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# Cadre Empowerment through the PESISIR SEHAT Model Based on a Digital PHBS Module in a Coastal Community of Pasuruan City

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***Abstract***

*Coastal communities require health promotion approaches that address locally identified environmental and behavioral health risks. Although previous PHBS interventions in coastal communities have used educational media to improve community health awareness, approaches that integrate digital learning resources for health cadres with household-level PHBS mapping remain underexplored. This community engagement aimed to strengthen PHBS knowledge among health cadres through the PESISIR SEHAT model, which combines a digital PHBS module with participatory household health risk mapping. The program involved 31 health cadres from Kelurahan Tapaan, Kecamatan Bugul Kidul, Pasuruan City, Indonesia. Using a participatory community empowerment approach, the cadres engaged in PHBS education, household risk mapping, practical training, simulations, monitoring practice, and evaluation, supported by the digital PHBS module. The primary outcome was the change in cadre knowledge, assessed using pre- and post-test scores, while household conditions were described using 10 PHBS indicators across 31 households. The mean knowledge score increased from 54.84 ± 8.11 to 82.26 ± 8.05, representing a 50.0% increase from baseline, with a statistically significant pre-test-post-test difference ($p < 0.001$). Household mapping revealed relatively favorable conditions in handwashing facilities, handwashing behavior, and maternal and child health practices, whereas waste segregation, indoor smoking exposure, and physical activity required greater attention. These findings demonstrate an improvement in short-term PHBS knowledge among participating cadres and provide locally relevant information for planning subsequent community health promotion activities. The PESISIR SEHAT approach offers an integrated framework connecting digital cadre learning with household-level PHBS assessment. However, its effects on sustained cadre practices and household behavioral changes require further evaluation.*

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***Keywords:*** *Cadre Empowerment; Coastal Community; Digital PHBS Module; Health Promotion; PESISIR SEHAT.*

## Introduction

Coastal settlements have health conditions closely linked to environmental, social, and behavioral factors. Household sanitation, water safety, waste management, hygiene, and disease prevention may become more difficult to maintain when environmental conditions and community resources are limited. In this setting, health promotion cannot rely only on the delivery of information. Communities also need mechanisms to recognize local risks, set priorities, and participate in preventive actions (Hamzah et al., 2024).

The World Health Organization has emphasized the importance of environmental conditions in health promotion. (United Nations Children's Fund, 2022). In Indonesia, the availability and monitoring of water, sanitation, hygiene, and waste-management systems remain important components of health protection, particularly where disparities in infrastructure and resources exist. Continuous monitoring provides a basis for identifying problems and determining appropriate corrective actions. (Kementerian Kesehatan Republik Indonesia, 2022).

Clean and Healthy Living Behavior (Perilaku Hidup Bersih dan Sehat/PHBS) is particularly relevant to coastal communities because household health practices are shaped not only by individual knowledge but also by the distinctive social, economic, and environmental characteristics of coastal settlements. In many coastal areas, households are closely connected to marine-based livelihoods, including fishing and fish processing, which influence daily activity patterns, household routines, and the use of available resources. Residential proximity to coastal environments may also expose households to specific environmental challenges, including fluctuating water availability, inadequate drainage, and difficulties in managing domestic waste, particularly where sanitation infrastructure is limited. These conditions interact with household socioeconomic circumstances, local customs, and community practices, potentially influencing access to clean water, food hygiene, sanitation, disease prevention, and other health-promoting behaviors. In the coastal community of Pasuruan City, previous research has demonstrated the relevance of household-based PHBS education,

highlighting the need to address health behavior within the specific context of coastal settlements (Kusuma et al., 2022). Therefore, PHBS implementation requires more than the provision of health information; it also requires context-sensitive approaches that consider household resources, established social practices, and community participation (Hariyanti, 2024).

