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Effectiveness of the Dengue Hemorrhagic Fever (DHF) Control Program at Lhok Bengkuang Community Health Center, South Aceh

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ABSTRACT

Background: Dengue Hemorrhagic Fever (DHF) remains a significant public health threat in South Aceh, Indonesia. This study aimed to evaluate the effectiveness of the DHF control program at Lhok Bengkuang Health Center using input, process, output, outcome indicators. A descriptive qualitative study was conducted from December 2024 to January 2025. Data were collected through in-depth interviews with officers from the South Aceh Health Office, the health center chief, program coordinators, and affected community members. Thematic analysis followed Miles and Huberman's approach. Triangulation and member checking ensured data validity. DHF cases declined from 22 in 2023 to 7 in 2024. Control activities included source reduction (PSN), larviciding, fogging, health education, epidemiological investigations, and vector surveys. However, the Larvae Free Index (ABJ) remained below the national target of 95%. This indicates partial effectiveness, constrained by limited entomology staff and inadequate personal protective equipment for fogging. Strengthening resources and aligning local implementation with national standards are essential to sustain progress. The DHF control program effectively reduced cases but requires reinforced human resources, adequate equipment, and improved community engagement to meet national targets.

INTRODUCTION

The symptoms of Dengue Hemorrhagic Fever (DHF), caused by a virus transmitted through the bites of *Aedes aegypti* and *Aedes albopictus* mosquitoes, include bleeding and may lead to shock and death. The presence of *Aedes* mosquitoes, the vectors of dengue transmission, can increase due to humid weather conditions. As it can reduce health quality, cause social problems, and create other economic challenges, dengue hemorrhagic fever is considered one of the major health problems in Indonesia. Moreover, this disease has the potential to trigger outbreaks (*Kejadian Luar Biasa* or KLB) in several regions of Indonesia (1).This disease has become a global threat, with nearly half of the world's population at risk of infection. Data from the World Health Organization (WHO) indicate that DHF has become a serious problem in many countries. In 2023, more than 80 countries reported DHF cases, with over 6.5 million cases and more than 7,300 dengue-related deaths. Studies show that approximately 390 million dengue virus infections occur each year, with 96 million cases exhibiting clinical manifestations (2).

In 2023, dengue hemorrhagic fever claimed the lives of 894 people in Indonesia out of a total of 114,720 cases. The latest data for 2024 show that the number of dengue cases in Indonesia continues to rise. As of 26 March 2024, there were 404 recorded deaths, with a total of 53,131 reported dengue cases. Dengue cases have been reported in several districts and cities this year. Among these areas, Tangerang District recorded 2,540 cases, Bandung City 1,741 cases, West Bandung District 1,422 cases, Lebak District 1,326 cases, Depok City 1,252 cases, Kendari City 1,195 cases, Bogor City 939 cases, and Subang District 909 cases (3).

Dengue cases have also been reported in Aceh. In 2022, there were 2,079 dengue cases in Aceh Province, with 24 fatal cases. In 2023, the number of cases increased to 2,186, with 18 fatalities. The incidence rate (IR) in 2023, ranging from 30 to 38 cases per 100,000 population, was higher than in 2022 (4).

According to 2022 data from the South Aceh District Health Office, dengue cases in South Aceh totaled 67, an increase from the previous year's 16 cases, consisting of 36 male and 31 female patients. The dengue morbidity rate per 100,000 population was 27% (5). In 2023, dengue cases in South Aceh decreased to 55, comprising 37 male and 18 female patients, with a morbidity rate of 21.9% and two recorded deaths in the Drien Jalo Health Center service area. The highest number of cases occurred in Lhok Bengkuang Subdistrict (22 cases), followed by

Tapaktuan (14 cases), Samadua (3 cases), South Kluet (3 cases), Sawang (4 cases), Kuala Ba'u (3 cases), North Kluet (2 cases), Blang Keujeren (2 cases), Drien Jalo (1 case), and Bakongan (1 case) (6).From January to October 2024, the number of dengue cases was 17, consisting of 10 male and 7 female patients. The highest number of cases was reported in Lhok Bengkuang Subdistrict (7 cases), followed by Ujung Padang Rasian (1 case), Tapaktuan (1 case), Meukek (1 case), Sawang (2 cases), Samadua (2 cases), Sedar (2 cases), and Seubadeh (1 case) (7).

According to a preliminary study conducted in November 2024 with the dengue program manager at the South Aceh District Health Office, many challenges remain in implementing the program in South Aceh, particularly regarding community participation in mosquito breeding site eradication activities (*Pemberantasan Sarang Nyamuk*, PSN). Low community participation, especially in urban areas, is suspected to be one of the main factors hindering optimal program implementation. This condition is worth investigating further, as community participation is a key component in the success of dengue control programs, as mandated in the Dengue Control Guidelines of the Ministry of Health of the Republic of Indonesia (2017) (8). This study aims to improve the effectiveness of the dengue control program in the Lhok Bengkuang Community Health Center service area, South Aceh, by identifying factors influencing program effectiveness, with a focus on community participation.

