



EVALUATION OF THE IMPLEMENTATION OF MOSQUITO BREEDING ERADICATION (PSN) FOR DENGUE HEMORRHAGIC FEVER (DHF) IN ELEMENTARY SCHOOLS IN PEKALONGAN CITY

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) remains a public health issue in Pekalongan City, particularly among elementary school children. Mosquito Nest Eradication (PSN) is a key strategy in DHF control; however, cases are still being reported. This indicates challenges in PSN implementation and factors affecting its success. Objective to analyze the implementation of PSN in elementary schools and identify factors contributing to the persistence of DHF cases among elementary school children in Pekalongan City. A qualitative study with a case study approach was conducted, involving 20 participants. The primary informants included representatives from the Health Office, Education Office, school principals, teachers, and school health officers. Triangulation informants consisted of jumantik (mosquito monitoring) cadres, parents, and students. Data were collected through in-depth interviews, observations, and documentation. The data analysis followed a thematic analysis approach. First, all interviews were transcribed verbatim, and field notes from observations were reviewed. The data were then coded systematically to identify patterns and emerging themes. Codes were grouped into broader categories, and themes were refined through an iterative process. Triangulation was conducted by comparing data from different sources to enhance credibility and validity. Finally, findings were interpreted in relation to the study objectives, supported by direct quotes from participants to provide depth and context. PSN implementation in elementary schools in Pekalongan City has been carried out through activities such as draining water containers, covering potential mosquito breeding sites, and monitoring by health officers and school jumantik cadres. However, several challenges remain, including low community awareness of environmental cleanliness, lack of regular supervision in schools, and environmental and climatic factors that support mosquito breeding. Additionally, limited facilities and human resources in schools pose challenges to optimizing the PSN program. The implementation of PSN in elementary schools in Pekalongan City has been conducted but remains suboptimal, leading to the continued occurrence of DHF cases. Increasing community awareness, strengthening routine supervision in schools, and cross-sectoral support are needed to ensure the sustainability of the PSN program and reduce DHF incidence.

Keywords: dengue hemorrhagic fever; elementary school; mosquito nest eradication; pekalongan city

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INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is a public health problem that can cause death in a short time and often leads to outbreaks. DHF is an endemic disease caused by a virus in tropical and subtropical regions, which occasionally becomes epidemic (Manda Sari Puskesmas Pundata Baji Kabupaten Pangkep, 2013). The public's reliance on fogging as the primary solution for dengue fever (DBD) prevention poses a challenge in the implementation of the Mosquito Nest Eradication Program (PSN). People tend to perceive fogging as the most effective method, even though its effectiveness is only temporary, lasting about two weeks after application. Fogging only eliminates adult mosquitoes without addressing eggs and larvae, allowing the DBD transmission cycle to persist. Therefore, the PSN approach, which focuses on mosquito nest eradication through the 3M Plus strategy (Draining, Covering, and Recycling), along with school involvement in education and monitoring, becomes a crucial aspect that needs to be evaluated to enhance the effectiveness of DBD prevention in

elementary school environments(Dian Kurniawati et al., 2020).

During this time, children aged 5-14 years are in the school environment, meaning that the transmission of dengue fever (DBD) may not only originate from home but also from school, as the Aedes mosquito is most active in searching for hosts during these hours. Therefore, effective efforts are needed to prevent the spread of DBD cases in schools by actively implementing the Mosquito Nest Eradication Program (PSN). School-age children are more receptive to understanding PSN compared to adults, making early education on PSN a foundation for developing health-conscious thoughts and behaviors in the future(Husna, 2022).

Dengue Hemorrhagic Fever (DHF) cases in Indonesia have become increasingly concerning since 2012, with a reported 90,245 cases, 816 deaths, an Incidence Rate (IR) of 37.11 per 100,000 population, and a Case Fatality Rate (CFR) of 0.90%. This marks an increase in the number of cases compared to 2011, which recorded 65,725 cases with an IR of 27.67 (Susanna et al., 2019). Various programs have been implemented under the directives of the Minister of Health to eradicate Dengue Hemorrhagic Fever (DHF), including epidemiological surveillance, case detection and management, early vector control measures, and outbreak response systems (SKD and KLB). Additionally, efforts have been made to involve the community through health education, capacity building, research, surveys, as well as monitoring and evaluation(Ayudiasari, n.d.). This situation highlights the need for a more sustainable and comprehensive approach, such as the implementation of *Pemberantasan Sarang Nyamuk* (PSN) or mosquito nest eradication. Dengue Hemorrhagic Fever (DHF) is a major public health concern in Indonesia and can lead to outbreaks (Kejadian Luar Biasa/KLB). Central Java is among the top ten provinces with the highest number of DHF cases. This province has a high potential for endemic transmission, with consistently high case numbers from year to year(Bestari et al., 2022).

