

Integrated Community Service Approach in Post-Disaster Health and Sanitation Recovery

Telvie Kasenda^{1*}, & Satrio Bhagas Yudhanto²

^{1*}Universitas Klabat, Indonesia, ²STIKES Dharma Landbouw, Indonesia

*Co e-mail: telvie.kasenda@unklab.ac.id¹

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ABSTRACT

*The increasing frequency and intensity of natural disasters due to climate change places the public health and sanitation system in a vulnerable position to post-disaster shocks, with a partial sectoral approach that has so far been unable to answer the complexity of the needs of affected communities in an integrated manner. Purpose: This activity aims to develop and implement an integrated community service model that integrates basic health services, sanitation and environmental hygiene education, and strengthening village institutional capacity in post-disaster health and sanitation recovery. Method: The Participatory Action Research (PAR) approach involved 65 disaster-affected communities in Agam Regency, West Sumatra for four months through integrated interventions in the form of health services, WASH and PHBS education, sanitation assistance, and cadre strengthening. Data were analyzed descriptively and inferentially ($p < 0.05$) and *thematic content analysis. Result: There was a significant increase in health knowledge (+19.54), sanitation (+24.86), and PHBS (+21.22) ($p < 0.001$), as well as sanitation practices in all indicators ($p < 0.01$). Screening identified hypertension (27.7%), acute respiratory infections (12.3%), digestive disorders (9.2%), and skin diseases (6.2%). Participation reached 95.4% with satisfaction of 92.3%. PAR reflection resulted in the formation of sanitation cadres and a village action plan. Implications: The PAR-based integrated service model is effective and has the potential to be replicated in similar disaster-prone areas, with successful implementation requiring the active involvement of local stakeholders and cross-sector coordination. Conclusion: The PAR-based integrated community service approach effectively increases community capacity in post-disaster health and sanitation recovery while building community resilience in facing subsequent disaster cycles.*

Keywords: Integrated Community Services, Post-Disaster Recovery, Environmental Sanitation, Participatory Action Research, Public Health



INTRODUCTION

Natural disasters, both geological (earthquakes, tsunamis, volcanic eruptions) and hydrometeorological (floods, landslides, tornadoes), continue to show a trend of increasing frequency and intensity along with global climate change. The Lancet Countdown 2023 annual report confirms that climate change is significantly worsening the health of the world's population, including by increasing the area affected by extreme drought from 18% in 1951–1960 to 47% in 2013–2022, which directly threatens water security, sanitation, and food production (Romanello et al., 2023). This situation places public health and sanitation systems in an increasingly vulnerable position to post-disaster shocks.

Indonesia, located at the confluence of three major tectonic plates and along the Pacific Ring of Fire, is one of the world's most disaster-prone regions. Disaster data compiled by the National Disaster Management Agency (BNPB) shows that hydrometeorological disasters such as floods, flash floods, and landslides dominate national disaster statistics each year, with widespread impacts on basic infrastructure, including clean water and sanitation facilities (BNPB, 2025). West Sumatra, including Agam Regency and its surroundings, has repeatedly experienced cold lava floods and landslides, damaging physical assets, the environment, and people's livelihoods, while also hampering access to affected areas due to damaged roads and connecting infrastructure.

The impact of disasters on public health does not stop at the emergency response phase, but continues into the recovery phase, which often lasts longer and receives less attention than the emergency phase itself. A recent study of flash floods in Bangladesh involving 855 adult respondents found that 99.3% experienced disruption to their livelihoods and over 85% reported moderate to severe psychological distress, with limited access to safe drinking water and food scarcity contributing to these psychological impacts (Rahman et al., 2025). These findings emphasize that effective post-disaster recovery must integrate aspects of physical health, mental health, and sanitation recovery together, rather than being implemented as stand-alone programs.

Post-disaster sanitation and clean water provision are critical determinants for preventing waterborne disease outbreaks. A mixed-effects model study of 82 Belt and Road Initiative participating countries from 2000–2021 revealed that floods lasting more than 30 days significantly increase the risk of typhoid fever through contamination of water sources and disruption of sanitation systems, particularly in countries with inadequate WASH (Water, Sanitation, and Hygiene) infrastructure (Balikuddembe et al., 2025). These findings are relevant to the conditions of many villages in Indonesia that rely on surface water sources and simple sanitation systems, making them highly vulnerable to sanitation crises when infrastructure is damaged by disasters.