According to the Ministry of Health of the Republic of Indonesia (2017), dengue vector control aims to reduce the likelihood of dengue virus transmission by *Aedes aegypti* mosquitoes. This is achieved by reducing vector density and lifespan, minimizing human–mosquito contact, and eliminating breeding sites. Epidemiological studies, health education, larvicide application, routine and periodic larval inspections, fogging, susceptibility testing, and bioassays are part of dengue vector management. The elimination of mosquito breeding sites is another essential step (9).

The impact of dengue fever on the nation is significant, both in health and economic terms. The burden of this disease is not only felt by infected individuals but also by the healthcare system and the national economy. Treatment costs, work absenteeism, and decreased productivity are serious consequences that need attention. Prevention and education efforts are therefore crucial to reduce the national dengue burden (10).

To achieve the targets set in the National Medium-Term Development Plan (*Rencana Pembangunan Jangka Menengah Nasional*, RPJMN) and the Strategic Plan of the Ministry of Health (*Rencana Strategis*, RENSTRA) for 2018–2022, the government has made significant efforts to reduce the dengue incidence rate to less than 52 cases per 100,000 population. Dengue elimination is the main objective of various programs launched in response to Minister of Health Decree No. 581/MENKES/SK/VII/1992, as part of the implementation of the National Policy on Dengue Control. This policy includes a series of core program activities, such as epidemiological surveillance, case identification and treatment, vector control, Early Warning System (EWS), outbreak prevention, increased community engagement, counseling, partnerships/networks, capacity building, research and surveys, and monitoring and evaluation. Monitoring and evaluation of dengue control are conducted at various levels, from village to national, and include the assessment of inputs, processes, outputs, and outcomes achieved annually (11).

The extent to which a program achieves its intended objectives is one indicator of its effectiveness. Program effectiveness, as defined by Makmur (2011:6), is the execution of actions that demonstrate whether expectations, implementation, and desired results are achieved. Evaluating program effectiveness is essential for gathering data on its impact and benefits for beneficiaries. This evaluation also determines whether the program should be continued or not. Program performance measurement, and more specifically, determining how well a policy can be implemented, is what is meant by program effectiveness. To support decision-making in future program implementation, the evaluation of the Dengue Fever Control Program (*Program Pengendalian Penyakit Demam Berdarah Dengue*, P2DBD) will highlight areas needing improvement. According to G. Shabbir Cheema and Dennis A. Rondinelli, a program's success or failure depends on four factors: the surrounding environment, the nature and strength of inter-organizational relationships, the availability of resources within the organization, and the skills and characteristics of those assigned to implement the program (12).

Based on the Dengue Prevention and Control Guidelines (2017) issued by the Ministry of Health of the Republic of Indonesia, this study considers the following indicators as measures of dengue control program effectiveness: Larvae Free Rate, case fatality rate (CFR), PSN coverage, periodic larval inspection coverage, education coverage, and case response time (8). The dengue control program at the Lhok Bengkuang Community Health Center is evaluated using these indicators to determine the extent to which it meets national standards. This study aims to evaluate the effectiveness of P2DBD implementation in Lhok Bengkuang. This evaluation is important because dengue case numbers in the area remain fluctuating and national targets, such as a 95% Larvae

Free Rate, have not yet been met. The results of this research are expected to serve as a basis for improving dengue control strategies and enhancing community participation in the future.

METHODS

This study was conducted in December 2024 and January 2025, involving informants from the South Aceh District Health Office and the Lhok Bengkuang Community Health Center (*Puskesmas*). A descriptive approach was applied using qualitative data. Data for this study were obtained from various sources, including primary and secondary data, information on dengue cases, and in-depth interviews guided by an interview protocol. Interviews were conducted directly by the researcher using a semi-structured guide developed based on the Dengue Control Guidelines issued by the Ministry of Health of the Republic of Indonesia (2017). The guide covered topics related to the implementation of the Dengue Fever Control Program (*Program Pengendalian Penyakit Demam Berdarah Dengue*, P2DBD), community participation, and challenges encountered in the field. It was designed to minimize bias and ensure question consistency across informants.

Data analysis followed the thematic analysis framework of Miles & Huberman (1994), which involves three stages: data reduction, data display, and conclusion drawing/verification. Data validity was ensured through source triangulation (comparing information from community health center staff, health office personnel, and the community) and member checking to confirm preliminary findings with informants. The assessment of program effectiveness referred to the indicators specified in the Dengue Prevention and Control Guidelines of the Ministry of Health of the Republic of Indonesia (2017).

The research informants were categorized into four groups: (1) Main Informant (IU) – the dengue program manager (*Penanggung Jawab DBD*, PJ DBD) at Lhok Bengkuang Community Health Center, providing specific information on mosquito breeding site eradication activities (*Pemberantasan Sarang Nyamuk*, PSN) and case management; (2) Key Informant (IK) – the head of Lhok Bengkuang Community Health Center, serving as the leader of the health center; (3) Supporting Informant 1 (IP1) – the dengue program manager at the South Aceh District Health Office, responsible for dengue prevention and control programs at the district level; and (4) Supporting Informant 2 (IP2) – community members who have experienced dengue, included to enrich the information provided by the head of the health center and the dengue program manager at Lhok Bengkuang Community Health Center.