Evidence from the same coastal context provides an important foundation for this community engagement. Kusuma et al. (2022) conducted a pre-experimental one-group pre-test–post-test study involving 92 households in Kelurahan Tapa'an, Bugul Kidul, Pasuruan City. The intervention consisted of health education delivered through a printed health booklet, with outcomes assessed using questionnaires measuring knowledge, attitudes, and actions related to PHBS. The study reported significant improvements in all three domains following the intervention ($p < 0.001$). These findings demonstrate that educational interventions can improve PHBS-related outcomes among households in the local coastal community. However, the previous study primarily focused on improving health behavior through direct education to household members. It did not address how local health cadres could be systematically prepared to independently deliver health education, identify household-level health risks, and conduct continuous monitoring after the educational intervention. Consequently, an important question remains regarding how the benefits of PHBS education can be sustained through strengthened community-based health promotion mechanisms. Addressing this gap, the present community engagement introduces the PESISIR SEHAT model, which extends household-oriented health education by integrating cadre capacity building, participatory PHBS risk mapping, sanitation education, household monitoring, and sustainability planning supported by a digital PHBS module. This approach seeks to establish a more structured and sustainable mechanism for community-led health promotion in coastal settlements.

Community empowerment provides a potential response to this challenge. In coastal communities, empowerment needs to take into account local social, economic, cultural, and environmental characteristics. Hariyanti et al. emphasized that community empowerment in coastal areas should be based on local potential and community needs, supported by education, training, counseling, and institutional involvement. Similarly, research on community-based sanitation in coastal areas has shown that sanitation

behavior is influenced by social-cultural conditions, infrastructure, gender roles, and stakeholder involvement, indicating that sanitation improvement cannot be addressed solely through individual education (Hariyanti, 2024).

The role of health cadres is therefore important. Cadres occupy a position between formal health services and households. Their proximity to the community enables them to communicate health messages in locally understandable ways and to identify problems that may not be apparent through routine health-service activities. Developing the cadre's capabilities also reflects the overall need for nurses and community health practitioners to promote an environmentally sustainable, preventive approach to health care delivery. Research has examined the role of nurses in environmental sustainability, highlighting the importance of education and nurses' participation. (Luque-Alcaraz et al., 2022).

The situation prevailing in Kelurahan Tapaan, Pasuruan City was the particular context that led to this community-based engagement. From the observations made, there were inconsistent household hygiene practices, a lack of systematic waste classification, sanitation issues, and health education programs that had not been incorporated into a systematic monitoring process. Based on the above observations, three core problems were identified as follows: inadequacy of cadres' capability in the systematic mapping of health risks in coastal areas, lack of PHBS instructional materials, and lack of a healthy community model.

In response to these challenges, the project introduced the PESISIR SEHAT model through a participatory empowerment strategy. The model was designed as a comprehensive approach involving risk mapping and education, sanitation, cadre activation, monitoring, reinforcement, empowerment, sustainability, health action simulation, and capacity transformation. The proposal recommended using the digital PHBS module as a systematic learning resource for cadres.

Although previous studies have demonstrated the benefits of household-based PHBS education in coastal communities, a key gap remains in translating educational outcomes into a structured, sustainable, community-led health promotion system. In particular, strengthening the capacity of local health cadres, systematically identifying household-level PHBS priorities, and establishing continuous monitoring mechanisms have not been addressed together within the scope of the previously reported intervention in Pasuruan

City (Kusuma et al., 2022). The contribution of the present community engagement therefore lies not simply in combining cadre training with PHBS mapping, but in linking these components into an integrated empowerment process. In this approach, household PHBS mapping serves as an evidence-based foundation for identifying priority health behaviors. At the same time, cadre capacity building equips local volunteers to deliver targeted education and conduct household monitoring using standardized digital learning materials and monitoring instruments. Furthermore, the inclusion of implementation guidelines, core cadre development, and sustainability planning provides an organizational foundation for continuing community health promotion beyond the initial intervention. This integrated approach bridges the gap between providing health education and establishing a locally supported mechanism for identifying, addressing, and monitoring household health risks in coastal communities.

To address this gap, the present community engagement introduced the PESISIR SEHAT model as an integrated framework for strengthening community-based health promotion in coastal settlements. The model connects eight interrelated components: PHBS risk mapping, cadre education, sanitation strengthening, monitoring, behavioral reinforcement, sustainable empowerment, health-action simulation, and cadre capacity transformation. Supported by a digital PHBS module, the model provides standardized learning materials and practical guidance for cadres in identifying household health risks, delivering targeted health education, and conducting community monitoring. Rather than treating these activities as separate interventions, PESISIR SEHAT positions them within a coordinated empowerment process that links local health needs with cadre-led preventive actions and sustainability planning. In addition to using knowledge as an indicator of the success of the educational effort, a behavioral pattern could help determine the community's priorities. Such an effort is necessary because it can influence how the cadre's future activities will be carried out (United Nations Children's Fund, 2022).

