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Enhancement of Public and Environmental Health in Tambak Sumur Village, Waru District, Sidoarjo Regency

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A B S T R A C T

This community service program aimed to raise awareness and foster active participation among residents in maintaining environmental health and preventing diseases such as Acute Respiratory Infection (ARI) and dengue fever through an educational-participatory approach. Three primary initiatives were implemented: education on low-smoke waste bins, Black Soldier Fly (BSF) maggot cultivation, and the planting of Family Medicinal Plants (TOGA) and snake plants (*Sansevieria trifasciata*). The waste bin and TOGA programs demonstrated positive outcomes, including increased knowledge, improved practical skills, and effective utilization of residential yards for self-reliant health and environmental preservation. However, the maggot cultivation program faced challenges, including limited hands-on practice, time constraints, and lack of participant interest, leading to suboptimal results. These findings suggest that program success depends not only on educational efforts but also on individual readiness and social support. Intensive mentorship and more precise participant selection are recommended to enhance program sustainability.

INTRODUCTION

Acute Respiratory Infection (ARI) is a disease that affects the upper respiratory tract, such as rhinitis, pharyngitis, and otitis, as well as the lower respiratory tract, including laryngitis, bronchitis, bronchiolitis, and pneumonia. This illness generally lasts for a maximum of fourteen days, which serves as the defining criterion to classify an infection as acute. The respiratory tract itself comprises various organs, including the pleura, sinuses, middle ear cavity, and alveoli in the nasal area (Wahyuni & Kurniawati, 2021)

The causes of ARI may stem from both bacteria and viruses. Bacterial pathogens include genera such as *Streptococcus*, *Staphylococcus*, *Pneumococcus*, *Haemophilus*, *Bordetella*, and *Corynebacterium*. Viral pathogens include microvirus, adenovirus, coronavirus, picornavirus, mycoplasma, and herpesvirus, among others (Wahyudi & Zaman, 2022).

The clinical manifestations of ARI vary widely, including fever, headache, malaise (fatigue), anorexia (loss of appetite), vomiting, photophobia (light sensitivity), restlessness, cough, nasal or respiratory secretions, stridor (noisy breathing), dyspnea, suprasternal retraction, and hypoxia (oxygen deficiency). If left untreated, these symptoms may progress to respiratory arrest and death (Wahyudi & Zaman, 2022).

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According to the Indonesian Ministry of Health 2018 (Wahyudi & Zaman, 2022), ARI risk factors are classified into internal and external categories. Internal factors include sex, birth weight, breastfeeding status, and vaccination history. External determinants encompass physical and biological environmental conditions, education, income, and social factors that increase exposure to ARI-causing pathogens. These factors include tobacco smoke, waste-burning emissions, the use of mosquito repellents, household members who smoke, population density, geographic conditions, housing ventilation, and lighting.

Geographic factors also significantly influence the prevalence of ARI. Indonesia is among the countries with a high prevalence of ARI. According to the Indonesian Health Profile (2020), the ten provinces with the highest ARI cases are Jakarta (46.0%), Banten (45.7%), West Papua (44.3%), East Java (42.9%), Central Java (39.8%), Lampung (37.2%), Central Sulawesi (35.8%), West Nusa Tenggara/NTB (34.6%), Bali (31.2%), and West Java (28.1%). East Java recorded the highest provincial cases, and the East Java Health Office reported that in 2018, the incidence of ARI in children under five years old in Sidoarjo Regency reached 8,747 cases per year (Inden et al., 2024).

Document analysis from the Project-Based Learning (PBL) Report in 2024 at Tambak Sumur Village, Waru Subdistrict, Sidoarjo Regency, indicated ARI cases in RW 01 (1 case), RW 02 (5 cases), and RW 03 (4 cases). In addition to ARI, the document review also identified other community health issues, including Dengue Fever, Hypertension, and Diabetes. Based on the results of the study, three community-based programs were developed: (1) health empowerment through the implementation of low-smoke waste bins, (2) economic empowerment through Black Soldier Fly (BSF) maggot cultivation, and (3) training activities focused on planting snake plants (*Sansevieria trifasciata*) for air purification, lemongrass to minimize dengue fever risk, and ginger as a family medicinal plant.

