



Improving Environmental Health Awareness through the PHAST Method for Household Sanitation Intervention in the Belawan Coastal Region

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<p>Track Record Article</p> <p>Revised: 27 January 2026 Accepted: 10 March 2026 Published: 31 March 2026</p> <p>How to cite : Naria, E., Chahaya, I., Rusmalawaty, Hamzah, D. F., Anggraini, & Adjani, T. S. (2026). Improving Environmental Health Awareness through the PHAST Method for Household Sanitation Intervention in the Belawan Coastal Region. <i>Contagion : Scientific Periodical of Public Health and Coastal Health</i>, 8(1), 316–327.</p>	<p style="text-align: center;">Abstract</p> <p><i>Coastal areas are often faced with complex public health challenges due to environmental vulnerability and limited access to sanitation facilities. Poor sanitation contributes to a high prevalence of environment-related diseases such as diarrhea and malnutrition among children under five. This quasi-experimental study included 30 households with toddlers in Medan Belawan, Medan City. The Participatory Hygiene and Sanitation Transformation (PHAST) method was implemented to empower families in managing sanitation and hygiene practices. Data were collected through observation and assessment of household sanitation conditions before and after the intervention. Analysis was conducted using the Wilcoxon Signed Rank test at a 95% confidence interval due to non-normal data distribution. The results showed a significant improvement in household sanitation scores after the PHAST intervention ($Z = -3.905$; $p < 0.05$). Approximately 63.3% of households had increased scores, particularly in handwashing at critical times, waste management, as well as water and food storage practices, signifying a meaningful magnitude of behavioral change. However, this study was limited by its small sample size, absence of a control group, and short observation period, which hindered causal inference and generalizability. Despite the limitations, the evidences suggest that PHAST is a promising method for improving household sanitation management and hygiene behavior in coastal settings. Future studies with larger samples and controlled designs are recommended to assess sustainability and long-term health outcomes.</i></p> <p>Keywords: Household Sanitation, Environmental Diseases, Coastal Area, PHAST</p>
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INTRODUCTION

Environmental sanitation is a parameter of environmental conditions in a region that contributes positively to children's well-being. This is closely related to the realization of the SDGs, particularly Goal 3 (Good Health and Well-being), 6 (Clean Water and Sanitation), and 11 (Sustainable Cities and Communities), which emphasize the importance of a healthy environment as the main foundation for optimal child growth and development. The basic sanitation facilities every child should have include continuous availability of clean water, ownership of a toilet, as well as management of household waste and sewage (Naria et al., 2021). Poor and unsanitary environmental sanitation conditions result in the growth of bacteria that use children's bodies as hosts to multiply and develop. This causes various environment-based diseases such as diarrhea and intestinal worms, thereby affecting nutritional status (Basyariyah et al., 2022).

Environment-based diseases are pathological conditions marked by functional or morphological abnormalities of human organs arising from interactions with surrounding environmental factors (Abera et al., 2024). In Indonesia, these conditions remain a significant public health concern, with diarrhea ranking among the ten most common cases reported across community health centers nationwide (Hendraswari, 2023). Other environmentally based diseases that contribute to malnutrition are parasitic infections. This causes serious complications such as intestinal obstruction and severe anemia, leading to a decline in nutritional status (Susilowati et al., 2019).

Toddlers differ from other age groups in their play behavior and dietary patterns, often playing outdoors without close parental supervision and consuming a wider variety of foods. These characteristics influence personal hygiene practices and increase vulnerability to environment-based diseases (Widiari et al., 2023). Evidence suggests that children under five in sanitation-constrained environments remain vulnerable to environment-based diseases and undernutrition. However, the effectiveness of sanitation interventions varies substantially across contexts, with stronger outcomes observed when behavior change is sustained at the household level (Merid et al., 2023; Alum et al., 2024).

The spread of environment-based diseases can be addressed by raising public awareness and knowledge about sanitation through community participation (Naria et al., 2021). Community-based sanitation initiatives that emphasize participation have been widely implemented. However, the effectiveness in achieving sustained household-level behavioral change remains inconsistent. Most existing interventions focus on community-wide engagement. Meanwhile, empirical evidence specifically examining family-centered participatory sanitation methods, particularly in environmentally vulnerable coastal settings, remains limited. This gap underscores the need for studies that position the household as the primary unit of sanitation behavior change.

