

ORIGINAL ARTICLE

Spatial Distribution of Achievement Community-Led Total Sanitation in Rural Areas

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ABSTRACT

Introduction: Access to adequate sanitation facilities remains a significant global challenge, particularly in rural areas of developing countries. Community-Led Total Sanitation has emerged as a promising approach to address this issue by engaging communities in 5 pillars: (1) Open Defecate Free (ODF), (2) handwash, (3) food and drink, (4) garbage and (5) sewage management. **Methods:** This research use survey method with sample 218 respondents. Instrument used questionnaire, contain 5 pillars Community-Led Total Sanitation. The spatial analysis used Argis program. **Result:** This study shows just pillar 2 (handwash) has been achieved and implemented by the community in rural areas. Spatial distribution of the 5 pillars indicates that as one moves closer to urban areas within the RT (Residential Areas), the achievement of all 5 pillars tends to improve. This improvement is closely tied to the better availability of sanitation facilities and infrastructure in proximity to urban centers. **Conclusion:** The spatial distribution of CLTS achievement shows significant disparities among RTs, with low performance in Pillar 1 (No Open Defecation), waste, and wastewater management (Pillars 4 and 5). Higher achievement is found in handwashing with soap and access to safe drinking water. These findings indicate the need for targeted interventions in areas with poor sanitation outcomes to support equitable CLTS progress.

Malaysian Journal of Medicine and Health Sciences (2025) 21(6):1-6. doi:10.47836/mjmhs.v21.i6.1407

Keywords: Open defecate, Handwash, Food and drink, Garbage and sewage management, Rural

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INTRODUCTION

Community-Led Total Sanitation (CLTS) is a community-led approach that focuses on creating demand for sanitation, in contrast to the traditional approach of supplying sanitation hardware. The program involves sending CLTS facilitators to villages to initiate a community analysis of existing sanitation practices and a discussion of the negative health consequences of such practices (1). The challenges facing Indonesia related to drinking water, hygiene, and sanitation are still enormous. People still behave big-drying in rivers, ponds, pools, gardens, and open spaces. This leads

to pollution in the water for the biological parameter *Escheria coli* (2). It's occurring in Karang Mumus River, Samarinda, because of open defecation of communities and farm activities (3,4). CLTS in Indonesia develop by Directorate of Environmental Health, Directorate General of Public Health and Centre for Health Promotion of the Ministry of Health in collaboration with World Bank. World Bank-funded program in Indonesia through Community-Based Drinking Water Supply and Sanitation Program, which the government plans to use to meet its recently adopted goal of achieving universal access to water supply and sanitation by 2019, has grown from a project to a national platform (5). CLTS consists of five pillars, which are Stop open defecation; Hand washing with soap; Safe handling and treatment of drinking water, Solid waste management; and Improved hygiene practices (2). The implementation of these five pillars has been successful in achieving behavior

change and creating sustainable sanitation outcomes in some cases (6).

The Samarinda towns, Indonesia especially Lempake Sub-District is in the rural, where land use is dominated by farming, agriculture, and settlement. A portion of the population is in the Karang Mumus River bank, which uses river water for everyday needs (7) (8). Community understanding and behavior around environmental sanitation and access to clean water are still at an extremely low level and there is poor awareness to manage waste (9). Initial observations from January 2023 and information from the Lempake Public Health Center indicate that people are still disposing of domestic waste and sewage into the Karang Mumus River. In addition, individuals still have limited access to clean water, so they utilize river water and replenished water for drinking purposes. Although some towns have access to water supplies, they frequently do not function, so some communities purchase tank water for their daily needs, but the quality of the water source is not always assured. Additionally, communities around the river bank defecate to the river, where the feces enter the stream untreated. The community living along the Karang Mumus River often defecate directly into the river, leading to a significant increase in fecal coliform bacteria (10). The community's daily consumption of river water may become contaminated. Public hygiene and sanitation is still lacking and is potentially causing diseases in communities such as diarrhea (11), even stunting and skin diseases (12-13).

