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Waste Management Assistance for Climate-Related Disease Prevention in Larangan Village, Sidoarjo: A Community Service Initiative

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ABSTRACT

Climate change has intensified environmental challenges in rural communities, particularly regarding waste management and its correlation with climate-related diseases. This community service initiative was conducted in Larangan Village, Sidoarjo, East Java, aiming to provide comprehensive assistance in waste management practices to prevent climate-related health issues. The program involved 150 households and community leaders through educational workshops, practical training sessions, and establishment of sustainable waste management systems. Methods included participatory action research, community-based interventions, and collaborative monitoring systems. Results demonstrated significant improvements in waste segregation practices (85% compliance rate), reduction in vector-borne disease incidents (40% decrease), and enhanced community awareness regarding climate-health linkages (90% knowledge improvement). The initiative successfully established

three community composting centers and implemented a village-wide waste collection system. Long-term sustainability was ensured through training of local facilitators and development of community-based monitoring mechanisms. This program serves as a replicable model for addressing climate-related health challenges through integrated waste management approaches in rural Indonesian communities.

INTRODUCTION

Climate change represents one of the most significant global challenges of the 21st century, with profound implications for public health, particularly in developing countries where adaptive capacity remains limited. The Intergovernmental Panel on Climate Change (IPCC) has consistently highlighted the interconnected nature of environmental degradation and health outcomes, emphasizing how inadequate waste management systems exacerbate climate-related health risks (Smith et al., 2014). In Indonesia, rural communities face mounting pressure from changing precipitation patterns, increased temperatures, and extreme weather events that directly impact waste management practices and subsequently influence disease transmission patterns.

The relationship between waste management and climate-related diseases has gained increasing attention from researchers and public health practitioners worldwide. Vector-borne diseases such as dengue fever, malaria, and chikungunya have shown significant correlations with improper waste disposal practices, particularly in tropical regions where standing water in discarded containers provides ideal breeding grounds for disease vectors (Johnson & Martinez, 2019). These conditions are further amplified by climate change, which extends the geographical range and seasonal activity of disease-carrying vectors, creating new challenges for rural communities with limited healthcare infrastructure.

Larangan Village in Sidoarjo Regency represents a typical rural Indonesian community grappling with the intersection of climate change and inadequate waste management systems. Located in East Java's industrial corridor, the village experiences dual pressures from rapid urbanization and climate variability, making it particularly vulnerable to climate-related health risks. The community's traditional waste disposal methods, combined with limited access to formal waste collection services, create conditions conducive to vector breeding and environmental contamination (Wilson et al., 2020). Understanding these local contexts is crucial for developing effective community-based interventions that address both immediate health concerns and long-term sustainability goals.

Community-based approaches to waste management have demonstrated significant potential for addressing climate-related health challenges in rural settings. Research by Thompson and Lee (2018) indicates that participatory interventions involving local communities in waste management planning and implementation achieve higher success rates and greater sustainability compared to top-down approaches. These community-driven initiatives not only improve

immediate environmental conditions but also build local capacity for ongoing climate adaptation and resilience. The integration of traditional knowledge systems with modern waste management techniques creates culturally appropriate solutions that are more likely to be adopted and maintained by local communities.

The burden of climate-related diseases in rural Indonesia continues to increase, with waste-related vectors contributing significantly to this trend. Studies conducted by the Indonesian Ministry of Health reveal that dengue hemorrhagic fever cases have increased by 35% over the past decade, with rural areas showing disproportionately higher incidence rates compared to urban centers (Indonesian Ministry of Health, 2021). This epidemiological pattern reflects the complex interplay between climate variables, environmental conditions, and socioeconomic factors that characterize rural Indonesian communities. Addressing these challenges requires integrated approaches that simultaneously tackle waste management deficiencies and enhance community resilience to climate-related health threats.

Educational interventions focusing on waste management and health promotion have shown promising results in similar settings across Southeast Asia. Research by Chen et al. (2019) demonstrated that comprehensive community education programs combining theoretical knowledge with practical skills training achieve sustainable behavioral changes in waste management practices. These interventions are particularly effective when they incorporate local cultural values, utilize trusted community leaders as change agents, and provide ongoing support for implementation. The success of such programs depends heavily on understanding local contexts, building community ownership, and establishing sustainable support systems.

The concept of One Health, which recognizes the interconnectedness of human, animal, and environmental health, provides a valuable framework for addressing waste management and climate-related diseases in rural communities. This holistic approach emphasizes the need for multisectoral collaboration and integrated interventions that address root causes rather than merely treating symptoms (Garcia & Patel, 2020). In the context of Larangan Village, applying One Health principles involves engaging multiple stakeholders, including health workers, environmental officers, community leaders, and residents, in collaborative efforts to improve waste management systems and reduce climate-related health risks.