For this reason, community engagement was conducted to implement the PESISIR SEHAT approach using cadre capacity building and a digital PHBS module, measure the differences in PHBS knowledge of cadres, and analyze the condition of household PHBS that would help set priorities for further community health promotion in Kelurahan Tapaan, Pasuruan City.

## Methods

### Study Design, Setting, and Participants

This community engagement program employed a participatory community empowerment approach through the PESISIR SEHAT model, supported by a digital PHBS module. The program was implemented over three months in Kelurahan Tapaan, Kecamatan Bugul Kidul, Pasuruan City, East Java, Indonesia. The location was selected based on the identification of household PHBS and environmental health problems that required a structured community-based health promotion approach. Health cadres were involved as the primary community partners because of their role in supporting health education, identifying household health risks, and promoting healthy behaviors within the community.

The intervention involved 31 health cadres who participated in the educational activities and completed both pre- and post-tests. The 31 cadres also participated in the PHBS mapping activities. In addition, household PHBS conditions were assessed in 31 households in the community. The available program records documented the number of participating cadres and mapped households. Still, they did not specify the total population of health cadres in Kelurahan Tapaan or a separate sampling procedure. Therefore, the 31 cadres were treated as program participants rather than as a randomly selected or total-population sample.

### Intervention Procedures

The intervention was conducted over three months through five sequential phases based on the participatory empowerment principles of the PESISIR SEHAT model. These phases translated community empowerment into practical activities, including local coordination, cadre capacity development, household health risk identification, sanitation education, monitoring, and sustainability planning. The cadres were positioned as active participants in the process rather than merely as recipients of health information.

Phase 1: Preparation and coordination. The implementation team coordinated with the local government and health cadres to establish the implementation arrangements, including participant involvement, activity locations, training requirements, and educational materials. The team prepared the digital PHBS module, training materials, pre-test and post-test questionnaires, observation instruments, and PHBS monitoring checklist.

This phase established local participation and coordination as the foundation for the subsequent empowerment activities.

Phase 2: PHBS risk mapping and cadre training. Cadres received educational materials on household PHBS, health risks relevant to the coastal setting, and the use of the PHBS mapping instrument. The learning activities included interactive lectures, discussions, case studies, and simulations. These activities aimed to strengthen cadres' understanding of PHBS and their ability to recognize household health problems through systematic mapping. This phase represented the participatory identification of community health needs and the development of cadre knowledge.

Phase 3: Sanitation strengthening and monitoring. The training focused on healthy latrines, safe water, household waste management, and other relevant sanitation practices. Role-play activities were used to practice communication for behavioral change. Cadres were also introduced to the PHBS monitoring checklist as a practical tool for identifying and documenting household health conditions. This phase connected the results of community risk identification with targeted health education and household monitoring.

Phase 4: Reinforcement and sustainability planning. The team developed implementation guidelines and procedures for the PESISIR SEHAT model and prepared the process for establishing a core cadre group. A one-year sustainability plan was also prepared, including the continued use of the digital PHBS module and model guidelines as learning and implementation resources. This phase emphasized local ownership and the organizational preparation required to sustain community health promotion activities.

Phase 5: Health-action simulation and evaluation. Cadres conducted simulations of PHBS health education using the digital module and other educational materials. The final evaluation included a post-test to assess changes in cadre knowledge and an evaluation of cadre activities during the simulation. This phase provided an opportunity for cadres to practice applying the knowledge acquired during the intervention.

**Data Collection Instruments**

Cadre knowledge was assessed using a pre-test administered before the educational intervention and a post-test administered after the intervention. The same assessment was used at both time points to evaluate changes in knowledge among the 31 participating cadres. The assessment was related to

the PHBS topics delivered during the educational activities and supported by the digital PHBS module and training materials.

Household PHBS conditions were assessed using a mapping checklist comprising ten indicators: (1) safe drinking and cooking water; (2) healthy latrines and septic tanks; (3) availability and use of handwashing facilities; (4) handwashing behavior; (5) household waste segregation; (6) mosquito breeding prevention; (7) balanced nutrition; (8) physical activity; (9) indoor smoking exposure; and (10) maternal and child health practices. The checklist was used to document household conditions and classify each indicator as positive or optimal, or as requiring attention.

