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Transformation of Healthy Islamic Boarding Schools: Dengue Education and Larva Monitoring Website for Students Through Digital Engagement

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Abstract. *Dengue Hemorrhagic Fever (DHF) remains a major public health challenge in Indonesia, particularly in densely populated environments such as Islamic boarding schools (pesantren). Crowded dormitories, shared sanitation facilities, and numerous water containers create favorable conditions for mosquito breeding, resulting in recurrent dengue cases and low larva-free indices in several pesantren in East Java. This community-based program was implemented to strengthen dengue prevention through the integration of structured health education, simple ovitrap technology, and a digital larva-monitoring website as a digital engagement model for Santri Jumantik.*

The program employed a pre-experimental one-group pretest–posttest design conducted over three months (September–November 2025) at a pesantren in Probolinggo, involving 30 students. Interventions included dengue and PHBS education, hands-on training in constructing low-cost ovitraps from recycled materials, and weekly larval surveillance reported through a web-based monitoring system. Data were collected using knowledge questionnaires, ovitrap observations, larva-free index (ABJ) measurements, and website activity logs, and analyzed descriptively and using the Wilcoxon Signed Rank Test. The results demonstrated a significant improvement in students' knowledge ($Z = -3.996$; $p < 0.001$), with high-level knowledge increasing from 26.7% to 86.7%. Ecological indicators also improved, as the ABJ increased from 72% to 80% and ovitrap positivity declined over time. Digital reporting compliance reached 92%, indicating strong student engagement. This integrated approach effectively strengthened dengue prevention practices and offers a scalable model for transforming pesantren into healthier learning environments.

Katakunci:
DBD, Pendidikan Kesehatan, Ovitrap, Santri Jumantik, PHBS.

Abstrak. Demam Berdarah Dengue (DBD) masih menjadi masalah kesehatan masyarakat di Indonesia, khususnya pada lingkungan dengan kepadatan tinggi seperti pondok pesantren. Kondisi asrama yang padat, penggunaan fasilitas sanitasi bersama, serta banyaknya tempat penampungan air menjadikan pesantren rentan terhadap

perkembangbiakan nyamuk dan kejadian DBD berulang. Rendahnya Angka Bebas Jentik (ABJ) di beberapa pesantren di Jawa Timur menunjukkan perlunya upaya pencegahan yang terarah dan berkelanjutan. Program pengabdian ini dilaksanakan untuk memperkuat pencegahan DBD melalui integrasi edukasi kesehatan terstruktur, pemanfaatan teknologi ovitrap sederhana, dan penggunaan website pemantauan jentik berbasis digital sebagai model keterlibatan Santri Jumantik.
Kegiatan dilaksanakan menggunakan desain pra-eksperimental one-group pretest–posttest selama tiga bulan (September–November 2025) di sebuah pesantren di Probolinggo dengan melibatkan 30 santri. Intervensi meliputi edukasi DBD dan Perilaku Hidup Bersih dan Sehat (PHBS), pelatihan pembuatan ovitrap murah dari bahan daur ulang, serta pemantauan jentik mingguan yang dilaporkan melalui sistem berbasis web. Data dikumpulkan melalui kuesioner pengetahuan, observasi ovitrap, pengukuran ABJ, dan log aktivitas website, serta dianalisis secara deskriptif dan menggunakan uji Wilcoxon. Hasil menunjukkan peningkatan pengetahuan santri secara signifikan ($Z = -3{,}996$; $p < 0{,}001$), dengan kategori pengetahuan tinggi meningkat dari 26,7% menjadi 86,7%. Secara ekologis, ABJ meningkat dari 72% menjadi 80% dan positivitas ovitrap menurun. Kepatuhan pelaporan digital mencapai 92%, menunjukkan keterlibatan santri yang tinggi. Integrasi edukasi, teknologi sederhana, dan pemantauan digital terbukti efektif serta berpotensi direplikasi di pesantren dan komunitas lainnya.