Based on this background, the research problem addressed is Based on this background, the research problem addressed is the effectiveness of the implementation of the Dengue Hemorrhagic Fever (DHF) mosquito breeding eradication program (PSN) in elementary schools in Pekalongan City. This study aims to evaluate the extent to which the PSN program has been implemented, identify challenges in its execution, and assess its impact on reducing the risk of DHF transmission in school environments.

METHOD

This study employed a case study research design with a qualitative approach to explore the implementation of the Dengue Hemorrhagic Fever (DHF) Mosquito Nest Eradication Program (PSN) in elementary schools in Pekalongan City. A total of 20 participants were selected using purposive sampling to ensure the inclusion of key stakeholders with relevant knowledge and experience. The primary informants included representatives from the Health Office, Education Office, school principals, teachers, and school health officers. To enhance data credibility, triangulation informants such as jumantik (mosquito monitoring) cadres, parents, and students were also included. Data were collected through in-depth interviews, observations, and documentation. Thematic analysis was used to examine the data, involving transcription, coding, and categorization to identify patterns and themes. Triangulation was conducted by comparing findings from different sources to enhance validity and provide a comprehensive understanding of the case(Assyakurrohim et al., 2022).

RESULT

Pekalongan City holds a highly strategic position in national development, as reflected in its role as one of the Regional Activity Centers (PKW) according to Government Regulation No. 26 of 2008 on the National Spatial Plan (RTRWN) and Regional Regulation of Central Java

Province No. 6 of 2010 on the Regional Spatial Plan of Central Java Province. As part of the Petanglong area (Pekalongan, Batang, and Pekalongan Regency), the city serves as a key economic strategic area. Pekalongan is also renowned as one of Indonesia's batik centers, making batik an essential cultural identity for its community.

In the context of education, Pekalongan City has numerous elementary schools spread across different districts. These schools play a crucial role in shaping a high-quality younger generation. Several elementary schools in the city are well-equipped with adequate facilities, including comfortable classrooms, libraries, and sports facilities. Most elementary schools in Pekalongan have also implemented curricula focused on character development and improving students' fundamental competencies in various fields, including literacy and numeracy. In Pekalongan City, there are many elementary schools (SD), both public and private, distributed across various districts. The following table provides information on the number of public and private elementary schools in Pekalongan City:

Table 1.

Elementary Schools in Pekalongan City

School Type	Number of Schools
Public Elementary Schools (SD Negeri)	71
Private Elementary Schools (SD Swasta)	32

Pekalongan City has a total of 103 elementary schools, consisting of 71 public schools and 32 private schools. The table below lists several elementary schools in Pekalongan City that recorded ≥ 2 cases of Dengue Hemorrhagic Fever (DHF) in 2023, which were the focus of mosquito research:

Table 2.

Elementary Schools in Pekalongan City with ≥ 2 DHF Cases in 2023

Elementary School (≥ 2 DHF Cases in 2023)	School Category
SD Muhammadiyah 02 Bendan	Private
SDN Klego 01	Public
SDI Setono 02	Private
SDN Kandang Panjang 02	Public
SDN Krapyak Lor 01	Public
SDN Kradenan 04	Public

The data analysis process is conducted through several stages. First, data is collected from interviews, then reduced and presented in a descriptive narrative format. Conclusions are drawn through an interpretative process, in which the meaning of the presented data is identified. To ensure the validity of the research data, triangulation is conducted using multiple data sources, along with a member check process, in which the researcher verifies the data with the sources or informants. In qualitative research, data analysis involves examining interview results, direct observations, and document studies. The data is processed by organizing it in a structured manner so that it can be interpreted effectively. Data organization is carried out by categorizing information based on topics, questions, parameters, and dimensions predetermined by the researcher. This process simplifies and structures the data to facilitate interpretation and meaningful conclusions.