The available program documentation did not provide numerical results of formal validity and reliability testing for the pre-test/post-test questionnaire or the PHBS mapping checklist. Therefore, no validity or reliability coefficients are reported. This limitation is acknowledged to maintain transparency regarding the measurement instruments used in the program.

**Data Collection and Analysis**

The quantitative evaluation focused on two outcomes: changes in cadre knowledge and household PHBS conditions. Cadre knowledge scores were summarized using means, standard deviations, minimum scores, and maximum scores. Because the same 31 cadres completed both assessments, the pre-test and post-test scores were compared using a paired-samples t-test. Statistical significance was determined at $p < 0.05$.

The relative increase in the mean knowledge score was calculated using the following formula:

$$\text{Increase (\%)} = [(\text{Post-test mean} - \text{Pre-test mean}) / \text{Pre-test mean}] \times 100$$

Household PHBS mapping data from 31 households were analyzed descriptively and presented as frequencies and percentages for each of the ten indicators. The results were used to describe household PHBS conditions and to identify areas requiring further attention to health promotion.

The program proposal established a target of at least 30% improvement in cadre knowledge. The observed knowledge improvement was compared with this predefined program target. Although cadre competency and implementation readiness were included in the broader program objectives, the available dataset did not contain sufficient numerical evidence to report these indicators as quantitative outcomes. Accordingly, the quantitative

analysis in this manuscript was limited to the available pre-test, post-test, and household PHBS mapping data.

No TOPSIS analysis was conducted or reported in the available program dataset. PHBS conditions were analyzed using descriptive frequencies and percentages; therefore, the identification of areas requiring attention was based on the observed distribution of the ten PHBS indicators rather than a multi-criteria decision-making procedure.

## Result and Discussion

### Cadre Characteristics

The program involved 31 health cadres from Kelurahan Tapaan, Pasuruan City. The mean age of the participants was 39.48 years, with ages ranging from 21 to 53 years. Most participants had completed senior high school education.

The participants represented varying age groups and educational backgrounds. Accordingly, the intervention incorporated conceptual explanations, interactive discussions, case studies, and practical simulations to facilitate the cadres' understanding of PHBS concepts and their application in household-level health promotion activities.

### Improvement in PHBS Knowledge

The mean pre-test knowledge score among the 31 health cadres was 54.84 ± 8.11, with scores ranging from 40 to 70. Following the intervention, the mean post-test score increased to 82.26 ± 8.05, with scores ranging from 70 to 90.

Table 1. Comparison of Cadre PHBS Knowledge Before and After the Intervention

| Assessment | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Pre-test | 54.84 | 8.11 | 40 | 70 |
| Post-test | 82.26 | 8.05 | 70 | 90 |
| Mean difference | 27.42 | | | |

The mean knowledge score increased by 27.42 points, equivalent to a 50.0% increase relative to the baseline mean. All 31 cadres demonstrated higher individual post-test scores than their pre-test scores.

The score distribution also shifted upward following the intervention. Pre-test scores ranged from 40 to 70, whereas post-test scores ranged from

70 to 90. This pattern indicates an improvement in the observed knowledge scores among the participating cadres.

The paired analysis showed a statistically significant difference between pre-test and post-test knowledge scores ($p < 0.001$). However, because the program used a one-group pre-test–post-test design without a comparison group, this finding should be interpreted as an increase in knowledge scores following the intervention rather than definitive evidence of the effectiveness of the PESISIR SEHAT model.

The program proposal had established a minimum target of a 30% improvement in cadre knowledge as a program performance indicator before implementation. The observed relative increase of 50.0% exceeded this predefined target. This comparison indicates that the program achieved its planned short-term knowledge improvement target; it should not be interpreted as independent evidence of causal effectiveness.

**PHBS Mapping Results**

The PHBS mapping provided a descriptive overview of household health practices across ten indicators among 31 households in Kelurahan Tapaan. The findings showed variations in the proportion of households meeting the positive or optimal criteria across the indicators.