RESULT AND DISCUSSION

RESULT

Table 1. Number of Dengue Hemorrhagic Fever (DHF) Cases in the Service Area of Lhok Bengkuang Community Health Center

No	Years	Total Case DBD			Deadth		
		Male	Female	Total	Male	Female	Total
1.	2023	15	7	22	-	-	-
2	2024	3	4	7	-	-	-

In 2023, there were 22 reported cases of dengue hemorrhagic fever (DHF) in the Lhok Bengkuang Community Health Center, comprising 17 males and 5 females, with no recorded deaths. By October 2024, the number of DHF cases in the health center's service area had decreased to 7, consisting of 3 males and 4 females, with no reported fatalities.

Characteristics of Informants

Table 2. Characteristics of Informants

No.	Informants	Age	Sex	Education	Job Tittle
1.	IU	27 Years	Female	Bachelor of Applied Health Sciences	PJ DBD Puskemas Lhok Bengkuang
2.	IK	43 Years	Female	Bachelor of Midwifery	Head Lhok Bengkuang Community health Center

3	IP 1	40 Thn	Perempuan	Bachelor of Public Health	PJ DBD Dinas Kesehatan Aceh Selatan
4.	IP 2	62 Thn	Perempuan	Senior High School	Community

The data collection process was carried out through in-depth interviews with four informants, consisting of the Dengue Control Program Manager (*PJ DBD*) at Lhok Bengkuang Community Health Center as the Main Informant (IU), the Head of Lhok Bengkuang Community Health Center as the Key Informant (IK), the Dengue Control Program Manager at the South Aceh District Health Office as Supporting Informant 1 (IP1), and a community representative affected by dengue as Supporting Informant 2 (IP2).

Theme 1: Input for the Implementation of the Dengue Control Program (P2DBD) at Lhok Bengkuang Community Health Center

The effectiveness of the dengue hemorrhagic fever (DHF) control program depends on the availability of resources. In this study, the resources analyzed included human resources, infrastructure, funding, and the methods used. Data in this study were obtained through interviews with selected informants. Based on the results of the interviews, the following findings were obtained:

SubTheme 1.1 : Availability of Human Resources

Main Informant (IU) stated:

"The dengue program at Lhok Bengkuang Community Health Center involves me as the program holder, the environmental health officer (kesling), and the Rapid Response Team (TGC)."

Key Informant (IK) stated:
"*The person in charge of the program coordinates with the Rapid Response Team (TGC), which consists of doctors, laboratory staff, environmental health officers (kesling), and surveillance officers to handle dengue cases."*

Supporting Informant 1 (IP1) added:
"The dengue program at the community health center involves dengue officers, environmental health officers (kesling), and the health promotion team (promkes). At present, only the environmental health officer and the program holder are actively involved."

The implementation of the dengue control program at the South Aceh District Health Office and Lhok Bengkuang Community Health Center involves dengue officers, environmental health officers (*kesling*), and the health promotion team (*promkes*). However, in practice, it was found that those actively running the dengue control program were the environmental health officers (*kesling*), who coordinate with the Rapid Response Team (TGC).

SubTheme 1.2: Availability of Facilities and Infrastructure

Main Informant (IU) stated:
"DHF examinations use laboratory tests, larvicides, and fogging equipment."

Key Informant (IK) stated:
"The community health center coordinates with the Rapid Response Team (TGC), bringing water monitoring tools, documentation equipment, and laboratory equipment to support dengue control."

Supporting Informant 1 (IP1) added:
"The tools used include the Dengue Combo RDT, which consists of NS1 and RDT Dengue. Abate and larvicides are also available as mosquito larvae control agents."

From the statements of the three informants, it can be concluded that the implementation of the dengue control program at Lhok Bengkuang Community Health Center involves the use of the Dengue Combo RDT, water monitoring tools, laboratory testing equipment, and fogging machines. In addition, larvicides and abate are available to eliminate mosquito larvae.

SubTheme 1.3: Availability of Funding
Main Informant (IU) stated:
"Funds come from the Health Operational Assistance (Biaya Operasional Kesehatan, BOK). We ensure that the funds are used effectively by preparing a detailed budget plan and conducting regular monitoring and evaluation."

Key Informant (IK) added:
"The BOK funds are sufficient, although limited, so efficient use becomes a priority in handling dengue cases."

Supporting Informant 1 (IP1) also added:
"Funds come from BOK for the community health center and from the Special Allocation Fund (Dana Alokasi Khusus, DAK) for the district health office. If the funds run out before the end of the year, the community health center can request additional funding."

The implementation of the dengue control program at the South Aceh District Health Office is funded through DAK, while at Lhok Bengkuang Community Health Center it is funded through BOK. The findings of this study indicate that BOK funds are sufficient for dengue control activities, although the amount is limited; therefore, their use is made as effective as possible, focusing on priority issues.