Thus, this community service initiative was designed to improve public and environmental health conditions in Tambak Sumur Village through education-oriented, empowerment-based, and preventive community programs.

METHOD

The method applied in this community service program was educational intervention concerning public and environmental health issues in Tambak Sumur Village, Waru Subdistrict, Sidoarjo Regency. The program was carried out over one month, from June 1 to June 30, 2025. The target participants were residents of Tambak Sumur Village.

This community engagement consisted of three main activities:

a. Low-Smoke Waste Bin

The first activity, conducted on Saturday, June 14, 2025, involved education and demonstration on the use of low-smoke waste bins. The activity included delivering educational materials, direct practice of using the bins, and distribution of user manuals for independent use. The primary objective was to enhance community knowledge and practical skills regarding waste bin usage. Outcomes were assessed through pre-test and post-test comparisons, as well as through monitoring and evaluation of residents' practical application.

b. Black Soldier Fly (BSF) Maggot Cultivation for Organic Waste Management

The second activity, conducted on Sunday, June 22, 2025, focused on education and demonstration of BSF maggot cultivation as a method for organic and household waste management. The session included material delivery, hands-on demonstration of maggot cultivation, and harvesting techniques, with the potential outcome of contributing to community economic empowerment. Each resident participant received one BSF cultivation kit along with a guidebook. Success indicators included improved knowledge (measured by pre-test and post-test) and enhanced practical skills (evaluated through monitoring and direct observation).

c. Cultivation of Family Medicinal Plants (TOGA) and *Sansevieria trifasciata* (Snake Plant)

The third activity, conducted on Sunday, June 29, 2025, centered on education and demonstration of planting TOGA and snake plants. The goal was to improve household health and air quality. Training included direct demonstration of planting methods to ensure transfer of skills for independent application at home.

Monitoring and evaluation were conducted using checklist forms and field observations. Achievement levels were categorized into four scores: 4 (excellent), 3 (good), 2 (fair), and 1 (poor), based on program achievement indicators, challenges encountered, and participant engagement levels. Three main outcomes were assessed:

- a. Knowledge, via pre-test and post-test differences;
- b. Skills, via observed competency during hands-on practice;
- c. Sustainability, via continued application of knowledge and practices by residents after the intervention.

Prior to program implementation, several preparatory steps were undertaken: (1) initial survey and coordination with village officials, (2) obtaining necessary permissions from relevant stakeholders, (3) coordination with local RT and RW leaders for dissemination of activity plans, (4) preparation of tools, materials, and instruments, and (5) distribution of guidebooks in each activity session to support independent learning.

At the end of the program, evaluation was conducted to measure the overall effectiveness of the intervention through interactive discussions and assessment of knowledge improvement. The key success indicator was the demonstrated increase in residents' knowledge and awareness regarding public and environmental health in Tambak Sumur Village.

RESULT AND DISCUSSION

a. Low-Smoke Waste Bin

The first activity of the Bina Desa community service program in Tambak Sumur Village, Sidoarjo, was carried out in the form of education and demonstration on the use of low-smoke waste bins. The session was facilitated by Anmay, an eighth-semester undergraduate student of Public Health at Nahdlatul Ulama University Surabaya, who served as the resource person.

This activity took place at the RW 2 Community Hall, with 10 community representatives from RW 1, RW 2, and RW 3 invited to participate. The selection of participants was based on the principles of regional representativeness, their level of concern for environmental issues, and their readiness to act as agents of change within their respective neighborhoods.

However, of the 10 invitees, 2 participants were unable to attend due to unforeseen circumstances, namely the head of RW 3 and the head of RT 1A, RW 1. Consequently, the total number of participants present was 8 individuals.



Figure 1. Community Service Activity Implementation

This community service activity was conducted in the form of education and live demonstration regarding the functions and benefits of low-smoke waste bins. Prior to the educational session, the community service team administered a pre-test to the participants in order to measure their baseline knowledge. Subsequently, educational materials were delivered on the dangers of smoke from open waste burning, followed by a direct demonstration of how to operate the low-smoke waste bin. The session also included an interactive discussion and question-and-answer segment, which encouraged active community participation.