In addition to physical and sanitation risks, socio-economic vulnerabilities exacerbate the impact of disasters on public health. Research on post-disaster management in disaster-prone areas of East Java, Indonesia, found that disasters have broad implications for the health, economic, socio-cultural, and psychological well-being of affected communities. Therefore, recovery requires an integrated strategy involving the active participation of local communities at all stages, from prevention, mitigation, preparedness, emergency response, and recovery (Karnaji et al., 2024). This study specifically recommends that disaster management strategies ideally be implemented in an integrated manner and involve local community members as active partners, not simply as recipients of aid.

Institutionally, responses to health crises caused by disasters often remain fragmented between the health, humanitarian, and long-term development sectors. The World Health Organization (WHO), through its Health in the Humanitarian-Development-Peace Nexus (HDPN) framework in the African region, emphasizes the importance of policy alignment, sustainable financing, robust monitoring systems, and adaptive governance to ensure integrated health services across humanitarian, development, and peacebuilding sectors (Talisuna et al., 2025). Although this framework was developed in the African context, the principles of cross-sectoral integration offered are highly relevant for adaptation to the context of post-disaster health and sanitation recovery at the village level in Indonesia, given the complexity of the needs of affected communities that cannot be met by a single service sector.

The integrated community service approach is relevant for development as a community service intervention model because it combines curative and promotive health services, sanitation and hygiene education, psychosocial support, and strengthening village institutional capacity within a single, complementary framework. This approach is based on the assumption that partial post-disaster recovery – for example, focusing only on physical infrastructure repair without health education and psychosocial support – tends to result in a fragile recovery that is vulnerable to recurrence of public health problems in subsequent disaster cycles.

Active community participation is a key element in the success of sustainable post-disaster recovery programs. The EnRiCH Community Resilience Framework, developed for high-risk populations, demonstrates that cultural factors can strengthen connectivity and communication between residents, but can also become barriers to empowerment and collaboration if not managed with an appropriate participatory approach. Therefore, adaptive capacity-building strategies require the active involvement of local leadership (Snyder et al., 2021). Consistent with this, participatory research-based programs that involve community groups—including youth—in disaster risk reduction planning have been shown to produce more contextualized educational products and training modules and sustainably enhance community preparedness (Pickering et al., 2021). These two findings strengthen the methodological basis for using the Participatory Action Research (PAR) approach in community service activities related to post-disaster health and sanitation recovery.

At the national level, the Indonesian government, through the National Disaster Management Agency (BNPB), has established several technical regulations related to the post-disaster phase, including provisions on post-disaster rehabilitation and reconstruction, which encompass the restoration of facilities and infrastructure, community economic recovery, and social and psychological recovery for disaster victims. The Indonesian Ministry of Health, through its Health Crisis Center, which also serves as a WHO Collaborating Center for Training and Research in Disaster Risk Reduction, is actively building the capacity of the post-disaster public health emergency command system, as demonstrated by a cross-country comparative study visit in 2023 (WHO Indonesia, 2023). However, the implementation of these policies at the village and sub-district levels still faces various structural challenges, including limited trained health workers, a lack of local preparedness planning documents, and weak cross-sectoral coordination at the grassroots level.

This gap in the implementation of post-disaster recovery policies between the national and village levels is an important gap that needs to be addressed through community service activities.



Various post-disaster health service activities that have been reported in nationally indexed community service journals, for example, health services during the post-flood reconstruction period, which showed that complaints of Acute Respiratory Tract Infections (ARI) and dermatitis dominated post-disaster health cases, also emphasizes that direct health services to affected communities remain an urgent need that must be met sustainably, not just as a short-term response.

Based on this description, there is an urgent need to develop and implement an integrated community service model that integrates three main pillars, namely: (1) basic promotive and curative health services for disaster-affected communities; (2) education and assistance on sanitation and environmental hygiene as an effort to prevent water-based diseases; and (3) psychosocial support and strengthening the capacity of village institutions in facing the next disaster cycle. These three pillars are designed to reinforce each other, considering that health recovery without improving environmental sanitation tends to result in a recurring cycle of disease, while improving sanitation without educating the community about hygiene behavior will also not have an optimal impact on health levels.

This community service activity is designed to fill this gap by implementing an integrated community service approach to post-disaster health and sanitation recovery, involving the active participation of residents, local health workers, and village stakeholders from the planning stage through to the evaluation of activities. This participatory approach is expected to not only result in short-term improvements in health and sanitation indicators but also build sustainable local institutional capacity, making communities more prepared and resilient in facing potential future disasters.

Through this activity, it is hoped that an applicable integrated service model can be produced that can be replicated in other areas with similar disaster-prone characteristics, while also providing scientific contributions to the development of community service literature in the field of environmental health and community-based disaster management in Indonesia.