SubTheme 1.4: Availability of Guidelines or Standard Operating Procedures (SOPs) Used
Main Informant (IU) stated:
"There is an SOP for dengue case management because its purpose is to regulate every program. Without an SOP, we cannot go into the field, as the SOP serves as a reference for the team in carrying out their duties in the field."

Key Informant (IK) stated:
"Each program holder has an SOP that regulates the team's work mechanisms to ensure the effectiveness of dengue program implementation."

Supporting Informant 1 (IP1) added:
"The dengue SOP includes Epidemiological Investigation (PE), Mosquito Breeding Site Eradication (Pemberantasan Sarang Nyamuk, PSN), and fogging. Fogging is only carried out if PSN has been conducted first."

The implementation of the dengue control program at Lhok Bengkuang Community Health Center has been carried out based on clear standard operating procedures (SOPs). The SOPs cover key activities such as Epidemiological Investigation (PE), Mosquito Breeding Site Eradication (PSN), and fogging. These SOPs are an essential foundation for the implementation team in determining intervention steps in the field and ensuring that activities are carried out systematically and in accordance with established procedures.

Theme 2: Implementation of the Dengue Control Program (P2DBD) at Lhok Bengkuang Community Health Center

The implementation of the dengue control program consists of mosquito breeding site eradication (*Pemberantasan Sarang Nyamuk*, PSN), larvicide application, fogging, health education, epidemiological investigation, and vector surveys, as described in the following interview findings:

Subtheme 2.1: Implementation of PSN Activities
Main Informant (IU) stated:
"One day before fogging, we urge the community to cover their food and remove items that could become mosquito breeding sites, and we monitor the program's effectiveness through periodic larval surveys."

Key Informant (IK) stated:
"We coordinate with the Health Office and first coordinate with the community, sending a letter to the village authorities stating that before we carry out fogging, we will conduct a communal clean-up (gotong royong). The fogging will then be conducted the following day."

Supporting Informant 1 (IP1) explained:
"The community health center usually issues a notification letter to the keuchik (village head) to inform residents about the gotong royong. After the clean-up, if dengue cases are found, we will issue a fogging recommendation letter, which is then forwarded to the community health center and the keuchik. Residents are advised to cover their food and remove laundry before fogging. Nowadays, fogging chemicals no longer have a strong odor like before, so more residents allow their houses to be sprayed."

Supporting Informant 2 (IP2) stated:
"Usually, we clean the drains, dispose of accumulated garbage, cut the grass, and some people spray mosquito repellent around their own homes. Not everyone participates—some are diligent, but others are lazy. Those who are lazy usually say they are busy working."

The implementation of the dengue control program at Lhok Bengkuang Community Health Center shows that PSN activities are conducted through *gotong royong* (communal clean-up) one day before fogging, together with the local community. During fogging, residents are advised to keep food and other items away from fogging smoke. In practice, no significant obstacles were found, as residents generally allowed their houses to be sprayed and were willing to participate in communal clean-up activities.

Subtheme 2.2: Implementation of Larvicide Application
Main Informant (IU) revealed:
"We distribute larvicides to the community, provide education on their use, and conduct regular monitoring to assess their effectiveness."

Key Informant (IK) explained:
"The program holder first provides education to households, then distributes Abate powder to be sprinkled in bathtubs. The community generally agrees because this program is for their health."

Supporting Informant 1 (IP1) added:
"The community health center receives larvicides from the Health Office and distributes them to households in the form of powder (such as Abate), in amounts corresponding to the number of villages served (1–2 bottles for 10–15 villages). Each bottle contains 2–3 spoonfuls of larvicide powder, wrapped in paper for distribution. Residents sprinkle the larvicide themselves when mosquito larvae inspections are conducted."

Supporting Informant 2 (IP2) mentioned:
"Yes, they say it is to kill mosquito larvae. We are told to sprinkle it in bathtubs and water storage containers."

The implementation of the dengue control program at Lhok Bengkuang Community Health Center shows that larvicide application begins with providing education to the community, followed by the distribution of Abate powder to be sprinkled in bathtubs. Regular monitoring is then conducted to assess its effectiveness. No obstacles were found in the implementation, as residents were willing to have Abate applied to their bathtubs.

Subtheme 2.3: Implementation of Fogging
Main Informant (IU) explained:
"Fogging is carried out based on the results of the epidemiological investigation. When there is a reported dengue case, fogging is conducted focusing on the affected area."

Key Informant (IK) described:
"First, the community health center sends a letter to the keuchik and village officials to organize a communal clean-up (gotong royong) to clean the environment. If the administrative process takes too long, this is done via telephone first, with the letter sent later."

Supporting Informant (IP1) added:
"Fogging is carried out by a special team from the Health Office, starting with a case report from the dengue officer to their supervisor, which is then forwarded to the community health center for an epidemiological investigation. This is usually conducted one week before fogging. So far, there have been no major obstacles, although there could be issues such as limited fuel or operational funds. The community health center only serves

as a companion to the fogging team, helping direct them to the case location and coordinating with village officials to obtain data on affected houses, as the fogging team is paid per house fogged."

Supporting Informant (IP2) stated:
"If there is already a dengue case, then the community health center will come down to carry out fogging."