At the end of the educational and demonstration session, four selected residents received low-smoke waste bins, along with user manuals. Additionally, a statement of commitment was signed by the

recipients to facilitate future monitoring and evaluation. To conclude the activity, a post-test was conducted to assess the level of knowledge improvement among the participants regarding the benefits and proper use of the low-smoke waste bin in Tambak Sumur Village.

The findings from the pre-test, post-test, and subsequent monitoring and evaluation of participants who attended the educational session are presented in the following table:

Table 1. Evaluation Results of the Low-Smoke Waste Bin Program

Indicator	Target	Achievement	Result	Percentage (%)	Score
Attendance	All invited participants attended the low-smoke waste bin activity	8 out of 10 invitees attended the session	8	80	3
Knowledge	Increased participant knowledge, with post-test scores > 80	7 out of 8 participants achieved scores 80 in the post-test	7	87.5	3
Skills	All recipients of modules and bins could operate them according to manuals	3 out of 4 recipients were evaluated as competent in operating the bins during monitoring	3	75	2
Sustainability (I)	Recipients could use the bins sustainably without complaints	All recipients reported no difficulties or obstacles in using the low-smoke waste bins	4	100	4
Sustainability (II)	Recipients consistently used the bins according to provided manuals	All recipients reported routine and proper usage of the bins as instructed in the user manual	4	100	4

Based on Table 3.1, attendance reached 8 out of 10 invited participants, achieving an 80% attendance rate. The participants consisted of 6 males and 2 females, with ages ranging from 41 to 58 years. The participants' knowledge scores in the pre-test ranged from 30 to 100, with an average score of 78.75. Following the intervention through education and demonstration, the average post-test score increased to 83.75, with the lowest score rising to 70 and the highest score being 90. The total overall score improved from 630 to 670 points, indicating an increase of 50 points.

This improvement suggests that the materials provided were effective in enhancing participants' knowledge. Although the highest post-test score slightly decreased, the lowest score increased significantly from 30 to 70, indicating an improvement in understanding among participants who initially had lower scores. Moreover, the score variation among participants was narrower in the post-test, reflecting more consistent comprehension across the group.

Regarding skills, monitoring results showed that 3 out of 4 recipients of the modules and low-smoke waste bins were deemed competent in operating the bins according to the guidelines. This demonstrates that the low-smoke waste bin program not only improved knowledge but also has the potential for sustainable practical application. All module and bin recipients reported no complaints or difficulties during use and have continued to utilize the bins according to the provided instructions. The average

evaluation score was 3.2 (categorized as Good), indicating that the program overall ran well and holds potential for sustainability within the community.

emphasize that environmental education activities actively involving the community play a crucial role in encouraging behavioral change, particularly in waste management. Their study shows that education programs accompanied by hands-on use of tools such as low-smoke waste bins can increase participants' awareness of the importance of safe and sustainable domestic waste management. The changes achieved are not only immediate but also sustainable, as participants gain greater awareness of the environmental impacts of their daily actions. The hands-on training also fosters a sense of ownership and responsibility toward the environment, motivating the community to implement the technology in their daily lives (Dyah, 2024).

One manifestation of this education is the use of low-smoke waste bins, a technology innovation aimed at reducing the negative impacts of open waste burning. Setiawan and Nurhayati (2021) report that the use of such bins can reduce emissions of harmful gases like carbon monoxide (CO) and fine particulate matter (PM 2.5) by up to 70% compared to conventional waste burning methods. This effectiveness makes the technology highly suitable for implementation, especially in densely populated areas lacking integrated waste management systems.

Furthermore, the World Health Organization (WHO) (Dumiri et al., 2024) notes that traditional open waste burning is a major contributor to air pollution in residential areas, particularly in developing countries. Continuous exposure to smoke from waste burning is linked to increased cases of lung diseases, asthma, eye irritation, and even heart disorders. Therefore, the use of technologies like low-smoke waste bins is a highly relevant preventive measure to reduce health risks associated with air pollution

Supporting this, the Ministry of Environment and Forestry of Indonesia (Suryanti, 2025) officially recommends low-smoke waste bins in its guidelines on appropriate technology as an alternative solution in areas without official waste management facilities. This technology is designed for household or small community use, with affordable production costs and simple operation. Thus, the community can independently manage organic waste disposal without causing environmental disturbances such as thick smoke or unpleasant odors, thereby creating a healthier and more comfortable environment.

b. Black Soldier Fly (BSF) Maggot Cultivation

The second activity of the Bina Desa program, focusing on maggot cultivation, was successfully conducted in Tambak Sumur Village, Sidoarjo. This activity was presented as an educational outreach and a hands-on demonstration about the empowerment of BSF (Black Soldier Fly) maggots. The session was delivered by Mr. Taufiq, an expert in BSF maggot farming, who served as the resource person.