Table 2. Household PHBS Conditions Based on the Ten Mapping Indicators

| PHBS indicator | Positive/optimal n (%) | Needs attention n (%) |
|---|---|---|
| Safe drinking and cooking water | 26 (83.9) | 5 (16.1) |
| Healthy latrine and septic tank | 29 (93.5) | 2 (6.5) |
| Availability and use of handwashing facilities | 31 (100.0) | 0 (0.0) |
| Handwashing behavior | 31 (100.0) | 0 (0.0) |
| Household waste segregation | 17 (54.8) | 14 (45.2) |
| Mosquito breeding prevention | 25 (80.6) | 6 (19.4) |
| Balanced nutrition | 26 (83.9) | 5 (16.1) |
| Physical activity | 24 (77.4) | 7 (22.6) |
| No indoor smoking exposure | 21 (67.7) | 10 (32.3) |
| Maternal-child health practices | 31 (100.0) | 0 (0.0) |

Handwashing facilities and handwashing behavior showed the most favorable findings, with all 31 respondents reporting positive conditions. Maternal-child health practices also showed a positive response among all respondents.

Sanitation was generally favorable. Twenty-nine households (93.5%) reported healthy latrine and septic-tank conditions, while 26 households (83.9%) reported safe drinking and cooking water.

In contrast, household waste segregation was the weakest indicator. Only 17 households (54.8%) reported consistent segregation, while 14 households required further attention.

Indoor smoking exposure was another priority. Ten households (32.3%) reported conditions requiring attention, indicating that smoking-related household exposure remained relevant despite the generally favorable results on other indicators.

Mosquito breeding prevention was relatively good, with 25 households (80.6%) reporting favorable practice. However, six households (19.4%) still reported inconsistent prevention.

Handwashing facilities, handwashing behavior, and maternal-child health practices showed the most favorable findings, with all 31 households (100.0%) meeting the positive or optimal criteria. Healthy latrine and septic-tank conditions were also relatively favorable, reported in 29 households (93.5%). Safe drinking and cooking water and balanced nutrition were reported in 26 households (83.9%) each.

In contrast, household waste segregation showed the lowest proportion of positive or optimal conditions. Only 17 households (54.8%) met the positive criteria, while 14 households (45.2%) required further attention. Indoor smoking exposure was another concern, with 10 households (32.3%) reporting conditions that required attention. In addition, six households (19.4%) required further attention regarding mosquito breeding prevention.

**Identification of Priority Areas**

Priority areas for further community health promotion were identified descriptively by comparing the proportion of households requiring attention across the ten PHBS indicators. Indicators with higher proportions of households requiring attention were considered more prominent areas for follow-up. This approach identified household waste segregation (45.2%) as

the primary priority, followed by preventing indoor smoking exposure (32.3%) and preventing mosquito breeding (19.4%).

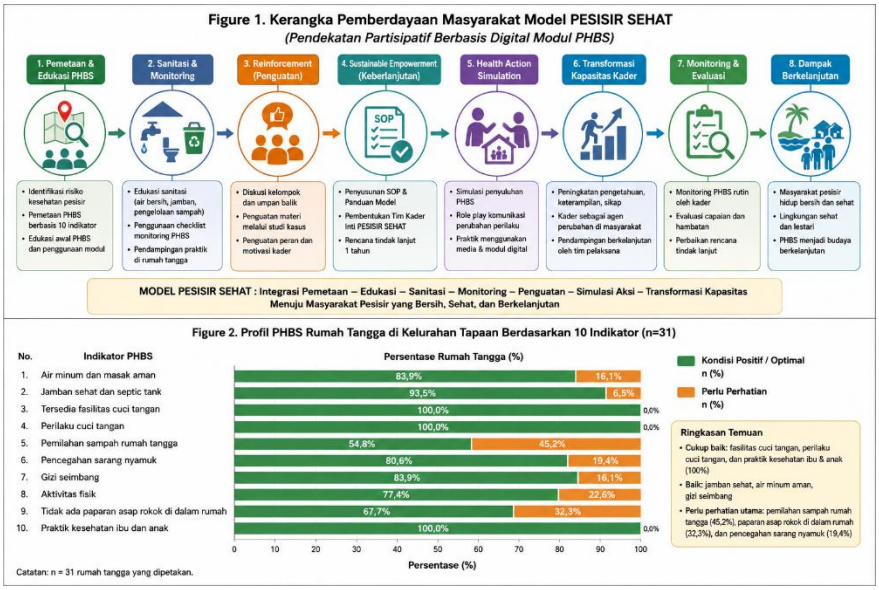
The prioritization was based on the frequency and percentage of households requiring attention and did not involve a weighted scoring system or a multi-criteria decision-making method. These findings provided a practical basis for directing subsequent cadre-led education and household monitoring toward the PHBS indicators with the greatest observed needs. The results also indicated that follow-up activities should maintain existing positive practices while strengthening behaviors that remained less consistently implemented.