Through qualitative data analysis, this study aims to reveal the underlying meanings within the collected data and provide deeper insights into the observed phenomena. The analysis process is not only intended to understand the obtained data but also to identify patterns, facts, and relationships between different phenomena within a specific context. This approach aligns with case study research, which is a form of qualitative research that does not prioritize the quantity of data collected but rather focuses on the quality of the data obtained. Case studies rely on the interpretation and understanding of a phenomenon as perceived by the subjects or participants involved in the research. By emphasizing depth over breadth, case studies allow for a comprehensive exploration of real-world situations, capturing the unique characteristics and contextual factors that influence the observed case (Pujiyanti et al., 2012).

This study aims to answer two key questions regarding the implementation of Mosquito Nest Eradication (Pemberantasan Sarang Nyamuk / PSN) for Dengue Hemorrhagic Fever (DBD) in Elementary Schools in Pekalongan City and the reasons why DBD cases are still found among elementary school children in the area. The research findings are described based on data obtained through interviews, observations, and document analysis, categorized according to the research focus. The presentation of the research findings is structured by grouping respondents from SD Muhammadiyah 02 Bendan, SDN Klego 01, SDI Setono 02, SDN Kandang Panjang 02, SDN Krapyak Lor 01, and SDN Kradenan 04. The classification of respondents into different groups aligns with the comparative nature of the research questions.

Based on the responses obtained from various stakeholders, including school principals, student health inspectors (Jumantik), UKS (School Health Unit) teachers, and other relevant parties, the implementation of the Mosquito Nest Eradication (PSN) program in elementary schools in Pekalongan City has been carried out fairly well. Regular inspections of water storage areas, such as bathtubs, bird drinking containers, and other potential mosquito breeding sites, are conducted at least once a week. This indicates a serious commitment to preventing dengue fever in schools. Furthermore, coordination between UKS teachers, student health inspectors, and UKS supervisors has had a positive impact on the implementation of PSN. They collaborate in inspecting and cleaning areas prone to mosquito breeding and report any larvae findings to the relevant authorities. However, some challenges still hinder the effectiveness of the PSN program, such as difficulties in cleaning hard-to-reach water storage areas and limited facilities in some schools. These obstacles can impede the overall success of mosquito nest eradication efforts.

Interviews regarding the implementation of the PSN program for dengue prevention in elementary schools in Pekalongan City revealed that the program is carried out using various methods. Efforts include routine activities such as draining and cleaning water containers, covering potential mosquito breeding sites, and conducting periodic fogging in school areas deemed high-risk. Additionally, education on Clean and Healthy Living Behavior (PHBS) is provided to students and teachers to raise awareness about dengue prevention. However, the effectiveness of this program faces several challenges, including a lack of active participation from the entire school community, limited resources for regular monitoring, and persistent standing water around schools that remains difficult to control.

Reasons for the Continued Presence of Dengue Cases Among Elementary School Students in Pekalongan City. Despite the proper implementation of PSN, dengue cases among elementary school students in Pekalongan City are still being reported. Several factors contribute to this issue:

1. Lack of Awareness and Discipline: Although mosquito larvae inspections and eradication activities are conducted in schools, awareness regarding the importance of PSN is not yet fully embraced by all stakeholders, including students and parents. Some parents or school authorities may not fully realize their crucial role in maintaining cleanliness and preventing mosquito breeding in their surroundings.
2. Hard-to-Reach Areas: Certain water storage locations in schools and residential areas are difficult to access or not thoroughly cleaned, making them potential mosquito breeding grounds. Areas such as damaged drainage systems or locations that cannot be easily drained are often overlooked during routine inspections.
3. Suboptimal Coordination: Although reports of mosquito larvae findings are submitted to the relevant authorities, follow-up actions are sometimes slower than expected. This delay may be due to ineffective communication between schools, UKS teachers, student health inspectors, and institutions like local health centers (Puskesmas).
4. Limited Facilities: Some schools face challenges related to cleaning facilities, such as a lack of proper equipment to clean hard-to-reach areas. This limitation hinders

comprehensive mosquito eradication efforts.