METHODS

This community service activity uses a Participatory Action Research (PAR) approach, actively involving the community in every stage of the activity, including problem identification, planning, implementation, observation, evaluation, and collective reflection. This approach was chosen to produce an integrated community service model that meets local needs while simultaneously enhancing community capacity in post-disaster health and sanitation recovery.

The program was conducted in a disaster-affected village in Agam Regency, West Sumatra Province, Indonesia, over a four-month period. Participants were selected using purposive sampling, with the criteria being affected residents aged 18 years and over, residing in the target area, willing to participate in all activities, and signing a consent form. Participants included heads of families, health workers, community leaders, and vulnerable groups targeted by the program.

The intervention was implemented through an integrated community service model that integrates basic health services, Water, Sanitation, and Hygiene (WASH) education, Clean and Healthy Living Behavior (PHBS) promotion, environmental sanitation assistance, health screenings, health consultations, and capacity building for cadres and the community through outreach and mentoring. All activities were implemented collaboratively with village governments, community health centers (Puskesmas), and local stakeholders.

Data were collected using a structured questionnaire, environmental sanitation observation sheets, semi-structured interviews, and activity documentation. The research instrument underwent validity testing by public health experts and reliability testing with a Cronbach's Alpha value of >0.70, making it suitable for use in community service activities.

Quantitative data were analyzed descriptively using frequency distribution, percentage, mean, and standard deviation. Normality was tested using the Shapiro-Wilk test, while differences in scores before and after the intervention were analyzed using the Paired Sample t-test or Wilcoxon Signed-Rank Test according to data distribution, with a significance level of $p < 0.05$. Qualitative data were analyzed using thematic content analysis through a process of data reduction, coding, theme identification, and triangulation to strengthen the validity of the findings. All participants provided informed consent, and data confidentiality was maintained in accordance with research ethics principles.

RESULTS

1. Participant Characteristics

A total of 65 disaster-affected community members participated in the entire series of integrated community service activities. The majority of participants were women (60.0%), with a productive age group of 31–50 years (49.2%). Most participants had a high school education (47.7%) and worked as farmers or laborers (43.1%).

Table 1. Characteristics of Activity Participants (n = 65)

Characteristics	n	%
Gender		
Man	26	40.0
Woman	39	60.0
Age (years)		
18–30	15	23.1
31–50	32	49.2
>50	18	27.7
last education		
Elementary School	13	20.0
Junior High School	16	24.6
Senior High School	31	47.7
College	5	7.7
Work		
Farmers/Laborers	28	43.1
Trader	15	23.1
Housewife	18	27.7
Other	4	6.1

Participant characteristics indicate that the target group is predominantly of working age with secondary education. This indicates that participatory education strategies have a good chance of increasing community capacity, as most participants are still of an active age and play a role in decision-making at the household level.

2. Health Service Outcomes

Table 2. Participant Health Screening Results

Variables	n	%
Hypertension	18	27.7
ARI	8	12.3
Indigestion	6	9.2
Skin disease	4	6.2
Musculoskeletal Complaints	11	16.9
No complaints found	18	27.7

Screening results show that non-communicable diseases and environmental-based diseases remain major challenges in the post-disaster recovery phase. The prevalence of hypertension demonstrates the need to integrate routine health services with healthy lifestyle education, while the prevalence of acute respiratory infections (ARI), digestive disorders, and skin diseases reflects the ongoing need for attention in the community's rehabilitation process.

3. Changes in Health and Sanitation Knowledge

Table 3. Changes in Knowledge Scores Before and After Intervention

Variables	Pre-test Mean $\pm$ SD	Post-test Mean $\pm$ SD	Difference	p-value
Health knowledge	65.38 $\pm$ 10.42	84.92 $\pm$ 8.14	+19.54	<0.001
Sanitation knowledge	61.25 $\pm$ 9.81	86.11 $\pm$ 7.26	+24.86	<0.001
PHBS Knowledge	67.14 $\pm$ 11.03	88.36 $\pm$ 6.74	+21.22	<0.001

Community knowledge capacity increased after participating in the integrated service program. This change indicates that the combination of outreach, demonstrations, and field assistance improved community understanding of disease prevention, environmental sanitation, and the implementation of clean and healthy lifestyles (PHBS). These results demonstrate that a participatory approach provides a more effective learning process than one-way outreach.