**Priority Areas Identified by the Mapping**

The mapping allowed the cadres to identify three main areas requiring continued attention: household waste segregation, indoor smoking exposure, and mosquito breeding prevention.

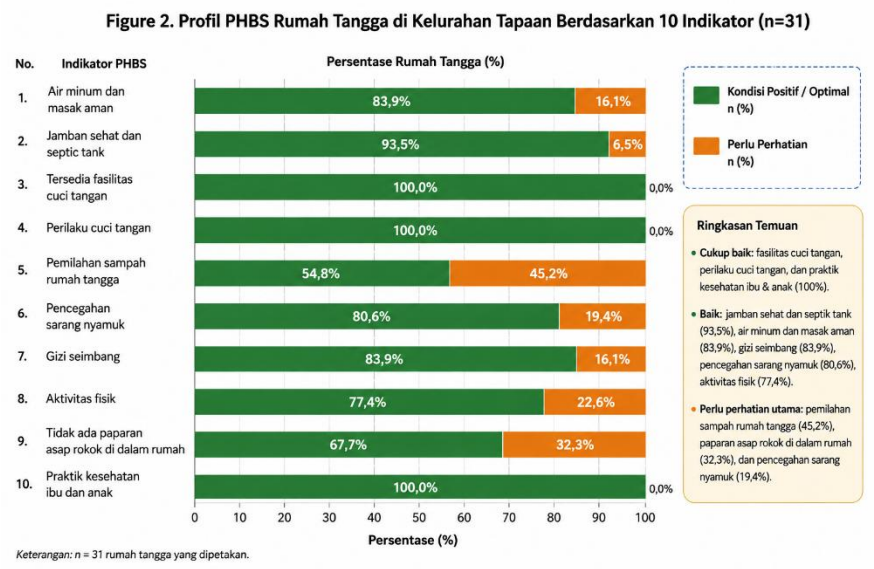
These results are important because the intervention did not assume that all PHBS indicators had the same level of need. Instead, the mapping differentiated established practices from behaviors requiring further reinforcement. This information can subsequently be used by cadres when developing household education and monitoring priorities.

Figure 1. PESISIR SEHAT Community Empowerment Framework



The framework illustrates the relationship between PHBS risk mapping, cadre education, sanitation strengthening, monitoring, reinforcement, sustainable empowerment, health-action simulation, and cadre capacity transformation.

Figure 2. Household PHBS Profile in Kelurahan Tapaan




One of the most notable results of this community engagement was the increase in knowledge among cadres after the implementation of the PESISIR SEHAT intervention. There was a marked rise from 54.84 to 82.26, corresponding to a 50.0% increase. This was statistically significant, but more importantly, the rise exceeded the ≥30% threshold set in the program proposal.

The observed increase in knowledge scores indicates that the intervention led to an improvement in the cadres' short-term knowledge, the program's primary measurable outcome. Nevertheless, this finding alone does not establish the overall effectiveness of the PESISIR SEHAT model, particularly regarding changes in cadre competencies, sustained implementation, or household health behaviors. Importantly, the intervention extended beyond a single educational session. It incorporated several practical components, including education on PHBS practices and coastal environmental health risks, household-level PHBS mapping, the use of monitoring instruments, interactive discussions, role-playing, and simulated community health education using the digital PHBS module. Through these activities, cadres

were directly involved in identifying household health conditions and recognizing PHBS indicators requiring further attention. The mapping involved 31 households and highlighted household waste segregation, indoor smoking exposure, and other PHBS indicators as areas requiring follow-up. Thus, the program provided cadres with opportunities to apply the knowledge gained through practical community-based activities. However, the available evaluation data primarily document improvements in knowledge and participation in program activities; they do not yet demonstrate independent, sustained cadre-led interventions or measurable changes in household health behaviors. Further monitoring is therefore needed to assess whether the competencies developed during the program are translated into continued cadre-led health promotion and improvements in household PHBS practices.