River basin areas play a crucial role in the achievement of CLTS pillars, particularly in access to clean water, sanitation practices, and hygiene behavior. Communities residing near river basins often rely on the river as their primary water source, which can impact the implementation of safe water supply and sanitation facilities. Additionally, the risk of open defecation and improper waste disposal tends to be higher in these areas, affecting environmental sanitation. The effects and influencing factors of CLTS in rural areas of low- and middle-income countries found that the program's impact on sanitation outcomes was mixed (14). Five pillars in CLTS need to identifying the progress as the general public will have access to clean water, hygienic facilities, soap for handwashing, and instructions on how to manage liquid and household waste. For CLTS implementation, spatial distribution is essential because it enables targeted interventions where they are most required by identifying high-risk areas with inadequate sanitation. By giving priority to areas with poor sanitation coverage for money, infrastructure, and awareness campaigns, it enables effective resource allocation. It also aids in evaluating how CLTS affects public health, especially in terms of lowering the prevalence of waterborne illnesses. Base on those problems, the purpose of this study is to analyze the spatial distribution of the five pillars of Community-Led

Total Sanitation (CLTS) in rural Lempake, Samarinda, by identifying variations in implementation levels and assessing factors influencing their achievement. The rural area of Lempake, Samarinda, was selected due to its ongoing sanitation challenges, varying levels of Community-Led Total Sanitation (CLTS) achievement, and its relevance as a representative case for assessing spatial disparities in sanitation implementation. Finally will find out which areas in Lempake Sub-District need special attention in the neighborhood to add knowledge and education about sanitation to the community.

MATERIALS AND METHODS

Study Design

The research method used is the survey method presented in a quantitative descriptive form. Identifying achievement of 5 pillars Community-Led Total Sanitation contains pillar (1) Open Defecate Free (ODF), Pillar (2) handwash, Pillar (3) food and drink, Pillar (4) garbage and Pillar (5) sewage management. The variable being studied is (1) the identification of the five pillars Community-Led Total Sanitation (CLTS) using observation of questionnaire sheets; and (2) the spatial spread analysis of CLTS access using the Geographic Information System (GIS).

Population, Samples and Sampling

The population in the study was the entire RT (Residential Area) in Lempake Sub-District who lived in the river bank and in the Lempake region of 20 RT with total householder are 2,179. Those RT are RT 10, 12, 15, 16, 19, 20, 22, 23, 26, 28, 30, 31, 32, 33, 34, 39, 41, 42, 43 and 47. Sample respondents used 10% from total population as by formula:

$$n = e \times N$$

n = Sample

e = 10%

N = Total population

Based on this formula, researchers can determine the sample size with the following results is 218 respondents.

$$\begin{aligned} n &= 10\% \times 2,179 \\ &= 218 \end{aligned}$$

Instrument

The instrument used in this research are questionnaire contains five pillars Community-Led Total Sanitation achievement from Indonesia Ministry of Health. The instrument includes a set of structured questions that evaluate each of the five CLTS pillars: (1) Open Defecate Free (ODF), (2) handwash, (3) food and drink, (4) garbage and (5) sewage management. Scoring system used percentage-based by responses are often scored on a binary scale (Yes/No). The formula used is:

Percentage of Achievement

= (Number of Achieved Households / Total Target Achievement) x 100%

Data collected by Kobo Collect application that we can get the coordinate of the location. The questionnaire is administered through household surveys, interviews, or observational checklists.

Procedure

The first step in this research is data collection. Data is obtained from respondents' answers to the given questionnaire. Information from respondents per RT (Residential Areas) forms the basis for assessing the Community-Led Total Sanitation (CLTS) in the community. Subsequently, the coordinates of the RT locations are obtained during data collection from the respondents, and they are used to process spatial data using ArcGIS. This process allows for the determination of CLTS achievements per RT and enables mapping. This can provide clearer information about the percentage of CLTS achievement that is already good and its known location.

ETHICAL CLEARANCE

This research was approved by Health Research Ethics Commission of East Kalimantan Ministry of Health Poltekkes, No. DP.04.03/7.1/018769/2023.

RESULT

A comprehensive assessment was conducted to evaluate the implementation of the five pillars of Community-Led Total Sanitation (CLTS). The findings provide an overview of sanitation practices and highlight areas that require further improvement. The results of identifying the achievements of the five pillars are presented in