The development of community participation needs to be strengthened from the smallest social unit, such as the family. PHAST is a participatory learning method that improves the community's capacity to solve health problems, particularly sanitation and environment-based diseases (Ikegulu et al., 2024). In practice, this sanitation model transformation includes public health center sanitation officers, integrated health service post cadres, and housewives in the area.

The problem of malnutrition that exists in Indonesia shows that there is a close relationship between health, environment, and sanitation. This is in line with the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), 6 (Clean

Water and Sanitation), and 11 (Sustainable Cities and Communities) (Alum et al., 2024). SDG 3 emphasizes efforts to combat malnutrition and environment-based diseases to improve public health. The cases of malnutrition in toddlers due to infectious diseases such as diarrhea and parasites show that health outcomes are affected by unsuitable environments (Melese et al., 2024). SDG 6 underscores the importance of clean water and proper sanitation as determinants of health quality (Singh.R.Jayaram, 2022).

Sustainable access to clean water, healthy toilets, and proper household waste management play a key role in preventing environment-based diseases that worsen children's nutritional status (Merid et al., 2023). The implementation of participatory sanitation models such as PHAST (Participatory Hygiene and Sanitation Transformation) is an effective strategy for increasing families' awareness and capacity to adopt clean and healthy living behaviors (Alum et al., 2024). SDG 11 is realized through efforts to create healthy, safe, and sustainable settlements, particularly in coastal areas where sanitation and health service access remain limited. By strengthening community participation at the family level through participatory models such as PHAST, improvements in health conditions, nutritional status, and environmental sanitation can be achieved, supporting the creation of resilient and sustainable communities. Therefore, this study aims to evaluate the effectiveness of a family-centered PHAST intervention in improving household sanitation management in coastal areas. The objectives include: (1) assess changes in household sanitation conditions before and after the intervention, (2) identify sanitation components with the most improvement, and (3) examine the role of family participation in supporting sanitation behavior change at the household level. Based on these objectives, this study hypothesizes that the PHAST method significantly improves household sanitation behavior in coastal areas.

METHODS

This study applied a quasi-experimental one-group pretest–posttest design to evaluate the empowerment intervention. The PHAST method was used to improve sanitation management behaviors, family dietary patterns, and incidence of environment-based diseases among families with toddlers in coastal areas. Measurements were conducted before and after the intervention within the same group. A total of 30 families were recruited based on feasibility and exploratory considerations. The inclusion criteria were informed consent, at least one toddler, residence in the same household for ≥ 6 months, good general health, and no ongoing medical treatment. The intervention was implemented over two weeks through guided discussions, practical activities, and monitoring, focusing on strengthening shared family roles

in sanitation and nutrition management. PHAST stages included problem identification through baseline household assessments, participatory problem analysis, development of feasible sanitation action plans, establishment of family agreements assigning responsibilities, and implementation of agreed actions. Other comprised monitoring of latrine hygiene, handwashing, water storage, and waste management, as well as participatory evaluation of behavioral changes and remaining challenges.

Household sanitation management was assessed using a structured observation checklist covering handwashing practices at critical times, latrine use, waste disposal, as well as water and food storage, which were quantified using a scoring system. Nutritional patterns were obtained through interviewer-administered questionnaires to mothers of toddlers regarding food preparation, feeding habits, and food hygiene. Environment-based disease incidence was recorded using a standardized reporting form documenting sanitation-related conditions such as diarrhea during the observation period. All instruments were administered by trained analysts to ensure data consistency. In this study, data were analyzed to compare pre- and post-intervention changes. Paired t-tests were used for normally distributed variables, while the Wilcoxon Signed Rank Test was applied for non-normally distributed data to determine the effectiveness of the PHAST intervention.

RESULT

Table 1. Characteristics of Subject by Age in Coastal Areas

Mother's age	F	%
Adolescents (< 20 Years)	1	3,3
Young adults (20-34 Years)	16	53,3
Older adults (≥35 Years)	13	43,3
Total	30	100

Based on the results of the study, the age distribution of mothers showed that most are in the young adult group (20–34 years) at 53.3%, followed by older adults (≥35 years) at 43.3% and adolescents (<20 years) at 3.3%. In line with this condition, the majority of respondents are of childbearing and child-rearing age, but have varying risks of environment-based diseases that need to be considered.