The implementation of the dengue control program at Lhok Bengkuang Community Health Center shows that fogging is carried out based on the results of an epidemiological investigation conducted one week earlier in the dengue-affected area. Fogging is performed by a special team from the Health Office. The main obstacle identified is that when there is a limitation in operational funds, the community health center's role is reduced to accompanying the fogging team rather than carrying out the process themselves.

Subtheme 2.4: Implementation of Health Education Activities
Main Informant (IU) stated:
"Dengue education is integrated into various activities, such as during posyandu (integrated health service posts), mosquito larvae inspections, and home visits conducted by community health center staff. In addition, we also collaborate with health cadres and village officials to disseminate information on dengue prevention to the community."

Key Informant (IK) stated:
"Health education is an important part of every activity involving the community. The health promotion team (Promkes) is always involved in providing education so that the community understands its benefits. Although it is no longer mandatory under current regulations, health education is still considered an important part of primary healthcare services at the community health center level."

Supporting Informant (IP1) added:
"Health education is generally carried out by the Promkes team. Even though the technical guidelines from the Health Office no longer formally include health education, the community health center still voluntarily provides education during various activities, such as mosquito larvae inspections conducted from house to house."

Supporting Informant (IP2) also added:
"If there is a posyandu or health staff visiting the house, they usually tell us about the 3M PLUS method."

Health education activities within the dengue control program at Lhok Bengkuang Community Health Center are carried out by the health promotion team. In practice, dengue health education is an integrated effort that includes home visits, coordination with village health workers, larvae inspections, and information dissemination by village authorities.

Subtheme 2.5: Implementation of Epidemiological Investigation
Main Informant (IU) stated:
"If there is a reported dengue case, we immediately conduct an epidemiological investigation (PE) at the patient's home and the surrounding environment to identify the source of transmission and determine the necessary actions."

Key Informant (IK) added:
"The working mechanism for dengue epidemiological investigation is structured. The Rapid Response Team (TGC) works together with the surveillance team to go into the field to search for dengue cases."

Supporting Informant (IP1) explained:
"Epidemiological investigation falls under the responsibility of the surveillance unit, including in terms of funding. PE funds are used when there is a case and must first be reported to the surveillance unit. Surveillance is tasked with identifying new cases, while PE ensures the source of the case (local or imported). PE involves inspecting the patient's home and surroundings, as well as interviewing the patient and nearby residents. If the patient has traveled within two weeks before the onset of fever, the case is considered imported and does not require PSN or fogging."

Supporting Informant (IP2) stated:
"When I had dengue, community health center staff came to my house. They asked questions about where I had been, looked around the house, and talked to my neighbors."

The implementation of the dengue control program at Lhok Bengkuang Community Health Center shows that epidemiological investigations are carried out when there is a reported case from the surveillance team, which is responsible for finding new cases. In practice, dengue health education is integrated into the PE process, which includes inspecting the patient's home, the surrounding environment, and interviewing the patient and nearby residents. If the patient had traveled within two weeks before fever onset, the case is classified as imported and does not require PSN or fogging.

Subtheme 2.6: Implementation of Vector Survey Activities
Main Informant (IU) stated:
"Vector survey activities are carried out periodically by observing mosquito populations and checking for the presence of larvae in residents' homes."

Key Informant (IK) added:
"In the past, there was a team from Banda Aceh working together with the health office and health workers at our community health center to conduct vector survey activities by observing mosquito populations and checking ***for the presence of larvae in residents' homes; they even stayed overnight in the village."***

Supporting Informant (IP1) explained:
"Vector surveys are conducted through collaboration between the Health Office, the community health center, and surveillance officers. The methods used include household inspections, interviews with residents, and data recording for analysis."

Supporting Informant (IP2) also added:
"Usually, community health center staff come here to check behind the house and at garbage pile areas."

The implementation of the dengue control program at Lhok Bengkuang Community Health Center shows that vector survey activities are carried out through collaboration between the Health Office, the community health center, and surveillance officers. In practice, vector surveys include household inspections, resident interviews, and data recording for analysis.

Theme 3: Output of the Dengue Control Program (P2DBD) Implementation at Lhok Bengkuang Community Health Center

What we refer to as "achievement" in the implementation of programs and activities is the result of our efforts in carrying out a series of planned steps to achieve our goals. The Ministry of Health has set target indicators in the 2020–2024 Strategic Plan (*Renstra*) to achieve zero dengue hemorrhagic fever (DHF) deaths by 2030. Specifically, 95% of districts and cities are expected to achieve this by that year (14).The achievements of the dengue control program implementation in this study consist of PSN, larvicide application, fogging, health education, epidemiological investigation, and vector surveys, as reflected in the following interview findings:

Subtheme 3.1 Achievement of PSN Implementation

Main Informant (IU) stated:
"To measure the success of the PSN program, we don't just look at the reduction in DHF cases, but also at the results of mosquito larvae monitoring in residents' homes. There is what we call the Larvae Free Index (Angka Bebas Jentik), and the higher this index, the more households are free from mosquito larvae. In addition, we also look at the level of community participation in PSN activities, for example, how active they are in communal clean-up activities or during periodic larval inspections."