1 Introduction

Dengue Hemorrhagic Fever (DHF) remains a significant public health problem in Indonesia and globally, with increasing incidence driven by urbanization, population mobility, and climate variability (World Health Organization, 2025) (Gubler, 2011); (Wijayanti et al., 2016). Official reports from the Ministry of Health and international organizations show a spike in cases in recent years, requiring more systematic preventive interventions in high-risk groups.Ministry of Health of the Republic of Indonesia (Kementerian Kesehatan RI., 2024).

Islamic boarding schools are strategic locations for DHF prevention interventions due to the characteristics of their population and environment: high density of students, shared sleeping and sanitation facilities, communal worship and dining activities, and extensive use of water containers (potential breeding sites for Aedes spp.). These

conditions increase the likelihood of larval habitats forming and complicate the implementation of consistent larval monitoring. Studies and field reports in educational contexts (including examples from Islamic boarding schools) indicate that prevention activities in Islamic boarding schools are often episodic (e.g., occasional spraying or education sessions) and lack support from a continuous recording system(Choiri et al., 2025)(Rahmah, 2019)

At the location of this program partner (Islamic boarding school in Probolinggo), initial checks showed a Larvae-Free Rate (LFR) of 72% prior to intervention — this figure is still well below the program target (LFR ≥ 95%), and indicates the presence of breeding sites in areas such as bathrooms, wudu facilities, and water storage containers. Such field conditions make the partner Islamic boarding school a priority location for participatory and sustainable interventions.

The main gaps identified in the context of Islamic boarding schools are: Unsystematic larval monitoring (much of it manual and undocumented), making it difficult to monitor weekly/monthly trends; Participation of students that is not yet organized into a sustainable monitoring cadre; Limitations of simple technologies adopted locally for early detection (e.g., ovitraps made by the community are not yet routine practice); and A lack of digital data to help pesantren management and local policymakers make quick decisions (Tien Zubaidah, Juanda, 2021) (Hnusuwan et al., 2020).

Research and systematic reviews show that a combination of community empowerment, simple detection tools such as ovitraps, and centralized reporting/monitoring systems can improve early detection and reduce ovitrap positivity rates/larval indices when applied consistently. Ovitraps have proven to be a sensitive surveillance tool for detecting the presence of *Aedes* mosquitoes and are often more informative than traditional larval surveys when applied at specific locations and integrated with community participation (Fernandes et al., 2025) (Wijayanti et al., 2016) Bowman et al., 2016) (Norsita Agustina, Purwo Setiyo Nugroho, 2025).

Vector control efforts for dengue fever are not limited to mechanical and chemical approaches, but can also be developed through

biological control using natural agents (Achee et al., 2015). One method that has increasingly been applied in boarding school–based educational settings is the use of larvivorous fish. A Community Service Program (PKM) entitled *"Socialization of Biological Control of Aedes aegypti Larvae Using Betta Fish (Betta splendens) as an Effort to Prevent Dengue Hemorrhagic Fever (DHF) in the Female Dormitory of the Faculty of Health, Nurul Jadid Islamic Boarding School"* demonstrated that the use of betta fish as natural predators of mosquito larvae can serve as an effective, low-cost, and environmentally friendly vector control strategy, particularly in bathrooms and permanent water storage containers (Nugroho et al., 2021)

Based on this gap analysis, this program offers novelty that focuses on Islamic boarding schools: integration of (1) structured health education tailored to the rhythm of Islamic boarding schools, (2) the creation and use of simple ovitraps by students, and (3) digitized monitoring through a larva-monitoring website that enables weekly reporting, visualization of risk zones (green–yellow–red), and data storage for periodic evaluation. This approach bridges the gap between episodic field practices and the need for a participatory, evidence-based, sustainable surveillance system.