Table 2. Sanitation Facilities and Activities in Families (n=30)

No	Environmental Sanitation Characteristics		Before Action		After Action	
			F	%	F	%
1	Where household members defecate	Own toilet	27	90.0	27	90.0
		Plunge	3	10.0	3	10.0
2	The time mother practiced handwashing with soap	0 exact	1	3.3	1	3.3
		handwashing with soap time				

No	Environmental Sanitation Characteristics	Before Action		After Action				
		F	%	F	%			
3	The time toddlers practiced handwashing with soap	1 exact handwashing with soap time	6	20.0	6	20.0		
		2 exact handwashing with soap time	19	63.3	19	63.3		
		3 exact handwashing with soap time	4	13.3	4	13.3		
		0 exact handwashing with soap time	3	10.0	3	10.0		
		1 exact handwashing with soap time	15	50.0	15	50.0		
		2 exact handwashing with soap time	8	26.7	8	26.7		
		3 exact handwashing with soap time	4	13.3	4	13.3		
		4	Frequency of washing drinking water storage containers	Once every 2-3 days	13	43.3	13	43.3
				Every day	9	30.0	10	33.3
Irregular (when dirty)	8			26.7	7	23.3		
5	Frequency of daily waste disposal	Every day	25	83.3	25	83.3		
		Not every day	5	16.7	5	16.7		
6	Waste storage location	Open	26	86.7	18	60.0		
		Closed	4	13.3	12	40.0		
7	Waste disposal method	Burned	1	3.3	1	3.3		
		Anywhere	16	53.3	16	53.3		
		TPS/transported	13	43.3	13	43.3		
8	Liquid waste disposal from household	Through open channels	30	100	30	100		
9	Closing the septic tank hole to prevent insect contact	Open	30	100	30	100		
		Closed	0	0	0	0		
10	Using septic tanks	Yes	11	36.7	11	36.7		
		No	19	63.3	19	63.3		
11	Litter is scattered around the house	Yes	19	63.3	11	36.7		
		No	11	26.7	19	63.3		
12	Water puddles caused by domestic waste	Yes	12	40.0	7	23.3		
		No	18	60.0	23	76.7		
Total Participants		30	100	30	100			

Household sanitation conditions generally showed relatively stable results, with several indicators featuring limited change. In terms of defecation practices, 90% of respondents used private toilets both before and after the intervention, while the remaining 10% continued to adopt pit latrines. This limited change shows that basic sanitation facilities were already available in most households prior to the intervention, thereby restricting the magnitude of

observable improvement between the pre-and post-intervention periods. Consequently, the contribution of the intervention should be interpreted as reinforcing and sustaining existing positive sanitation behaviors rather than producing substantial structural changes. This result suggests the role of PHAST intervention in maintaining sanitation standards while targeting behavioral aspects that require improvement.

The PHAST intervention mainly focused on behavioral sanitation indicators, such as handwashing at critical times, household waste management, as well as water and food storage practices. In contrast, structural sanitation indicators, including latrine ownership, septic tank availability, and liquid waste channels, were not directly targeted and were expected to show minimal change during the study period. The intervention effect is reflected in the observed improvements in selected behavioral indicators and environmental cleanliness measures. Meanwhile, the absence of negative changes across indicators suggests that the PHAST intervention contributed to reinforcing and sustaining existing sanitation practices rather than producing widespread structural change.

In terms of handwashing with soap, both mothers and toddlers showed a fairly good level of implementation. A total of 63.3 and 13.3% of mothers practiced HHS at two and three appropriate times, respectively. Meanwhile, 50 and 26.7% of toddlers practiced HHS at one and two appropriate times, respectively. Despite not being fully optimal, this habit shows an increase in awareness of the importance of personal hygiene in the household environment. In terms of maintaining drinking water storage, most families (43.3%), 30–33.3, and 23–26.7 washed their containers every 2–3 days, every day, and irregularly, respectively. These values showed a slight improvement in the regularity of maintaining the cleanliness of water containers.

Before the intervention, 86.7% of respondents used open trash bins. After the intervention, the value decreased to 60%, while the use of closed trash bins increased from 13.3% to 40%. This showed an increase in public awareness of the importance of hygienic waste management. However, end-of-life waste disposal behavior has not shown significant changes. Approximately 53.3% of respondents still dispose of waste indiscriminately, and only 43.3% use waste collection points or transportation services.

All respondents (100%) disposed of household liquid waste through open channels and have not covered their septic tanks, which potentially increased the risk of environmental contamination. Only 36.7% of households use septic tanks, while the remaining do not have a safe sanitation system.

There has been a significant improvement in the cleanliness of the area surrounding homes. Households with scattered garbage decreased from 63.3% to 36.7%, and puddles caused by domestic waste decreased from 40% to 23.3%.