Considering these factors, it is essential to conduct evaluations and improvements in PSN implementation while intensifying awareness campaigns for students, parents, and school authorities to reduce dengue cases in Pekalongan City. Interviews also indicated that dengue cases among elementary school students persist due to several key factors. One significant issue is the lack of awareness and active participation among school community members in implementing PSN. Despite socialization and recommendations from relevant authorities, the practice of "3M Plus" (draining, covering, and recycling) in schools remains suboptimal. Additionally, resource constraints, such as a lack of trained mosquito larvae monitors (Jumantik) and delays in fogging when cases surge, pose significant challenges to dengue control. Environmental factors, including high rainfall and persistent water accumulation around schools, further create ideal breeding conditions for *Aedes aegypti* mosquitoes. The insufficient involvement of students and teachers in maintaining school cleanliness and their lack of initiative in conducting regular mosquito larvae inspections exacerbate this issue. Therefore, more intensive measures are needed to increase the engagement of all school members in PSN efforts to effectively reduce dengue cases among elementary school students.

Evaluation of the Implementation of Mosquito Nest Eradication (PSN) for Dengue Fever in Elementary Schools in Pekalongan City

1. Implementation of Mosquito Nest Eradication (PSN) for Dengue Fever in Elementary Schools in Pekalongan City

The PSN program in Pekalongan City's elementary schools has generally been implemented well, with regular inspections of water storage areas, such as bathtubs, bird drinking containers, and other potential mosquito breeding sites. The involvement of UKS teachers and supervisors has strengthened the program, with regular reporting to the relevant authorities. Additionally, some schools utilize student health inspectors (Jumantik) to assist in detecting mosquito larvae. However, several challenges need to be addressed. Some schools struggle with cleaning water storage areas that are difficult to reach or cannot be drained effectively. Limited facilities and difficulties in cleaning certain locations also hinder the comprehensive success of mosquito eradication efforts.

2. Reasons for the Continued Presence of Dengue Cases Among Elementary School Students in Pekalongan City

Dengue cases among elementary school students in Pekalongan City persist due to several factors, including:

- 1) **Insufficient Understanding:** Although most respondents recognize the importance of PSN, some students, parents, and school authorities do not fully understand the preventive measures required, especially regarding water container cleaning in both schools and homes.
- 2) **Lack of Consistency in PSN Implementation:** While routine inspections are conducted, some schools and participants neglect to inspect certain high-risk locations, such as hard-to-reach areas. This inconsistency indicates irregularities in PSN implementation.
- 3) **Limited Facilities:** Some schools and residential areas lack adequate resources for thorough cleaning, including damaged drainage systems or difficult-to-access areas.
- 4) **Suboptimal Coordination:** Reports of mosquito larvae findings often do not lead to immediate actions by relevant authorities, such as UKS teachers or health centers (Puskesmas), delaying effective mosquito eradication.

Further evaluation and improvements in awareness, implementation consistency, and coordination among stakeholders are crucial in reducing dengue cases among elementary school students in Pekalongan City.

DISCUSSION

Dengue Hemorrhagic Fever (DHF) remains a significant public health issue in Indonesia, with annual cases continuing to be reported despite various control measures. This aligns with broader global concerns, where DHF poses a substantial public health risk, particularly in developing countries. Understanding the incidence trend of DHF is essential for formulating early warning and prevention strategies. A multi-year trend analysis of DHF cases in Indonesia from 2007 to 2022 revealed a generally declining trend in Java Island, while an increasing trend was observed outside Java, particularly in provinces such as Gorontalo, North Kalimantan, and Maluku. The case fatality rate (CFR) and infection rate (IR) showed a decreasing trend in most provinces, reflecting the effectiveness of eradication programs. However, the persistence of DHF in certain high-risk areas indicates the need for more targeted control strategies. These findings underscore the importance of continuous efforts in DHF prevention, particularly through programs like the Mosquito Nest Eradication Program (PSN) implemented in elementary schools. Such initiatives play a crucial role in sustaining the declining trend of DHF cases by enhancing public awareness and engagement in vector control. Integrating spatial analysis with localized interventions can further improve early detection and mitigation efforts, ensuring that high-risk regions receive appropriate attention to reduce DHF incidence effectively (Gani et al., 2022).

