have nothing to do with health, especially with the incidence of cases of ESO.

Conclusions

This study's findings determined no important association amid participants' educational attainment and the occurrence of dengue cases because the amount of Education a person undergoes does not always have a relationship with health problems, especially DHF. There is no association among respondents' mobility and the incidence of dengue cases. MNE activity is connected to the occurrence of DHF cases. The attendance of Aedes aegypti mosquito larvae is unrelated to the incidence of DHF cases. Several variable issues related with the incidence of DHF cases in Bukittinggi City cannot be proven, assumed because Bukittinggi City has a small area (25,239 km2), a very strategic geographical location on transportation routes, as a tourist destination city, and is surrounded by DHF endemic districts and towns.

To control the LFN, Aedes aegypti mosquitoes infected with the dengue virus cause the incidence of DHF cases. It is necessary to optimize MNE activities through cross-program and cross-sector cooperation, empowering cadres of jumantic monitors and indigenous and religious leaders who still have strength in society.

However, this study has several limitations. The sample size and geographic scope were limited to Bukittinggi City, which may affect the generalizability of the findings to other regions. Additionally, the study did not account for seasonal variations and other environmental factors that might influence the incidence of dengue cases. Despite these limitations, the study provides significant insights into the factors influencing the incidence of DHF in Bukittinggi City. It underscores the position of communal appointment and intersectoral collaboration in dengue fever deterrence exertions. Future research should consider expanding the geographic scope and incorporating additional environmental variables to further elucidate the dynamics of dengue transmission.

Author's Contribution

All proposed the topic of this Analysis and design, research and design with data. All authors helped prepare the last flow of the document, reviewed and critically studied the intellectual content, and drafted and revised the last document. All authors accepted the latest variety of this document.

Conflicts Of Interest

The authors declares there is no conflict of interest.

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