Table 3. Sanitation Scores Before and After PHAST Intervention (n=30)

Category	F	Mean Rank	Sum of Ranks	Z	P value
Negative Ranks (Score Sani After < Score Sani Before)	0	0.00	0.00		
Positive Ranks (Score Sani After > Score Sani Before)	19	10.00	190.00	-3,905	0,000*
Ties (Score Sani After = Score Sani Before)	11	-	-		
Total	30	-	-		

Based on the results of the Wilcoxon Signed Rank Test, a Z value of -3.905 with a p-value of 0.000 (<0.05) was obtained. This suggested a significant difference between household sanitation scores before and after the implementation of the PHAST method. These results showed that the intervention was effective in improving the sanitation behavior and facilities of participating families in the coastal area of Medan Belawan. A total of 19 families (63.3%) showed an increase in scores, none experienced a decrease, and 11 (36.7%) had unchanged scores after the intervention. The increment in sanitation scores reflected meaningful improvements in daily hygiene practices at the household level, particularly in behaviors that are directly associated with reduced exposure to environment-based diseases. The absence of negative ranks further suggested that the PHAST intervention did not merely shift behaviors statistically but contributed to consistent and non-regressive sanitation improvements among participating families.

DISCUSSION

The results of this study show a statistically significant improvement in household sanitation scores following the implementation of the PHAST method. These evidences should be interpreted cautiously, as the observed improvements reflect changes within a relatively small sample and were assessed without a parallel control group. Therefore, the effectiveness observed in this study represents context-specific outcomes rather than broad generalizable effects.

This improvement shows that the PHAST method was effective in building family awareness and participation in household sanitation management. The participatory method allows family members to analyze self-sanitation conditions, recognize risks, and commit to improving their daily behaviors. This process increases the sense of responsibility as well as ownership of clean and healthy living behaviors.

The participatory essence of PHAST encourages empowerment by integrating learning with action. Families in this study were encouraged to observe self-hygiene practices, evaluate environmental risks, and collectively decide on behavioral changes (Sawyer et al., 1988). The self-analysis, reinforced by visual aids and discussion sessions, builds a sense of ownership and responsibility. When families understand the adverse consequences of poor sanitation on their children's health, specifically toddlers who are vulnerable to diarrhea and parasitic infections, there is motivation to maintain and monitor hygiene practices.

Empowerment in PHAST is not only about knowledge transfer, but also about creating a sense of independence. Families gain the confidence to act based on an understanding of sanitation issues and maintain behavioral changes independently. The implementation of PHAST in Medan Belawan has special significance given the environmental and socioeconomic characteristics of the region. Coastal communities often face unique sanitation challenges, including periodic flooding, high humidity, and inadequate sewage systems. These factors contribute to the spread of environment-related diseases, such as diarrhea, intestinal worms, and skin infections. Furthermore, the existence of informal settlements and limited access to clean water worsens the community's health vulnerability.

The study has several methodological limitations that should be acknowledged. First, the small sample size limits the statistical power of the study and restricts the generalizability of the results. Second, the relatively short intervention and observation period may not fully capture long-term behavioral sustainability. Third, some variables, particularly environment-based disease occurrence and certain hygiene practices, relied on self-reported data from mothers, which may be subject to recall and social desirability bias. These limitations underscore the need for cautious interpretation of the results.

Despite structural barriers, this study shows that participatory interventions focused on behavioral change can yield significant improvements even without large-scale infrastructure investments. These results are consistent with the idea that behavior-centered interventions can serve as adaptive measures for communities affected by climate variability and environmental degradation (MacLeod et al., 2025). When physical sanitation infrastructure is inadequate or slow to develop, behavioral change offers an immediate and cost-effective strategy for disease prevention and environmental protection.

PHAST interventions improve families' capabilities by providing sanitation knowledge and practical skills, creating opportunities through supportive participation and peer influence, as well as strengthening motivation by fostering emotional commitment and shared family

goals. The interventions trigger cognitive and affective change mechanisms, two key factors for maintaining new health behaviors (Talat et al., 2023).

The results of this study are consistent with international evidence on the effectiveness of participatory sanitation methods in improving community hygiene behaviors. For example, an investigation conducted in Kenya shows that community-based sanitation education reduced the incidence of diarrhea and respiratory infections in children (Karinja et al., 2020).