Dengue Hemorrhagic Fever (DHF) is caused by the dengue virus (DENV), which is transmitted through the bite of *Aedes aegypti* mosquitoes. The transmission and spread of DHF are influenced by multiple factors, including the host (human), vector (mosquito), agent (dengue virus), and environmental conditions. As one of the most widespread and dangerous viral diseases, dengue affects over 400 million people worldwide annually, leading to approximately 22,000 fatalities. It is prevalent in tropical and subtropical climates across more than 100 countries. Despite the significant global burden, no specific antiviral treatment exists for dengue. Prevention strategies such as vector control, early diagnosis, and proper medical care remain essential in reducing mortality rates. The first licensed dengue vaccine, CYD-TDV (Dengvaxia), is a quadrivalent vaccine; however, its approval is limited to certain countries due to concerns about safety and effectiveness. Major challenges in vaccine development include the lack of adequate animal models, limited mechanistic studies on dengue pathogenesis, and potential adverse reactions. Given the complexity of dengue virus transmission and its widespread impact, comprehensive approaches integrating epidemiological surveillance, public health interventions, and advanced research on viral biology and vaccine development are necessary. Strengthening mosquito control programs, improving early detection, and enhancing community awareness remain the most effective measures to mitigate the spread of DHF and reduce its public health burden (Pourzangiabadi et al., 2025).

Dengue Hemorrhagic Fever (DHF) is caused by the dengue virus (DENV), which is transmitted through the bite of *Aedes aegypti* mosquitoes. The transmission and spread of DHF are influenced by multiple factors, including the host (human), vector (mosquito), agent (dengue virus), and environmental conditions. Clinical manifestations of DENV infection range from mild dengue fever (DF) to severe complications such as DHF and dengue shock syndrome (DSS). Despite the global burden of dengue, there is currently no specific antiviral treatment or fully effective vaccine. Various therapeutic and control strategies have been proposed to manage DENV infection. A systematic literature review following PRISMA guidelines emphasizes the importance of understanding virus characteristics, epidemiology, and transmission patterns to develop better prevention and treatment approaches. Several factors contribute to the severity of DHF and DSS, including antibody-dependent enhancement, immune dysregulation, viral virulence, host genetic susceptibility, and preexisting dengue antibodies. Given these complexities, effective dengue control requires a multifaceted approach, integrating early diagnosis, public health interventions, vector control

strategies, and ongoing research into viral pathogenesis and risk factors. Strengthening preventive measures, such as mosquito eradication programs and improved surveillance, is crucial to mitigating the spread of DHF and reducing its public health impact (Khan et al., 2023).

The high number of Dengue Hemorrhagic Fever (DHF) cases in Indonesia, as reported by the Ministry of Health (2019), highlights the urgent need for continuous evaluation and enhancement of control programs, particularly the Mosquito Nest Eradication (PSN) program. The increasing trend of DHF incidence over the past 50 years, as revealed by the National Disease Surveillance database, further reinforces the necessity of sustained and adaptive intervention strategies. DHF incidence in Indonesia has been observed to follow a cyclic pattern, peaking approximately every 6–8 years. While the case fatality rate (CFR) has declined by nearly half each decade since 1980, the overall number of cases remains high, especially in densely populated regions such as Java Island, which records the highest average annual DHF cases. More recently, Bali and Kalimantan have experienced the highest incidence rates, while Papua Island has had the lowest. These findings emphasize the importance of strengthening vector control measures, including the PSN program, to reduce mosquito breeding sites and mitigate DHF transmission. Given the cyclic nature of outbreaks, continuous surveillance, early warning systems, and community engagement are crucial in preventing large-scale epidemics. Additionally, region-specific strategies should be implemented to address varying incidence rates across different islands, ensuring a more targeted and effective response to DHF in Indonesia (Harapan et al., 2019).

CONCLUSION

This study confirms that dengue hemorrhagic fever (DHF) in Indonesia is influenced by various determinants, including human factors, vectors, the dengue virus, and environmental conditions. The epidemiological trend shows an increase in DHF cases over the years, highlighting the need for more effective intervention and prevention strategies. Control programs such as the Mosquito Nest Eradication (PSN) method using 3M (draining, covering, and recycling) have proven effective but require enhanced education and community involvement for better implementation. Therefore, a multisectoral approach involving the government, healthcare professionals, and the public is necessary to raise awareness, improve monitoring, and implement sustainable control strategies to reduce DHF incidence in Indonesia.

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