The urgency of addressing climate-related health challenges through improved waste management cannot be overstated, particularly in vulnerable rural communities like Larangan Village. The convergence of climate change impacts, inadequate infrastructure, and limited healthcare access creates a perfect storm of health risks that require immediate and sustained attention. This community service initiative represents a practical response to these challenges, offering a replicable model for addressing similar issues in rural Indonesian communities and contributing to the broader global effort to build climate-resilient health systems.

METHODE

The community service program was implemented using a participatory action research approach, emphasizing collaborative engagement between university teams and community members throughout all phases of the initiative. The methodology was designed to ensure sustainable outcomes through capacity building and community ownership of interventions. Initial community assessment was conducted through focus group discussions with village leaders, health workers, and representative households to identify specific waste management challenges and climate-related health concerns. This baseline assessment utilized structured interviews, observational studies, and participatory mapping techniques to document existing waste disposal practices, vector breeding sites, and disease occurrence patterns within the village.

Implementation strategies were developed collaboratively with community stakeholders, incorporating local knowledge and cultural practices into program design. The intervention package included educational workshops on waste segregation and composting, practical training sessions for community facilitators, establishment of waste collection points, and development of community-based monitoring systems. Educational materials were developed in local languages and utilized culturally appropriate communication channels, including traditional community meetings, religious gatherings, and informal social networks. Training sessions combined theoretical presentations with hands-on demonstrations, allowing participants to practice waste segregation techniques, composting methods, and vector control measures under guided supervision.

Monitoring and evaluation activities were integrated throughout the program implementation period, utilizing both quantitative and qualitative assessment methods to track progress and identify areas for improvement. Data collection included pre- and post-intervention surveys measuring knowledge, attitudes, and practices related to waste management and health protection. Observational studies documented changes in waste disposal behaviors, vector breeding site reduction, and community engagement levels. Regular community feedback sessions provided opportunities for program adjustment and ensured that interventions remained responsive to local needs and preferences. The evaluation framework incorporated both process indicators (participation rates, training completion) and outcome measures (behavior change, health improvements) to provide comprehensive assessment of program effectiveness.

RESULT AND DISCUSSION

Community Engagement and Capacity Building Outcomes

The community engagement phase of the waste management assistance program demonstrated remarkable success in mobilizing local participation and building sustainable capacity within Larangan Village. Initial skepticism from community members gradually transformed into enthusiastic participation as the

benefits of improved waste management practices became evident through early implementation activities. The program successfully engaged 150 households, representing approximately 85% of the village population, in various educational and training activities throughout the six-month implementation period. Community leaders played a crucial role as change champions, leveraging their social influence to encourage widespread participation and model appropriate waste management behaviors for other residents.

Training sessions on waste segregation and composting techniques achieved consistently high attendance rates, with an average of 45 participants per session across twelve scheduled workshops. Participants demonstrated significant knowledge gains, with post-training assessments showing an average improvement of 75% in understanding proper waste segregation methods and 68% improvement in composting technique comprehension. The hands-on training approach proved particularly effective, as participants could immediately apply learned concepts and receive feedback on their performance. Women's groups emerged as particularly engaged stakeholders, taking leadership roles in organizing neighborhood-level composting activities and peer-to-peer education initiatives.

The establishment of community facilitator networks represented a key sustainability achievement of the program. Twenty-five village residents completed intensive facilitator training and demonstrated competency in delivering waste management education to their neighbors. These local facilitators have continued program activities beyond the formal implementation period, conducting monthly neighborhood meetings and providing ongoing technical support for waste management initiatives. Their deep understanding of local contexts and established social relationships within the community have proven invaluable for maintaining program momentum and addressing emerging challenges.

Community ownership of the waste management program was evidenced by the spontaneous formation of neighborhood committees dedicated to maintaining and expanding program activities. These volunteer groups took responsibility for monitoring compliance with waste segregation practices, organizing regular clean-up activities, and advocating for additional resources from local government agencies. The emergence of these grassroots organizations demonstrates the program's success in building local capacity for sustained environmental health improvements beyond external support.

Assessment of community engagement outcomes revealed several factors contributing to program success, including the participatory approach to program design, utilization of respected community leaders as program ambassadors, and integration of interventions with existing social structures and cultural practices. The program's emphasis on practical, immediately applicable skills resonated with participants who could observe direct benefits from improved waste management practices in their daily lives. Regular celebration of achievements and recognition of active participants helped maintain enthusiasm and encouraged continued engagement throughout the implementation period.

Environmental Health Improvements and Vector Control

Implementation of comprehensive waste management practices in Larangan Village resulted in measurable improvements in environmental health conditions and significant reductions in vector breeding habitats. Systematic surveys conducted before and after program implementation documented a 60% reduction in potential vector breeding sites, including discarded containers, blocked drainage systems, and accumulated organic waste. These environmental improvements were achieved through combined efforts in proper waste disposal, regular community clean-up activities, and targeted elimination of standing water sources that serve as mosquito breeding grounds.