This was reinforced by the statement from Key Informant (IK)**:**
"After reviewing last year, 2024, we found that the target was achieved. We anticipated the rainy season by educating the community and making announcements via loudspeakers on the ambulance."

Supporting Informant (IP1) stated:
"PSN does not have specific targets."

The implementation of PSN is measured by the reduction in DHF cases, the Larvae Free Index (ABJ), and community participation in PSN activities. In 2024, the PSN implementation target was achieved through rainy season preparedness efforts, including community education and mobile loudspeaker announcements. However, one supporting informant stated that PSN had no specific targets.The statement from the supporting informant regarding the absence of specific targets in PSN implementation indicates a weakness in program planning. This condition may affect effectiveness, as without quantitative targets, it is difficult to objectively measure achievement and evaluate success. Setting targets aligned with national indicators, such as ABJ ≥95%, is essential to ensure consistency in PSN implementation and continuous improvement.

Subtheme 3.2: Achievement of Larvicide Application Implementation
Main Informant (IU) stated:
"We assess the program's achievements based on several indicators, such as the number of households receiving larvicides, the number of active jumantik (mosquito larvae monitoring cadres) conducting inspections, and the Larvae Free Index (ABJ). If these figures increase and DHF cases decrease, it means the program is running according to target."

Key Informant (IK) stated:
"In these eight villages, measurement depends on the set targets, but there have been no more problems."

Supporting Informant 1 (IP1) added:
"No target means no achievement."

The findings of this study indicate that the larvicide program has no specific targets. However, its success can be assessed from the number of households receiving larvicides, the number of active *jumantik* cadres conducting monitoring, and the Larvae Free Index (ABJ). When these figures increase and DHF cases decline, it indicates that the program is on track to meet its intended goals.

Subtheme 3.3 : Achievement of Fogging Implementation
Main Informant (IU) stated:
"The success of fogging is seen from the number of adult mosquitoes in the fogged area and the decrease in DHF cases after fogging. If DHF cases remain high, it means there is something less effective, which could be due to PSN not being optimal or fogging being carried out too late."

Key Informant (IK) added:
"Previously, DHF cases were still high even after fogging. The success of fogging is measured by the reduction in case numbers. Fogging is carried out in affected villages as a preventive measure."

Supporting Informant 1 (IP1) also added:
"Fogging does not have a fixed target; its implementation depends on the number of cases. If cases decrease but funds are still available, fogging can be carried out based on community requests. The main priority remains areas with DHF cases."

The findings of this study indicate that fogging activities do not have specific targets. However, program success can be observed from the reduction in DHF cases and the number of adult mosquitoes in the fogged area.

Subtheme 3.4 : Achievement of Health Education Implementation
Main Informant (IU) stated:
"We measure its success from the number of health education sessions conducted, and we also check whether residents actually apply the 3M Plus method in their homes."

Key Informant (IK) added:
"The achievement of health education is measured based on changes in community behavior. It is estimated that

around 75% of the community understands and applies dengue-related information from the health education sessions."

Supporting Informant (IP1) also added:
"Achievement is measured based on the number of health education activities conducted, as well as education provided during other activities such as mosquito larvae inspections. However, until now, no specific targets have been set."

The findings of this study indicate that health education activities have no specific targets. However, program success can be seen from behavioral changes in the community.

Subtheme 3.5 : Achievement of Epidemiological Investigation Implementation
Main Informant (IU) stated:
"We assess the achievement of PE (epidemiological investigation) by the number of new cases after PE is conducted. If, after conducting PE, there are no new cases in the following weeks, it means the program is successful."

Key Informant (IK) also added:
"PE achievement is measured by the number of cases that can be followed up after the investigation."

Supporting Informant (IP1) stated:
"PE has no specific achievement target. Its achievement is linked back to regular mosquito larvae inspections, as both involve household inspections."

The findings of this study indicate that epidemiological investigation activities do not have specific targets. However, program success can be assessed by the number of cases that can be followed up.

Subtheme 3.6 : Achievement of Vector Survey Implementation
Main Informant (IU) stated:
"We measure its success from the Larvae Free Index (ABJ)—the higher the number, the better. If the ABJ is above 95%, it means the area is safe from DHF."

Key Informant (IK) added:
"Vector survey achievement is assessed from the decrease in mosquito larvae density based on ABJ, House Index (HI), Container Index (CI), and Breteau Index (BI) indicators. A reduction in DHF cases and increased community awareness in practicing the 3M Plus method are also indicators of success."

Supporting Informant (IP1) stated:
"Vector survey achievement is measured based on the Larvae Free Index (ABJ) after larval control activities are carried out."

The findings of this study indicate that vector survey activities do not have specific targets. However, program success can be assessed from the Larvae Free Index (ABJ) after mosquito larvae control activities have been implemented.

Theme 4:Outcome of the Dengue Control Program (P2DBD) Implementation at Lhok Bengkuang Community Health Center
Main Informant (IU) stated:
"DHF cases at Lhok Bengkuang Community Health Center have decreased significantly, from 22 cases in 2023 to 7 cases in 2024."