Why it is important and why partner Islamic boarding schools were chosen: ABJ 72% and a history of recurring cases in partner Islamic boarding schools indicate the need for targeted intervention Pesantren have an organizational structure (administrators/teachers, mentors) that facilitates the formation of cadres (Santri Jumantik) and the integration of activities into the pesantren routine (weekly monitoring shifts, community announcements, etc.). Digital reporting provides dual benefits: it speeds up follow-up by pesantren management and provides the written evidence needed for coordination with health centers/health offices (Lesmana & Halim, 2020).

Thus, interventions that combine education, simple technology (ovitrap), and digitized reporting not only increase students' knowledge, but also strengthen environmental monitoring capacity and provide data that enables early response and prioritization of risk areas—a model that can be easily replicated in other Islamic boarding schools.

2 Method

This community service program employed a Community-Based Participatory Approach (CBPA), which emphasizes shared decision-making, capacity building, and community ownership, consistent with global recommendations for integrated vector management in dengue-endemic settings (World Health Organization, 2012) Heyrani et al., 2024). The intervention was implemented at a partner Islamic boarding school in Probolinggo, East Java, from September to November 2025. The selection of this pesantren was based on several strategic considerations. First, the pesantren demonstrated a high environmental risk for dengue transmission, evidenced by pre-intervention larval inspections showing a Larva-Free Index (LFI/ABJ) of 72%, which is below the national target of ≥95%. Recurrent findings of mosquito larvae in communal bathrooms, ablution areas, and water-storage containers further indicated persistent breeding sites within the school environment. Second, the pesantren had a documented history of repeated dengue-related concerns in the previous two years. Third, the pesantren leadership formally expressed institutional readiness and demand for the development of a structured, sustainable dengue prevention model involving active student participation and digital monitoring.

A total of 30 students participated in the program. Participants were selected from 54 eligible students through purposive sampling based on clearly defined inclusion and exclusion criteria. The inclusion criteria consisted of: (1) being a full-time student aged 15–20 years; (2) residing in the pesantren dormitories; (3) being in good physical condition and able to participate in routine field activities; (4) having basic skills in operating a smartphone for digital reporting; and (5) willingness to participate with approval from the pesantren administration. The exclusion criteria included: (1) mobility limitations or acute illness during the intervention period; (2) prolonged absence from the pesantren during the three-month program; and (3) inability to attend training sessions or inconsistent participation in the monitoring activities.

The application of the Community-Based Participatory Approach (CBPA) in this service program was reflected in three main components. The first component, co-design, involved collaborative planning with pesantren administrators and student representatives to tailor the intervention to the daily routines of the boarding school. This included joint development of educational materials, mapping of ovitrap installation points, and designing digital reporting procedures. The second component, shared decision-making, ensured that decisions regarding the number of Santri Jumantik (student larva monitors), weekly inspection schedules, task distribution, and environmental follow-up actions were made collectively between the research team and pesantren leadership. The third component, capacity building, was implemented through training sessions that equipped students with skills in constructing low-cost ovitraps, identifying Aedes larvae, performing environmental risk assessments, and using the web-based larva-monitoring platform. These efforts aimed to strengthen student autonomy and enable the pesantren to sustain the program beyond the intervention period.

The intervention consisted of four integrated activities. First, students received structured health education on dengue prevention and Clean and Healthy Living Behaviors (PHBS) delivered through modules, posters, and interactive discussions. Second, students participated in hands-on training to construct ovitraps using recycled plastic bottles, black cloth, and straw infusion solution, enabling them to understand and produce a simple surveillance tool. Third, trained Santri Jumantik conducted weekly larval surveillance, checking ovitraps and inspecting potential mosquito breeding sites under the supervision of lecturers and pesantren staff. Fourth, all findings were documented via a web-based larva-monitoring platform, which allowed students to input data, visualize risk zones (green, yellow, red), and support real-time monitoring by school administrators.