Water quality assessments conducted in village wells and surface water bodies showed marked improvements following the implementation of proper waste management practices. Bacterial contamination levels decreased by an average of 45%, while chemical pollutant concentrations showed reductions ranging from 25-40% across different measurement sites. These water quality improvements directly correlate with reduced exposure to waterborne pathogens and decreased risk of gastrointestinal diseases among community members. Regular monitoring by trained community members has helped maintain these environmental health gains through early identification and prompt addressing of potential contamination sources.

Vector surveillance activities revealed significant reductions in adult mosquito populations and larval breeding indices following program implementation. Aedes aegypti larval surveys showed a 55% decrease in positive breeding sites, while adult mosquito landing rates decreased by 40% based on standardized collection methods. These entomological improvements correspond with reduced risk of dengue fever transmission and other vector-borne diseases that pose significant health threats to rural communities. Community members reported noticeable decreases in mosquito nuisance levels, contributing to improved quality of life and reduced reliance on commercial insecticides.

The integration of biological vector control methods, including the introduction of mosquito-eating fish in appropriate water storage containers and promotion of natural predator habitats, proved effective in maintaining long-term vector suppression. Community members readily adopted these environmentally friendly approaches, which align with traditional ecological knowledge and avoid the environmental and health risks associated with chemical pesticides. Training in integrated vector management techniques has enabled residents to continue these practices independently, ensuring sustainable vector control outcomes.

Air quality improvements were observed following the elimination of open burning practices and implementation of proper organic waste composting systems. Particulate matter measurements showed average reductions of 35% during traditional burning seasons, while community reports indicated decreased respiratory irritation and improved comfort during outdoor activities. These air quality improvements provide additional health benefits beyond vector-borne

disease prevention, contributing to overall environmental health enhancement in the village setting.

Health Behavior Change and Disease Prevention Outcomes

Systematic assessment of health behavior changes following the waste management assistance program revealed substantial improvements in practices directly related to climate-related disease prevention. Pre- and post-intervention surveys demonstrated significant increases in proper waste segregation practices, with compliance rates improving from 25% to 85% over the six-month implementation period. Community members showed particular improvement in separating organic waste for composting and properly disposing of containers that could serve as vector breeding sites. These behavioral changes reflect successful internalization of program messages and integration of new practices into daily routines.

Figure 1. Waste management by the community

Healthcare utilization data from the village health post indicated a 40% reduction in consultations for vector-borne disease symptoms, including fever, headache, and skin rashes commonly associated with dengue fever and chikungunya. While direct causal attribution requires longer-term surveillance, these preliminary health improvements coincide with program implementation and suggest positive health impacts from improved waste management practices. Community health workers reported increased health-seeking behavior for

preventive services and greater awareness of environmental factors contributing to disease transmission.

Knowledge assessments conducted six months post-implementation showed sustained improvements in understanding the connections between waste management and health outcomes. Participants demonstrated 90% accuracy in identifying potential vector breeding sites and appropriate elimination methods, compared to 35% accuracy in pre-program assessments. This knowledge retention indicates successful learning outcomes and suggests strong potential for continued application of program concepts. Community members also showed improved understanding of climate change impacts on disease transmission patterns and the role of environmental management in adaptation strategies.

Adoption of personal protective behaviors increased significantly following program participation, with 80% of households reporting consistent use of protective measures such as proper water storage, elimination of standing water around homes, and use of bed nets during high-risk periods. These individual-level behavior changes complement community-wide environmental improvements in creating comprehensive protection against vector-borne diseases. The integration of personal and environmental protection strategies provides multiple barriers to disease transmission and enhances overall community resilience.

Long-term behavior change sustainability was supported through the establishment of peer support networks and community accountability systems. Neighborhood groups developed informal monitoring systems to encourage continued compliance with waste management practices and provide mutual support for maintaining healthy behaviors. Regular community meetings include discussions of environmental health topics, ensuring continued reinforcement of program messages and adaptation to emerging challenges. These social support mechanisms have proven crucial for maintaining behavior change outcomes beyond the formal program implementation period.

CONCLUSION

The waste management assistance program implemented in Larangan Village, Sidoarjo, successfully demonstrated the effectiveness of community-based approaches in addressing climate-related health challenges through integrated environmental interventions. The program achieved significant improvements across multiple outcome domains, including enhanced community knowledge and practices related to waste management, substantial reductions in vector breeding habitats and disease risk factors, and strengthened local capacity for sustained environmental health promotion. These outcomes were achieved through collaborative engagement with community stakeholders, culturally appropriate intervention strategies, and comprehensive capacity building activities that ensured local ownership and long-term sustainability of program benefits.

The success of this initiative provides valuable insights for scaling similar interventions across rural Indonesian communities facing comparable challenges at

the intersection of climate change and environmental health. Key factors contributing to program effectiveness included the participatory approach to program design and implementation, integration of traditional knowledge systems with modern waste management techniques, and establishment of community-based support systems for maintaining behavior change outcomes. The program's emphasis on building local capacity and creating sustainable institutional structures has resulted in continued program activities beyond external support, demonstrating the potential for community-driven environmental health improvements to achieve lasting impact in addressing climate-related disease risks in vulnerable rural populations.

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