Through this activity, the community was introduced to the potential of maggot farming both as a solution for organic waste management and as an economic opportunity. Below is the documentation of community service activities related to BSF maggot cultivation:



Figure 2 Implementation of Educational Activities on Maggot Cultivation

The initial target for this community service activity was five representatives from each neighborhood unit (RW) in Tambak Sumur Village, with the requirement that at least one participant came from each of RW 1, RW 2, and RW 3. However, during implementation, there were obstacles involving representatives from RW 1 and RW 2, resulting in the participants being exclusively from RW 3.

This community service activity was carried out in the form of education on the utilization of organic waste through Black Soldier Fly (BSF) maggot cultivation. The series of activities began with the delivery of education and direct demonstration, followed by participants completing a pre-test sheet to assess their initial knowledge level. Subsequently, an educational session titled "Guidelines for BSF Maggot Cultivation for Organic Waste Management" was presented, outlining the cultivation steps systematically. The activity also included a discussion and question-and-answer session to deepen participants' understanding.

Following the educational session, Maggot Box Sets were distributed to five residents from RW 3, accompanied by the provision of user manuals and the signing of commitment letters. These documents were intended to facilitate the community service team's monitoring and evaluation activities after the training.

To conclude the activity series, participants were asked to complete a post-test to evaluate their improved understanding of the benefits and techniques of BSF maggot cultivation. The results of the pre-test, post-test, and monitoring evaluations of the participants who received the education are presented in the following table:

Table 2 Monitoring and Evaluation Results of the BSF Maggot Cultivation Activity

Indicator	Target	Achievement	Result	Percentage (%)	Score
Attendance	All participants attend the activity	5 out of 5 participants attended	5	100	4
Knowledge	Participants achieve post-test	All participants scored above 80 in the	5	100	4

Indicator	Target	Achievement	Result	Percentage (%)	Score
Skills	scores above 80 Participants can cultivate maggots according to the user manual	post-test None of the participants were able to cultivate maggots according to the manual	0	0	1
Sustainability	Participants continue maggot cultivation	3 out of 5 participants discontinued maggot cultivation; 2 others cultivated but not per manual	2	40	1

Based on Table 2, the attendance for the Maggot BSF activity was 100%, with all invited participants present and achieving a score of 4 (very competent). Regarding knowledge improvement, 3 out of 5 participants showed a 66.66% increase, with their scores improving from an initial 60% to a perfect 100%. The other 2 participants started with higher pre-test scores (80%), resulting in a smaller percentage increase of 25%. This phenomenon is common, as higher initial scores limit the potential for large improvements. Overall, the pre-test and post-test evaluations indicate a significant increase in knowledge for all participants, with the majority benefiting greatly from the activity, as reflected by the score jump from 60% to 100%.

However, the skills evaluation revealed that none of the participants were able to cultivate maggots in full accordance with the user manual. This limitation was attributed to the fact that three participants delegated the responsibility to one individual due to their busy schedules, preventing independent maggot cultivation. In terms of sustainability, 3 out of 5 participants discontinued maggot cultivation, while the remaining 2 continued but did not follow the manual's guidelines fully. This resulted in an overall program score of 2.5 (unsuccessful), indicating that the maggot cultivation program could not be sustained.

The significant knowledge increase aligns with findings by (Purnamasari et al., 2023) ,who reported that practical, hands-on educational approaches such as demonstrations and field training significantly enhance community understanding more effectively than conventional lecture methods. Activities involving direct participation encourage learners not only to grasp concepts but also to internalize and reflect on them in daily life, who emphasized that experiential learning methods are highly effective in instilling sustainability values by simultaneously engaging cognitive, affective, and psychomotor domains.

c. Empowerment of Family Medicinal Plants (TOGA) and Snake Plant

The third Bina Desa community service activity was conducted at the RW 3 Village Hall, Tambak Sumur Village, Sidoarjo Regency. The activity was delivered in the form of an educational question-and-answer session and the planting of family medicinal plants (TOGA), including ginger, lemongrass, and snake plants. The session was presented by Audina, a fourth-semester undergraduate student of Public Health at Nahdlatul Ulama University.