Table I: Result of Identify the Five Pillars of Community-Led Total Sanitation

RT (Residential Area)	Pillar 1 (%)		Pillar 2 (%)		Pillar 3 (%)		Pillar 4 (%)		Pillar 5 (%)	
	MR	NE	MR	NE	MR	NE	MR	NE	MR	NE
10	0	100	80	20	100	0	100	0	100	0
12	0	100	72.7	27.3	81.8	18.2	90.9	9.1	45.5	54.5
15	0	100	100	0	91.7	8.3	91.7	8.3	83.3	16.7
16	0	100	85	15	25	75	55	45	5	95
19	0	100	50	50	50	50	50	50	0	100
20	0	100	71.4	28.6	71.4	28.6	57.1	42.9	57.1	42.9
22	0	100	88.9	11.1	77.8	22.2	0	100	22.2	77.8
23	0	100	100	0	0	100	0	100	0	100
26	0	100	42.9	57.1	14.3	85.7	14.3	85.7	0	100
28	0	100	100	0	16.7	83.3	0	100	0	100
30	0	100	87.5	12.5	0	100	0	100	0	100
31	0	100	100	0	0	100	0	100	0	100
32	0	100	70	30	80	20	40	60	10	90

continue

Table I: Result of Identify the Five Pillars of Community-Led Total Sanitation (cont.)

RT (Residential Area)	Pillar 1 (%)		Pillar 2 (%)		Pillar 3 (%)		Pillar 4 (%)		Pillar 5 (%)	
	MR	NE	MR	NE	MR	NE	MR	NE	MR	NE
33	0	100	60	40	100	0	0	100	0	100
34	0	100	25	75	100	0	0	100	25	75
39	0	100	83.3	16.7	16.7	83.3	0	100	0	100
41	9.1	90.9	90.9	9.1	63.6	36.4	36.4	63.6	0	100
42	0	100	88.9	11.1	55.6	44.4	22.2	77.8	0	100
43	0	100	87.5	12.5	31.3	68.8	37.5	62.5	37.5	62.5
47	0	100	83.3	16.7	16.7	83.3	0	100	0	100
Average	0.5	99.5	78.4	21.6	49.6	50.4	29.8	70.2	19.3	80.7

Note: Meets the Requirements (MR); Not Eligible (NE)

Table I.

Based on the identification results of the five CLTS pillars, it can be seen that there are differences between the results of each pillar in each RT. This happens because the facilities, infrastructure and access to locations in each RT vary geographically. There are several RTs that are remote and don't even have internet access. The distribution of achievements of the five CLTS pillars is

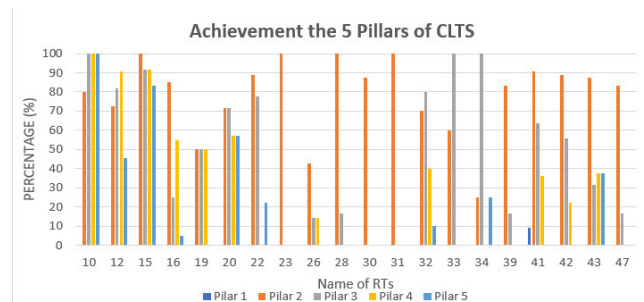


Figure 1 Achievement the 5 Pillars of CLTS in Each RT

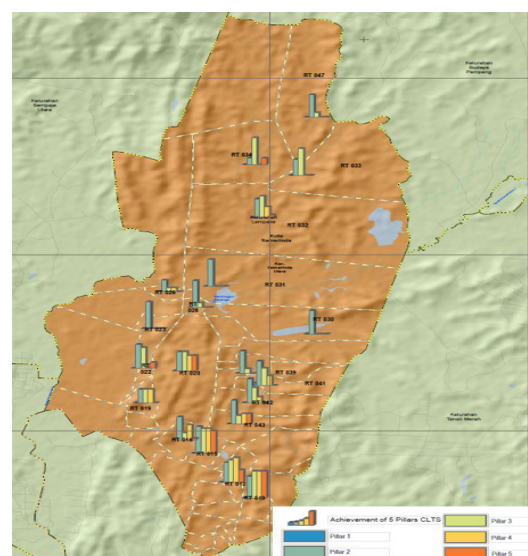


Figure 2 Spatial Distribution of Achievement the 5 Pillars of CLTS

presented in Figure 1 and spatial distribution in Figure 2.