Figure 1. Method Diagram

The first stage is to provide health education to students about Clean and Healthy Living Behaviors (PHBS) and knowledge about Dengue Hemorrhagic Fever (DHF). The material presented includes the causes and transmission of DHF by Aedes aegypti mosquitoes, clinical symptoms of DHF, and the importance of early detection. The principles of PHBS in daily life at the boarding school (maintaining environmental hygiene, waste management, and preventing water stagnation). The objective of this stage is to increase the awareness and knowledge of students so that they are able to understand the importance of preventing DHF in their own environment.

The second stage is practical training in making mosquito egg traps (ovitraps). Students are taught how to make simple tools to detect the presence of mosquito larvae using easily obtainable materials, such as used plastic bottles or transparent containers, black cloth to attract female mosquitoes, a biological solution (straw infusion) as an attractant, and a mesh or gauze cover. The goal is to build the students' technical skills in making and using ovitraps as a tool for early detection of mosquito larvae in the pesantren area.

The third stage is field implementation, where students who have been trained as Santri Jumantik (Larva Monitoring Officers) conduct direct inspections in the pesantren environment. Activities include: Installing ovitraps at strategic points (dormitories, bathrooms, kitchens, and yards). Monitoring and recording the number of larvae found. Cleaning and draining water containers that are positive for larvae. These activities are carried out routinely every week, with tasks divided between male and female students. The goal is to foster responsibility and active participation among students in creating a larvae-free environment.

The fourth stage is reporting monitoring results through a technology-based system, namely the DBD Alert Pesantren website. In this system, Jumantik students input their findings (presence/absence of mosquito larvae) into a digital form. The data is automatically stored and displayed on a dashboard in the form of a mosquito larvae zone map (green = safe, Yellow = alert, and red = vulnerable). The benefit of this digital system is that it facilitates tracking and periodic evaluation by pesantren administrators and university support teams without having to take manual notes. In addition, digital reporting also helps create transparency and consistency of data as evidence of PKM activities. The final stage is the evaluation of activity results and improvement of the Larva-Free Rate (ABJ).

Activities are carried out by: Analyzing weekly reports from the monitoring website. Identifying high-risk areas (yellow/red zones). Taking follow-up actions in the form of joint clean-up efforts or fogging if necessary. The pesantren management team and assistants from the UNUJA health faculty hold monthly meetings to assess the effectiveness of the activities. The objective of this stage is to ensure the program runs sustainably, with an increase in ABJ over time until the pesantren is free of mosquito larvae and dengue fever.

3 Results

A total of 30 students participated in the intervention and completed both the pre-test and post-test assessments. The knowledge assessment instrument consisted of 20 multiple-choice questions, covering four key domains: dengue transmission, clinical symptoms, preventive behaviors, and ovitrap function. Each question carried a score of 1 point, with a possible total score range of 0–20, which was later converted into categorical levels: Low (<50%), Moderate (50–75%), and High (>75%).

Figure 1. DHF and PHBS education activities, as well as pre-test implementation

The instrument underwent a validation process prior to use. Content validity was assessed by two public health experts specializing in vector control and health promotion, ensuring alignment with learning objectives and intervention scope. Reliability testing using a pilot sample of 20 similar respondents produced a Cronbach's alpha coefficient of 0.82, indicating good internal consistency.

The pre-test results showed that most students had low to moderate understanding, with only 26.7% categorized in the high-knowledge group. Following the structured education and hands-on ovitrap training, there was a substantial improvement, with 86.7% of students achieving high knowledge scores in the post-test.

Statistical analysis using the Wilcoxon Signed Rank Test confirmed a significant improvement between pre- and post-intervention scores ($Z = -3.996$, $p < 0.001$), demonstrating that the intervention effectively enhanced students' cognitive understanding of dengue prevention

Improvement in Student Knowledge

The pre-test results showed that the majority of students had insufficient or moderate understanding of dengue prevention, with only 26.7% classified in the high-knowledge category. After the intervention, the proportion of students with high knowledge increased to 86.7%, indicating substantial improvement. Statistical analysis using the Wilcoxon Signed Rank Test showed a significant difference between pre- and post-test scores ($Z = -3.996$, $p < 0.001$), demonstrating that structured education and hands-on ovitrap training effectively enhanced students' cognitive understanding of dengue prevention.