The difference between this study and many similar cases is the focus on the family unit as the primary target of intervention, rather than the wider community. This micro-level focus recognizes that households are the basic social systems where decisions about hygiene, child care, and waste management are made on a daily basis. By concentrating efforts within the family, this study achieved greater engagement and accountability, which are often difficult to maintain in broader community programs where participation levels vary. The household-based model also allows for more tailored solutions, taking into account the unique constraints, routines, and socio-cultural dynamics of each family.

Sanitation practices are deeply embedded in social norms and cultural beliefs. In Indonesia, especially in coastal communities such as Medan Belawan, family values play a central role in determining daily hygiene behaviors. The role of mothers as primary caregivers and health decision-makers in the family significantly influences the success of this program. Women's participation in PHAST discussions ensures that hygiene practices such as hand washing, waste disposal, and water storage are not only understood but also applied in daily routines.

This underscores the importance of a gender-sensitive method in participatory sanitation programs. A number of studies show that when women have a role and authority in decision-making related to water and sanitation, households are more prone to maintain hygiene practices and facility maintenance on an ongoing basis (Doma et al., 2023). Therefore, the PHAST model's emphasis on inclusive participation, where both men and women contribute to household sanitation decision-making, is in line with best practices in community health promotion (Tough et al., 2023). Future interventions could strengthen gender equality by integrating capacity-building sessions that address women's leadership, time management, and access to sanitation resources (Fadilah et al., 2020).

The results have strong policy implications for Indonesia's national WASH (Water, Sanitation, and Hygiene) framework, particularly in the context of the Community-Based Total Sanitation (STBM) strategy and the Community-Based Sanitation program, which emphasize participation in sustainable sanitation management. Participatory methods such as PHAST can

strengthen the effectiveness of the national model by adding components of learning and behavioral change within families as a basis for sustainability (Cecilia et al., 2024). Integrating PHAST at the household level can complement existing community-based sanitation initiatives by strengthening behavior change within families as the smallest social units. This method can be implemented through routine activities at community health centers and family-based programs, where trained health workers facilitate participatory learning to support sustainable sanitation practices.

From a global perspective, the results directly support the achievement of Sustainable Development Goals (SDGs) 3, 6, and 11, which emphasize health, clean water, sanitation, and sustainable communities. Improved household sanitation contributes to disease prevention (SDG 3) (WHO, 2023), ensuring access to clean water and sanitation (SDG 6), and promoting the establishment of livable and resilient settlements (SDG 11) (United Nations, n.d.). In coastal areas vulnerable to climate change, the intersection between these objectives is critical, as environmental degradation and health inequalities often reinforce each other. Strengthening families' adaptive capacity through participatory sanitation can serve as both a health intervention and a climate resilience strategy.

Future programs should expand this model through large-scale implementation and longer follow-up periods to assess sustainability. Long-term evaluations should incorporate measurable outcomes such as changes in household sanitation scores, consistency of hygiene practices over time, incidence of diarrhea among toddlers, and maintenance of sanitation facilities. The inclusion of comparison or control groups in future studies would also strengthen causal inference and provide more robust evidence on the effectiveness of family-centered PHAST interventions.

CONCLUSIONS

In conclusion, this study shows that the PHAST method was associated with improvements in household sanitation management, hygiene behavior, and environmental awareness among families living in coastal areas of Medan Belawan. A statistically significant difference was observed between sanitation conditions before and after the intervention ($p < 0.05$). This suggested that participatory, family-centered methods contributed to strengthening sanitation practices in settings with limited infrastructure.

The PHAST intervention emphasized household-level participation and collective responsibility among family members, particularly in managing domestic waste, maintaining clean water storage, and practicing handwashing at crucial times. These results underscore the

potential role of household empowerment as a supportive component of Indonesia's community-based sanitation strategy (STBM) and its correlation with the Sustainable Development Goals, particularly SDG 3 (Good Health and Well-being), 6 (Clean Water and Sanitation), and 11 (Sustainable Cities and Communities).

Future public health initiatives should consider adapting the family-centered PHAST method within existing community health systems, such as integrated health service posts and the Family Welfare Movement (PKK), to support sustained assistance and monitoring of sanitation behaviors. Long-term evaluation and the use of digital tools for behavior monitoring could further strengthen the sustainability of changes observed in this study.

Based on the limitations of the present study, the integration of local participatory methods with national development frameworks and global agendas contributed to strengthening progress toward universal sanitation coverage and enhancing community resilience in vulnerable coastal settings.

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