The target participants of this community service activity were residents of RW 3, consisting of PKK cadres and Muslimat NU members in Tambak Sumur Village. Attendance reached 8 out of 10 invitees, as 2 residents were unable to attend due to unavoidable circumstances.

Below is an overview of the outcomes of this community service activity:



Figure 3.3 Implementation of Family Medicinal Plants (TOGA) and Snake Plant Activities

This activity was motivated by the underutilization of household land in Tambak Sumur Village and the community's limited knowledge regarding the benefits of herbal plants for maintaining family health independently. Many residents possess unused or suboptimally used land, although there is significant potential for planting beneficial plants. Additionally, excessive use of chemical medicines in households and low awareness of pollution-absorbing plants such as snake plants (*Sansevieria trifasciata*) underscore the need for environment- and health-based education. Based on these needs, a community service activity themed on education and utilization of Family Medicinal Plants (TOGA) and snake plants was conducted.

The community service activity was implemented through education and training on the planting techniques of TOGA and snake plants. This was followed by the distribution of seedlings, including ginger, lemongrass, and snake plants, with each targeted resident receiving the three plant varieties. All participants actively engaged in discussions and question-and-answer sessions, demonstrating interest in the benefits and cultivation methods of these plants. Participants raised various questions regarding the plants' medicinal properties, care techniques, and the use of TOGA for household health and environmental cleanliness.

Participant engagement became the main qualitative indicator of program success. The education effectively increased participants' understanding of the benefits of herbal plants, both for consumption and as air pollution absorbers (especially the snake plant). Moreover, participants recognized TOGA's potential for promoting natural and independent family health. Overall, this activity encouraged positive attitude changes toward utilizing household land as a medium for family medicinal plants and demonstrated the effectiveness of an educational-participatory approach in enhancing knowledge and environmental awareness.

The use of household land was evidenced through direct observations conducted before and after the activity. Initial observations aimed to identify land conditions, such as the presence of empty plots, existing plant types, and the extent of land usage by residents. After the activity, follow-up observations were conducted to assess physical changes, including increases in the number of plants or planting media, as well as behavioral changes in residents' care and sustainable land utilization. Comparative results demonstrated improved land use, transforming underutilized spaces into more productive and beneficial areas, particularly for planting family medicinal plants (TOGA) and other health-supportive plants. This improvement is illustrated in the images below:



Figure 4. Documentation of a Resident's Land

The utilization of ginger and lemongrass plants in the Family Medicinal Plants (TOGA) program has been demonstrated to raise community awareness regarding the significance of herbal plants for health management (Rozi et al., 2024). who emphasize that participatory education in TOGA cultivation, including ginger and lemongrass, enhances family skills in natural health care practices. The snake plant (*Sansevieria trifasciata*) is recognized not only for its aesthetic qualities but also for its capacity to absorb indoor air pollutants (Dewi Susanti et al., 2024). Community empowerment programs centered on local medicinal plants contribute to strengthening family resilience related to health and environmental sustainability.

CONCLUSION

The community service program in Tambak Sumur Village aimed to enhance public and environmental health by promoting community awareness and participation in preventing diseases such as Acute Respiratory Infection (ARI) and dengue fever through educational and participatory approaches. The initiatives included low-smoke waste bin education, Black Soldier Fly (BSF) maggot cultivation, and the planting of Family Medicinal Plants (TOGA) and snake plants. The low-smoke waste bin and TOGA programs demonstrated positive outcomes, significantly improving residents' knowledge, practical skills, and utilization of household land for health and environmental sustainability. However, the BSF maggot

cultivation program was less successful due to limited practical engagement, time constraints, and low participant interest. Overall, the findings highlight that program effectiveness depends not only on educational efforts but also on participant readiness and social support, emphasizing the need for more intensive mentoring and targeted participant selection to ensure long-term sustainability.

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