Table 1. Level of knowledge among Islamic boarding school students prior to health education on dengue fever (DF)

pre-test knowledge level

	Frequency	Percent	Valid Percent	Cumulative Percent
Low	14	46.7	46.7	46.7
Moderate	8	26.7	26.7	73.3
High	8	26.7	26.7	100.0
Total	30	100.0	100.0	

Changes in Student Behavior After the Intervention In addition to knowledge gains, there were observable improvements in preventive behaviors. Weekly observations documented increased student participation in cleaning shared bathrooms, covering water containers, removing standing water, and monitoring ovitraps. More than 90% of Santri Jumantik consistently performed weekly inspections and submitted reports. The number of students demonstrating proper ovitrap maintenance techniques also improved from 46.7% at baseline to 93.3% by the end of the program. These findings indicate that the intervention successfully encouraged sustainable behavioral change aligned with PHBS (Clean and Healthy Living Behaviors).

Table 2. Level of knowledge among Islamic boarding school students after receiving health education about dengue fever (DF)

post-test knowledge level

	Frequency	Percent	Valid Percent	Cumulative Percent
Moderate	4	13.3	13.3	13.3
High	26	86.7	86.7	100.0
Total	30	100.0	100.0	

Table 3. Differences in the level of knowledge of students before and after health education on Dengue Hemorrhagic Fever (DHF) and the practice of making Simple Ovitraps

Ranks

		N	Mean Rank	Sum Of Rank
Pre-test knowledge level	Negative Ranks	1	4.50	4.50
post-test knowledge level	Negative Ranks	20	11.32	226.50
	Ties	9		
	Total	30		
Z		-3.996a		
P Value		.000		

Based on the results of statistical testing using the Wilcoxon Signed Rank Test, a p-value of 0.000 ($p < 0.05$) was obtained, indicating a significant difference between knowledge before and after the educational intervention. A calculated Z-value of -3.996 indicates a strong and consistent improvement in the respondent group after receiving education and hands-on practice.

Changes in Entomological Indicators

Environmental outcomes also showed notable improvement. The larva-free index (ABJ) increased from 72% at baseline to 80% by the end of the program. In addition, the ovitrap positivity rate declined steadily each week, with a 35% reduction in positive ovitraps compared to the initial inspection. These results suggest that consistent monitoring and improved sanitation behaviors contributed to a measurable decrease in mosquito breeding sites, in line with findings from ovitrap-based surveillance studies in endemic regions (Lima-camara, 2016)

Effectiveness of the Digital Larva-Monitoring Website

The web-based monitoring system proved effective in supporting real-time reporting and decision-making. Website logs indicated that 92% of students submitted complete reports during each monitoring cycle, with an average of 3–5 entries per student per week. The digital

dashboard automatically generated color-coded risk maps, supporting rapid response and targeted interventions, which is consistent with best practices in dengue surveillance systems (Mccall et al., 2014); (Ebi & Nealon, 2016). The digital platform also reduced data loss and improved transparency compared to previous manual monitoring methods. Overall, the application demonstrated strong usability, high engagement, and practical value for routine surveillance.

4 Discussion

The results of the DBD Alert Pesantren program show a significant increase in the knowledge level of students, supporting evidence that school- and community-based dengue education programs improve knowledge, attitudes, and practices when combined with practical activities and surveillance tools (World Health Organization, 2023). (Indriyani & Soemirat, 2020)

. Based on the pre-test and post-test results of 30 students, the Wilcoxon Signed Rank Test showed a p-value < 0.001, which means that there was a significant difference between before and after the education. This increase indicates that the health education activities and field practices carried out were successful in increasing the knowledge and awareness of students about the dangers of Dengue Hemorrhagic Fever (DHF) and the importance of Clean and Healthy Living Behaviors (PHBS).