The PESISIR SEHAT strategy was designed around a community empowerment approach, in which health cadres were positioned as potential agents of change in household-level health promotion. Accordingly, the program incorporated training, practical guidance, household PHBS mapping, monitoring activities, and sustainability planning to strengthen the cadres' capacity to support local health initiatives. The intervention also provided opportunities for cadres to connect the knowledge acquired during training with practical community-based activities, particularly through identifying household PHBS conditions and recognizing behaviors requiring further attention. This approach reflects the importance of linking learning with practical application in community health promotion (Maryanti et al., 2025). However, the cadres' designation as agents of change represents the intended role within the program design rather than a demonstrated long-term outcome. Although their participation in mapping and practical learning activities was documented, further evaluation is required to determine whether they subsequently translated these experiences into independent, sustained household-level health promotion activities.

The present program builds on previous evidence from the same coastal region while introducing a different intervention approach. Kusuma et al. (2022) demonstrated that health education delivered via a printed booklet improved knowledge, attitudes, and practices regarding PHBS among coastal residents in Pasuruan City. In comparison, the PESISIR SEHAT program employed a digital PHBS module as a structured learning resource specifically for health cadres. Its contribution was not limited to the use of a digital

educational medium; rather, the module was integrated into a broader participatory empowerment process that included cadre training, household PHBS risk mapping, monitoring instruments, and community health education simulations. This integration was intended to connect the acquisition of PHBS knowledge to practical activities, enabling cadres to identify household health conditions and recognize behaviors that require further attention. Therefore, while the previous study focused on improving PHBS knowledge, attitudes, and practices among coastal residents through booklet-based education, the present program emphasized strengthening the learning resources and practical capacity of local cadres within a structured community health promotion model. Nevertheless, the contribution of the digital module should be interpreted in the context of this integrated intervention, as the current program did not separately evaluate its effect compared with printed educational materials.

Another vital contribution is the PHBS mapping results. Not all factors related to the community were poor. Positive responses to the availability of facilities for hand washing, hand washing, and healthy behaviors for mothers and children were received from all participants in the survey. There was also a relatively positive response regarding latrines and septic tanks.

The most important priority, according to the mapping exercise, was the separation of household waste. This was done only by 54.8% of the people. This is very relevant since waste management had earlier been identified as a problem in the area. The agreement between what was obtained from the initial analysis and the current situation is an important indicator that waste management should continue to be a priority in future efforts (Dharmayanti et al., 2023).

In addition, the problem of waste also demonstrates the need for a more specific plan targeting coastal communities. Household waste can reach beyond household premises and can impact drainage, water bodies, and the coast. Therefore, the intervention cannot limit waste management solely to personal accountability. The cadres can use the mapping data to discuss sorting and waste management within households (Maryanti et al., 2025).

Secondly, indoor smoking was another concern. There were ten households identified that required assistance. This result shows that having good practices with regard to PHBS in other aspects does not guarantee that all health risks in the household have been solved. The issue of smoking is

especially important since the impacts are not limited to the one who smokes. The issue of the smoke-free household can be brought up through cadre education (Astyandini et al., 2025).

Priority number three was mosquito breeding prevention. While 80.6% of the respondents indicated that there were positive preventive practices, 19.4% indicated negative practices. It should not be viewed as a failure on the part of the community. It shows that there is need for emphasis on this aspect. The continuity of prevention behaviors depends on the environmental situation (Melki et al., 2024).

From the outcomes, it is clear that there is practicality in integrating knowledge testing with risk mapping. If it was just the pre- and post-tests used, then the inference would have been that the knowledge of the cadres improved. With risk mapping, we add another dimension, which identifies where health promotion efforts should be targeted in the community (Hajar, 2025).

Such an approach is in line with existing research on community-based sanitation practices. Studies have found that sanitation behaviors are influenced by several determinants, such as socio-cultural settings, infrastructures, gender issues, and stakeholder involvement. Thus, having knowledge is not enough to influence and promote environmental health practices (Wolff et al., 2021).

The digital PHBS module assumes a supportive rather than a stand-alone function. The most important aspect is that of the development of standardized content which the cadres can access during and after the intervention. This is especially important in the cadre approach since it would be hard to maintain continuity of education without direct interaction with health workers (Ramadhani et al., 2023).