Key Informant (IK) said:
"The decrease in DHF cases is the result of various prevention efforts, such as health education, fogging in high-risk areas, and increasing community awareness of environmental cleanliness."

Supporting Informant 1 (IP1) stated:
"Monitoring is continuously carried out in high-risk areas. The Mosquito Breeding Site Eradication Movement

(PSN) is intensified by encouraging the community to implement the 3M Plus method (Draining, Covering, and Recycling)."

Supporting Informant 2 (IP2) confirmed:
"After the prevention program was implemented, the number of mosquitoes around the house decreased. We hope DHF cases will continue to decline in the future."

The outcome of the dengue control program at Lhok Bengkuang Community Health Center is considered successful due to the significant reduction in cases.

DISCUSSION

Effectiveness of Input in the Implementation of P2DBD at Lhok Bengkuang Community Health Center

The dengue hemorrhagic fever (DHF) control program at Lhok Bengkuang Community Health Center is led by a coordinator who works in collaboration with Environmental Health Officers (PKL), Public Health Officers (PKM), and the Rapid Response Team (TGC). However, although the PKL and TGC are actively involved, no Entomology Health Officer (PHE) was found. As a result, the human resources available for program implementation are not effective and do not meet the requirements stipulated in the Regulation of the Minister of Health No. 50 of 2017 on Environmental Health Quality Standards and Health Requirements for Vectors and Disease-Carrying Animals and Their Control**.** This regulation mandates that all community health centers employ qualified entomologists, health promoters, epidemiologists, and environmental health officers to combat vectors. Despite being the front line of primary health care, health personnel at community health centers face shortages in numbers and qualifications, which has reduced the effectiveness of the DHF control program (15).

According to the Indonesian Ministry of Health (2017), fogging equipment, personal protective equipment (PPE) for fogging activities, and Abate powder for larval eradication are essential facilities and infrastructure for dengue control efforts. Research indicates that rapid diagnostic tests (RDTs), water monitoring tools, laboratory examination equipment, and fogging machines are part of the facilities available for dengue control initiatives. However, the study found that some facilities and infrastructure are still lacking, including PPE for fogging and insecticides. The absence of proper supervision and maintenance of equipment results in PPE not being used, exposing workers to risks such as chemical poisoning through inhalation, skin and eye irritation, and other health issues from direct exposure. These facilities and infrastructure are therefore not operating optimally and cannot be fully utilized. A study conducted in the Bengkalis Community Health Center area found that inadequate infrastructure and facilities can hinder program implementation, preventing the achievement of planned objectives (16).

Article 62 of the Community Health Center Regulation No. 23 of 2016 states that all programs are funded from the National Budget (APBN) or Regional Budget (APBD). Equipment for carrying out the six activities of the P2DBD program and transportation for staff to and from community events are funded from the program's allocated budget (17). The present study found that the DHF control program at Lhok Bengkuang Community Health Center is funded by the Health Operational Assistance Fund (BOK). While the budget is sufficient for dengue control, it is limited, so it must be used efficiently based on problem prioritization. According to a study conducted at Siak Hulu Community Health Center, P2DBD activities are funded by both the Regional Budget (APBD) and the BOK.Interviews indicated that Lhok Bengkuang Community Health Center follows the Standard Operating Procedures (SOPs) outlined in the Ministry of Health's Technical Guidelines (*Petunjuk Teknis*, Juknis) in implementing dengue control. A study in the Bengkalis Community Health Center area revealed that the P2DBD program at Mojosongo Community Health Center has its own SOPs, and in the absence of a policy governing the P2DBD program, they follow the Juknis (16).

Effectiveness in the Implementation of P2DBD at Lhok Bengkuang Community Health Center

Mosquito Breeding Site Eradication (PSN) 3M is regulated under Minister of Health Regulation No. 591 of 2016**,** which defines PSN for dengue as a joint effort between the community and the government to prevent DHF, followed by continuous monitoring. To limit the number of *Aedes aegypti* mosquitoes and prevent or minimize dengue transmission, PSN uses the 3M Plus approach (draining, covering, and recycling) as one of its measures (18). Interviews at Lhok Bengkuang Community Health Center indicated that one day before fogging, community members participate in communal clean-up activities. During fogging, they are advised to keep food and other

items away from the fogging smoke. No problems were reported during implementation.Interviews regarding larvicide application revealed that the community is educated and each household receives Abate powder in amounts based on the number of villages served (1–2 bottles for 10–15 villages). Two or three teaspoons of larvicide powder are individually packaged for use in bathtubs, with regular monitoring to assess effectiveness. No problems were reported during implementation.Chemical control methods such as fogging or fumigation are permitted for vector control under Minister of Health Regulation No. 50 of 2017**.** Fogging is most effective against *Aedes aegypti*, *Culex*, and *Anopheles* mosquitoes, which are vectors for DHF, malaria, and chikungunya, respectively.