Previous studies have also shown that community-based educational interventions are effective in improving knowledge and behavior related to dengue prevention. A study by (Iman et al., 2021) in Bandung found that education on vector control combined with ovitrap monitoring increased public awareness of dengue prevention efforts. Ovitraps themselves have been proven effective as a tool for early detection of the presence of Aedes aegypti and Aedes albopictus mosquitoes, as well as a practical learning medium for understanding the mosquito life cycle and transmission risks (Norsita Agustina, Purwo Setiyo Nugroho, 2025). A systematic review study by (Fernandes et al., 2025) in the journal Insects also confirmed the effectiveness of using

ovitraps as part of surveillance and community education programs in reducing the risk of mosquito-borne diseases.

Empowering students as mosquito larvae monitors can effectively reduce mosquito breeding sites, increase the active participation of students in dengue fever prevention efforts, and reduce the number of dengue fever cases in Islamic boarding schools (Sri Astutik Andayani, Avita Bulghois Humairo, Diana Agustina, Eka Wahyu Fitri, 2022). In addition, previous research by the research team proved that there is a significant relationship between the role of health cadres and the incidence of dengue fever, with a P value of 0.000. The mosquito-free rate also shows a significant relationship with the incidence of dengue fever, with a P value of 0.000. In conclusion, there is a meaningful relationship between the role of health cadres, the number of free larvae, and the incidence of dengue fever(Sri Astutik Andayani, Emelya Yuliana Sugianto, Fitri Ani Arifah, Inayatul Karimah1, 2024).

In addition, the increase in knowledge among students was also influenced by the participatory learning approach applied during the training. Educational activities were carried out in stages through interactive lectures, practical sessions on making simple ovitraps, simulations of larval inspections, and group discussions on the findings in the field. This approach enabled students to understand the concepts comprehensively and fostered a sense of responsibility for the cleanliness of the pesantren environment. Similar results were also reported in a study (Tamilselvi et al., 2025) in the Global Journal of Health Education and Science, which found that active participant involvement in training contributed to a significant improvement in dengue prevention behavior after practice-based education. The Pesantren Dengue Alert program combines health education, simple technology practices, and innovative website-based digital reporting systems. Reporting larvae through online forms allows Jumantik students to submit monitoring results quickly and in an organized manner, so that data can be analyzed to determine larvae-prone zones. This innovation makes it easier for boarding school administrators and accompanying lecturer teams to monitor environmental conditions and determine hygiene action priorities. This approach is in line with the Indonesian

Ministry of Health's recommendation on the importance of community-based surveillance systems in preventing infectious diseases in densely populated environments such as Islamic boarding schools (Heyrani et al., 2024).

Educational activities and practical training on ovitrap making as a preventive measure against Dengue Hemorrhagic Fever (DHF) in Islamic boarding schools were carried out under the PKM program "DBD Alert Pesantren: Health Education for Instructors and Ovitrap Innovation for Dengue Prevention through Empowering Jumantik Students." This program aims to increase the knowledge and skills of students in understanding the dangers of DBD and how to prevent it through 3M Plus education (draining, covering, and recycling used items that have the potential to become breeding grounds for mosquitoes).

The activity began with a pre-test to measure the students' initial knowledge of dengue fever, followed by an interactive lecture, discussion, and demonstration of mosquito egg traps (ovitraps). During the practical session, students were trained to make simple ovitraps from used mineral water bottles, which are easily available and inexpensive. The used bottles were cut into two parts, with the top part turned upside down as a funnel and attached to the bottom part, then filled with water mixed with yeast and sugar. These ovitraps function to attract and trap Aedes aegypti mosquito larvae so that they do not breed in the pesantren environment.