Sustainability of the PESISIR SEHAT model therefore is important. The proposed model had planned for the development of a model guide, standard operating procedure, core cadre team, and one year follow up plan. These are meant to ensure that the intervention does not end after the training is over .

However, the findings should be interpreted in light of several methodological limitations. The one-group pre-test–post-test design demonstrates short-term changes in cadre knowledge following the intervention but cannot establish long-term knowledge retention or attribute the observed changes exclusively to the PESISIR SEHAT program. Similarly,

the household PHBS mapping provides a descriptive overview of conditions at the time of data collection but does not establish causal relationships or demonstrate behavioral changes resulting from the intervention. The program also involved a relatively small number of participants (31 health cadres) from a single coastal community, which limits the generalizability of the findings to other settings. Furthermore, gender distribution was not available in the participant data used for this analysis, limiting the description of the cadres' sociodemographic characteristics. Future programs should document participants' gender and other relevant characteristics, involve cadres from multiple coastal communities, and incorporate follow-up assessments of knowledge retention, practical competencies, and sustained household-level implementation.

Validity of instruments is another issue. Documentation on the instruments provided with the manuscript does not contain validity and reliability coefficients. Thus, the manuscript will not claim validity of the instruments unless separate documentation is available. It would be better to avoid unsubstantiated psychometric claims.

The results, however, form a strong foundation for the second stage of the program. It was observed that there had been a considerable increase in knowledge among the cadres, whereas the mapping process had pinpointed certain behavioral issues. The obvious step at this stage would be to carry out a program based on cadre-led activities.

In this respect, the main contribution of the PESISIR SEHAT intervention is not simply the magnitude of the post-test increase. Its broader value lies in establishing a framework that connects cadre capacity-building, locally identified health priorities, and planned community-based actions. The development of standard operating procedures (SOPs), the preparation of a core cadre team, and the formulation of a one-year follow-up plan provide an initial foundation for continuing community health promotion activities. These components represent strategies designed to support program continuity; however, their implementation and long-term sustainability have not yet been evaluated. Nevertheless, linking cadre education with local PHBS monitoring and structured follow-up planning offers a practical approach to strengthening the potential for sustained community health promotion.

**Conclusion and Suggestion**

The implementation of the PESISIR SEHAT program, which integrated cadre empowerment activities with a digital PHBS module, was followed by an improvement in PHBS knowledge among 31 health cadres in Kelurahan Tapaan, Pasuruan City. The mean knowledge score increased from 54.84 to 82.26, representing a 50.0% increase from the baseline score, with a statistically significant pre-test and post-test difference ($p < 0.001$). This improvement exceeded the program's predefined target of at least 30%, indicating that the planned short-term knowledge improvement target was achieved. However, these findings reflect a cognitive outcome and do not establish whether the increased knowledge resulted in changes in cadre behavior or household PHBS practices.

The household PHBS mapping provided a descriptive overview of conditions across the ten assessed indicators. Handwashing facilities, handwashing behavior, and maternal and child health practices showed relatively favorable conditions. In contrast, household waste segregation, indoor smoking exposure, physical activity, and mosquito breeding prevention were among the indicators requiring further attention. These findings provide locally relevant information that can inform the planning of subsequent community health promotion activities.

The program involved cadres in educational sessions, practical training, household PHBS mapping, the use of monitoring instruments, and simulated community health education using the digital PHBS module. These activities provided opportunities for cadres to develop knowledge and practice identifying household health priorities. However, the available evaluation data do not demonstrate independent cadre-led interventions or sustained implementation of health promotion activities at the household level. Therefore, the contribution of the PESISIR SEHAT program should currently be understood in terms of its short-term knowledge outcomes, participatory learning activities, and the initial development of supporting arrangements for future community engagement, rather than as demonstrated effectiveness in changing community health behavior.

Future implementation should prioritize follow-up activities addressing the PHBS indicators identified through household mapping. Evaluation should assess knowledge retention, cadre competencies, actual cadre-led health promotion activities, and measurable changes in household PHBS

practices. Longer follow-up periods, repeated household assessments, and stronger evaluation designs, including comparison groups where feasible, are recommended before drawing conclusions about sustained behavioral changes or the broader effectiveness of the PESISIR SEHAT model.

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