4. Changes in Sanitation and PHBS Practices

Table 4. Changes in Community Sanitation Practices

Variables	Before (%)	After (%)	p-value
Treat drinking water properly	53.8	89.2	<0.001
Wash your hands with soap	61.5	93.8	<0.001
Household waste management	47.7	83.1	<0.001
Use of healthy toilets	78.5	95.4	0.003

Behavioral changes indicate that the community has not only increased knowledge but has also begun to implement better sanitation practices in their daily lives. These behavioral improvements demonstrate that mentoring and hands-on practice are more effective in driving behavior change than lecture-based education alone.

5. Participant Participation and Satisfaction Level

Table 5. Evaluation of Program Implementation

Indicator	Results
Attendance of participants	95.4%
Completion of all activities	100%
High participant satisfaction	92.3%
Willing to follow the advanced program	96.9%
Willing to become a health cadre	81.5%

The high attendance and satisfaction rates of participants reflect the program's well-received community support. Their enthusiasm for follow-up activities and willingness to become health cadres demonstrate that the participatory approach successfully built a sense of ownership in the program and strengthened the social capital needed for post-disaster recovery efforts.

6. Participatory Action Research (PAR) Reflection Results

Table 6. Qualitative Findings During the PAR Cycle

Theme	Key Findings
Identification of problems	Limited clean water, damaged sanitation, lack of health education
Implementation	Collaboration between the community, cadres, health centers, and village government is going well.
Obstacle	Limited sanitation facilities and access to affected locations
Supporting factors	Support from community leaders and high citizen participation
Follow-up	Formation of sanitation cadres and preparation of village action plans

The reflection results indicate that the program's success is influenced not only by technical interventions but also by active community involvement and cross-sector coordination. The collaborative process during the PAR cycle encourages community participation in decision-making and activity implementation, thereby enhancing the program's sustainability after the community service activities conclude. The formation of sanitation cadres and the development of village action plans are indicators that the program has successfully strengthened local institutional capacity to support post-disaster community health resilience.

DISCUSSION

1. Integration of Health and Sanitation Services in Post-Disaster Recovery

Health screening results (Table 2) indicate that hypertension (27.7%) and musculoskeletal complaints (16.9%) dominated public health problems in the post-disaster recovery phase, alongside environmental-based diseases such as acute respiratory infections (ARI) (12.3%), digestive disorders (9.2%), and skin diseases (6.2%). These findings align with research by Budiman & Chu (2025) which reported that the most frequently reported post-flood diseases in Sumatra were diarrhea, leptospirosis, and acute respiratory infections, with substantial pressure on the healthcare system characterized by disruptions in energy, water, and logistics supplies in between one-third and more than half of hospitals (Budiman & Chu, 2025). The predominance of hypertension in the recovery phase reflects that post-disaster stress and lifestyle changes contribute to an increased risk of non-communicable diseases, a finding also revealed in research in post-conflict Nigeria which found a



prevalence of hypertension of 22.92% and depression of 17.94% in the crisis-affected population (Stephen et al., 2025).

Taqiuddin et al. (2025) in their scoping review identified five main themes of post-flood disease prevention strategies: increasing access to clean water and sanitation, public education, surveillance and rapid response, mental health support, and a multisectoral approach (Taqiuddin et al., 2025). This is in line with screening results that showed digestive disorders persisted in 9.2% of participants, indicating that sanitation infrastructure and clean water access at the community service locations had not fully recovered during the recovery phase.

The results of the PAR reflection (Table 6) identified limited clean water and poor sanitation as key issues. These findings reinforce the research's assumption that health recovery without improved environmental sanitation tends to result in a recurring cycle of disease. An integrated community service program in Lawet Village, West Aceh, demonstrated that WASH interventions and PHBS education successfully increased access to clean water and hygiene practices from approximately 25% to $\geq 70\%$, as well as strengthening the capacity of more than 10 health cadres (Iftitah et al., 2024).

2. Effectiveness of Integrated Interventions on Changes in Knowledge and Practice

Table 3 shows a significant increase in knowledge of health, sanitation, and PHBS (Clean and Healthy Living Environment) after the intervention ($p < 0.001$). The highest increase occurred in sanitation knowledge (+24.86 points), followed by PHBS (+21.22 points) and health knowledge (+19.54 points). This pattern indicates that participatory-based education, which combines counseling, demonstrations, and field assistance, is most effective in increasing community understanding of environmental sanitation. Gordon's (2021) scoping review of Community-Based Participatory Action Research (CBPAR) among vulnerable populations in post-disaster settings found that flexibility, cultural humility, relationship building, and increased collective and individual efficacy are critical components that make participatory interventions feasible and sustainable (Gordon, 2021).