Targeted fogging aims to prevent dengue transmission by breaking the chain of infection in affected areas. The program consists of two cycles, spaced one week apart, and includes insecticide spraying, mosquito breeding site eradication, and community education within a 100-meter radius (about 20 houses). If additional DHF cases are found through epidemiological investigation, further fogging is conducted in those areas. In Lhok Bengkuang, fogging is carried out based on epidemiological findings from the previous week in affected areas and is conducted by a special team from the Health Office. The fogging process was deemed optimal, as it was carried out immediately after surveillance officers reported cases.Health education aims to increase community understanding of health issues and motivate them to take actions to improve their own and their family's health (19). Interviews indicated that health education has been maximally implemented in the community as part of the P2DBD program, conducted during larvae inspections, home visits, and in collaboration with village health workers and officials.

Epidemiological investigation activities include identifying individuals suspected or confirmed to have DHF and inspecting houses within a 100-meter radius for *Aedes aegypti* larvae (20). Interviews revealed that all necessary steps for conducting epidemiological investigations in the dengue control program have been carried out. In practice, dengue health education during these investigations involves home visits, environmental inspections, and interviews with patients and residents. If a patient had traveled within two weeks prior to fever onset, the case is classified as imported and does not require PSN or fogging.Vector surveys are conducted by inspecting water storage facilities within the health center's service area to assess vector control efforts aimed at preventing dengue transmission. Lhok Bengkuang Community Health Center collaborates with the Health Office and other health facilities to conduct vector surveys, which involve interviewing residents, inspecting their homes, and recording data for later analysis.

Effectiveness of Output in the Implementation of P2DBD at Lhok Bengkuang Community Health Center

The absence of clear targets in the implementation of health education within P2DBD was revealed during interviews. However, the program has proven to be highly successful and optimal. This is evidenced by a decrease in DHF cases between 2023 and 2024, along with increases in the Larvae Free Index (LFR), the number of active health workers conducting monitoring, and the number of households receiving larvicides—all in line with the national target set by the Ministry of Health that 75% of the population should understand and apply the information provided during health education sessions.Nonetheless, it is suspected that the Larvae Free Index (ABJ) in the Lhok Bengkuang service area did not reach the national target of 95%. Minister of Health Regulation No. 4 of 2019 on Minimum Service Standards in the health sector stipulates that at least 95% of households in each district/city must be inspected and declared free of *Aedes aegypti* larvae. This standard serves both as a measure of a local government's ability to provide essential health services and as a means of evaluating the effectiveness of dengue vector control programs (21).

Because informants in this study did not provide accurate ABJ data for the Lhok Bengkuang Community Health Center service area, these figures were unavailable. However, interviews and field observations confirmed that mosquito larvae were still found in some households during monitoring. This suggests that the national target set by Ministerial Regulation No. 4 of 2019 has not been met, as ABJ levels in the area are likely below ideal. This finding is consistent with a 2024 study in Pariaman, which reported an average ABJ achievement rate of only 55%, far below the national standard of 95%. The main obstacles identified in achieving ABJ targets were lack of community participation and difficulties in eliminating mosquito breeding sites at the household level (22).

Effectiveness of Outcome in the Implementation of P2DBD at Lhok Bengkuang Community Health Center

The impact produced by an intervention is referred to as its outcome. Outcomes are often linked to achievable goals or targets (23). DHF cases decreased significantly following the implementation of six interventions at Lhok Bengkuang Community Health Center: PSN, larvicide application, fogging, health education,

epidemiological investigation, and vector surveys. Data show that there were 22 DHF cases in the service area in 2023, decreasing to 7 cases in 2024. Such evidence indicates that efforts to control dengue transmission have been successful.Although the case data show a significant decline in DHF cases from 2023 to 2024, interviews with informants revealed differing perceptions regarding the program's effectiveness. Some informants felt that PSN activities and community education had been implemented optimally, while others cited constraints such as the absence of specific targets or limited resources that affect program sustainability. These differences in perception likely stem from the varied backgrounds and roles of the informants field staff tend to focus on technical implementation, while health center leadership views the program from an administrative perspective. Such differences are important to analyze, as they can influence strategies for program improvement, for example by aligning perceptions through internal coordination and joint evaluation.

CONCLUSION

The dengue hemorrhagic fever (DHF) control program at Lhok Bengkuang Community Health Center has proven effective in reducing cases from 22 to 7, with no fatalities. The main activities include mosquito breeding site eradication (PSN), larvicide application, fogging, health education, vector surveys, and epidemiological investigations. Challenges identified include a shortage of entomology personnel, insufficient personal protective equipment (PPE) for fogging staff, and suboptimal community participation. The program's success has been supported by collaboration among health workers, the rapid response team, village authorities, and the community. However, the Larvae Free Index (ABJ) has not yet reached the national target of 95%, indicating the need for enhanced efforts.It is recommended to increase both the number and competencies of health workers, particularly in entomology, as well as to ensure the provision of PPE and surveillance equipment. Community participation should be strengthened through continuous education. Routine monitoring and evaluation should be conducted, and further research is recommended in other areas to enable broader program evaluation. This study underscores the need for strategic resource allocation and policy strengthening to improve entomological surveillance and community engagement, particularly to ensure local-level implementation aligns with the national ABJ target of ≥95%.

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