During the practice, the students appeared enthusiastic and excited in making and understanding the function of ovitraps. With this hands-on educational approach, students not only gained theoretical knowledge but also concrete experience in making and utilizing ovitraps as an environmentally friendly and easy-to-apply mosquito control method in Islamic boarding schools. This activity is in line with the opinion of (Norsita Agustina, Purwo Setiyo Nugroho, 2025) that the use of ovitraps is very effective in suppressing the population of Aedes aegypti.

Furthermore, (Nanda et al., 2025) also used Wilcoxon test analysis to assess the effectiveness of counseling and demonstrations on ovitrap making in increasing community knowledge in dengue-endemic areas in

Surabaya. The results showed a difference in the average knowledge scores before (mean = 57.8) and after the intervention (mean = 83.9) with a p-value of 0.001. These findings support that the community empowerment-based education model is effective in improving community environmental health literacy.

Weekly inspection data showed a gradual decline in ovitrap positivity rates, with a total decrease of 35% at the end of the intervention. The Larva-Free Rate (LFR) increased from 72% at the beginning to 91% after the intervention. Jumantik students showed active involvement, with more than 90% of cadres consistently reporting results through pre-tests and post-tests. This reporting system allows boarding school administrators to monitor risk areas with a green-yellow-red color code, enabling a rapid response.

The integration of structured health education, ovitrap innovation, and digital reporting has proven effective in empowering the boarding school community. These findings are in line with international research on school-based dengue prevention programs, which show an increase in knowledge, attitudes, and practices after intervention .

The involvement of santri as Jumantik cadres ensures community ownership and program sustainability. By involving young leaders, Islamic boarding schools are able to instill long-term behavioral changes in line with PHBS principles. The use of ovitraps is a simple but effective tool for early detection, while the digital reporting system modernizes surveillance efforts to make them more efficient and transparent (Nanda et al., 2025).

Key challenges include initial skepticism among some santri, the need for ongoing supervision, and limited internet access for reporting. Nevertheless, this participatory model has strong potential for replication in other pesantren and rural schools, in line with the national strategy for dengue prevention and the Sustainable Development Goals (SDGs) related to health and well-being.

In addition to increasing knowledge, this activity also encourages the development of the character of santri as health cadres in Islamic boarding schools. Santri who are members of the Santri Jumantik Team

not only monitor mosquito larvae, but also become agents of change in educating their peers and fostering a culture of clean living in the dormitory environment. This is in line with the results of a study by (Sri Astutik Andayani, Avita Bulghois Humairo, Diana Agustina, Eka Wahyu Fitri, 2022) in the Peduli Masyarakat Journal, which reported that community-based health education effectively increases community knowledge and participation in maintaining environmental hygiene at the Azzainiyah Clinic. This service experience became the basis for the development of a student empowerment model in this program.

Overall, the significant increase in students' knowledge and skills in early detection of mosquito larvae shows that a combination of theoretical education, field practice, and simple technological innovations can create sustainable behavioral change. Although this study used a pre-experimental design without a control group, the results provide strong evidence that pesantren-based PKM activities have great potential in participatory dengue fever prevention. Going forward, it is recommended that similar activities be carried out periodically, with the integration of a more stable digital reporting system, as well as expanded collaboration between Islamic boarding schools, health agencies, and universities to strengthen dengue fever prevention efforts at the community level.

5 Conclusion

The DBD Alert Pesantren Program has proven effective in improving santri knowledge and skills related to dengue fever prevention through an integrated approach combining structured health education, demonstrations, hands-on practice in constructing ovitraps from recycled bottles, and digital larval monitoring. This program enables students to understand the function of ovitraps, recognize mosquito breeding sites, and appreciate the importance of maintaining environmental cleanliness to prevent standing water. By empowering santri as Jumantik (larva monitoring cadres), the program fosters active student participation in independently monitoring and controlling mosquito larvae within the boarding school environment, positioning them as agents of change in promoting environmental hygiene and

surveillance. Overall, this model demonstrates that the integration of education, simple technology, and community empowerment is effective, sustainable, and innovative in reducing dengue risk in pesantren settings.

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