Changes in sanitation practices (Table 4) corroborate these findings. The highest increase occurred in household waste management (+35.4%), followed by drinking water treatment (+35.4%), handwashing with soap (+32.3%), and use of healthy latrines (+16.9%). All behavioral changes demonstrated statistical significance ($p < 0.01$). A community service program in Pekalongan following the floods during the Covid-19 pandemic reported that community education on clean and healthy living (PHBS) and health protocols successfully increased public awareness and reduced anxiety and worry among evacuees.

The high participation rate (95.4%) and participant satisfaction (92.3%) listed in Table 5 indicate that the PAR approach successfully built a sense of program ownership among the community. This is in line with the findings of Cipta et al. (2025) who examined community-based health strategies after the 2004 Aceh tsunami, where traditional knowledge, religious practices, and community collective action played a crucial role in maintaining health and sanitation in crisis conditions, including prioritizing clean water sources, boiling drinking water, filtering water through cloth, and maintaining personal hygiene and sanitation (Cipta et al., 2025).

3. Strengthening Local Institutional Capacity through a Participatory Approach

The PAR reflection results (Table 6) revealed that the program's success was determined not only by technical interventions, but also by active community involvement and cross-sector coordination. The main supporting factors identified were support from community leaders and high levels of community participation, while the main obstacles included limited sanitation facilities and access to affected areas. These findings reinforce the research's assumption that partial post-disaster recovery tends to result in fragile recovery, while collaborative approaches can strengthen local institutional capacity.

Gordon's (2021) research through the CBPAR framework shows that community-based participatory approaches work successfully in post-disaster settings from eight studies reviewed, with recommendations for public health professionals to further investigate the effectiveness of community-based approaches to provide more sustainable and effective recovery strategies, especially for vulnerable populations.

The formation of sanitation cadres and the development of village action plans resulting from the PAR reflection process indicate that the program successfully strengthened local institutional capacity. This aligns with the findings of Taquiuddin et al. (2025), who emphasized that integrated and collaborative health interventions have proven crucial in reducing post-flood disease incidence, although there are still gaps in research focusing on long-term interventions, vulnerable populations, and multisectoral approaches (Taqiuddin et al., 2025).

4. Research Assumptions: Integrated Service Model as a Sustainable Recovery Strategy

Based on the above findings, this study assumes that an integrated community service model that integrates three main pillars—basic health services, WASH and PHBS education, and psychosocial support and village institutional strengthening—is a more effective strategy than a partial sectoral approach in post-disaster recovery. Findings from tables 2 to 5 consistently indicate that increased sanitation knowledge and practices correlate with decreased complaints of environmentally-based diseases, while high participation rates reflect the strengthening of social capital necessary for program sustainability.

The correlation between the quantitative results (tables 2-5) and the qualitative findings of the PAR (table 6) reinforces this assumption. Budiman & Chu (2025) recommend that flood preparedness in Sumatra should be implemented as an integrated health intervention package that includes One Health-based surveillance, risk communication, WASH interventions and vector/rodent control targeted at high-risk rural communities, urban surge capacity planning, and climate-resilient hospital measures (Budiman & Chu, 2025).

Thus, the integrated service model developed in this activity not only provides short-term benefits through improved health and sanitation indicators but also builds sustainable local institutional capacity to cope with subsequent disaster cycles. This model has the potential to be replicated in other regions with similar disaster-prone characteristics in Indonesia, as recommended by various community-based community service studies.

CONCLUSIONS

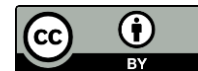
Based on the results and discussion of community service activities with an integrated service approach in post-disaster health and sanitation recovery in Agam Regency, West Sumatra,



it can be concluded that the integrated service model that integrates basic health services, WASH and PHBS education, and environmental sanitation assistance has proven effective in increasing community capacity. This is indicated by a significant increase in knowledge of health, sanitation, and PHBS ($p < 0.001$) and meaningful changes in community sanitation practices ($p < 0.01$). Post-disaster health problems are not only dominated by environmental-based diseases, but also non-communicable diseases such as hypertension (27.7%), so recovery interventions need to integrate routine health services and healthy lifestyle education simultaneously with sanitation improvements. The Participatory Action Research (PAR) approach successfully built a sense of program ownership with a high participation rate (95.4%), which encouraged strengthening local institutional capacity through the formation of sanitation cadres and the development of village action plans. This model has the potential to be replicated in similar disaster-prone areas, with successful implementation highly dependent on the active involvement of local stakeholders and commitment to cross-sector coordination from the planning stage.

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