DISCUSSION

The achievement of Pillar 1, no open defecation in all RTs does not meet the standard of 99.5%. This is in accordance with the statement from WHO that people in the world in some areas still do not have basic sanitation services, such as private toilet or latrines. People still open defecate in street gutters, behind bushes or into open water bodies (11). Furthermore 55% of people use plunge toilets without goose necks and are not equipped with lids that no insects can touch the feces. Actually, people on the riverbanks use goosenecks but the feces go straight into the river, there are no septic tanks. Toilets were constructed in areas with high beginning social capital, while the community-led method proved ineffective in villages with low social capital, where fewer toilets were constructed (1). Result of mediation analysis show that relationship of CLTS participation with probability of owning a latrine is mediated by social context factors (15). Factor CLTS implementation especially for Pillars 1 are community participation (village level leadership, social cohesion, sense of responsibility), community capacity (access to materials for toilet construction, financial resources, and technical knowledge), and community behavior (15) (expectations of subsidies, preference for Open Defecate (OD), preference for better latrine, traditional beliefs regarding OD or latrine use) (14). The distance for waste disposal is also less than 10 meters from the house and dug wells (60%). People do not throw baby or elderly feces into the toilet, even though they use diapers (64%). There is no access to anal cleansing in the community (96%). This happens due to a lack of knowledge about sanitation and the importance of cleanliness in maintaining health. CLTS approach was embraced because it was perceived as a fast and effective solution to the problem of open defecation, one which was in line with the decentralization and community participation paradigms, especially for rural area (16). The government support, social acceptance and technology reliability that is successfully adjusted to regional conditions (17).

The achievement of Pillar 2, washing hands with soap in all RTs has met the standard of 78%. The community has been able to access clean water at home and soap for washing hands (93%). People understand that they have to wash their hands, such as after defecating and cleaning up baby feces; before eating and preparing food (96%). Actually sometimes there are some people who don't use soap even though soap is available. Even though overall soap use increased, but found that there was no increase in the amount of soap used after defecation (18). Because soap and hand washing facilities are not available, people rarely wash their hands properly (19). The availability of water and soap supports the realization of Water, Sanitation and Hygiene (WASH)

and achieving SDGs point 6 (20). It means not only the available facilities but also knowledge and behavior that support sanitation goals and improve public health in the community.

The achievement of Pillar 3, managing safe drinking water and food in all RTs, reached 50.4%. It needs improvement especially in disinfection process efforts by treating drinking water before consumption, such as boiling. People boil water before drinking (63%), store it in closed containers and always cover the food they serve (82%). Drinking water containers are also routinely cleaned (85%). It is necessary to improve the habit of keeping food and drinks clean and always covering them with a serving cover to avoid disease-carrying vectors. In many regions of the world, especially those with poor sanitation, hygiene, and water treatment systems, tap water may include pathogens such as bacteria, viruses, parasites, or chemical pollutants (21). The availability of drinking water influences how much is consumed and is linked to a decreased incidence of diarrhea (22).

The achievement of Pillar 4 that focusses on managing waste properly in all RTs reaches 30%. This case needs improvement to get the goal in waste management in the community. Waste production was discovered in 68% of people's yards. The percentage of waste that is treated before disposal is 44% since there is still a lack of waste processing and landfilling in the community. Most people have a tendency of burning their rubbish. Reduce the production of waste by preventing, minimizing, recycling, and reusing (23).

The achievement of Pillar 5, managing domestic wastewater safely in all RTs, is 19%. Around the home, there are no discernible pools of domestic wastewater (65%). The problem is that 74% of domestic wastewater is released without being processed or receiving special treatment before discharged. There are no suitable infiltration wells, waste is not used for plants, and it is dumped straight into the drainage or sewage system. Surface water that is safe and clean has importance to human health (24). The reason is due to the fact that building an absorption well is expensive. Domestic wastewater from the settlement is the used water generated from households, including kitchen, bathroom, and laundry effluents, which requires proper treatment and disposal to safeguard the environment and public health (25). Wastewater contain organic matter, through the biological and chemical degradation processes, it impacts on the amount of oxygen in aquatic habitats (26). The fact that plants can be irrigated using household wastewater is still not widely known. Certain individuals dispose of their household garbage straight into the drainage or sewage system.

Overall, the results show that there are considerable differences in the study area's performance across the five CLTS pillars, with Pillars 1, 4, and 5 needing the

most immediate attention. Due to societal issues and insufficient sanitary infrastructure, open defecation is still a problem, underscoring the need for improved community involvement and access to suitable restroom facilities. Inconsistent behavior remains even when handwashing with soap (Pillar 2) satisfies the requirement, highlighting the significance of ongoing hygiene instruction. Although there has been some progress in managing safe drinking water (Pillar 3), better water treatment techniques are still required to lower health hazards. With little waste processing and direct wastewater discharge into the environment, waste management (Pillar 4) and household wastewater treatment (Pillar 5) continue to be the least effective pillars, which can lead to pollution and health risks. A comprehensive strategy involving government assistance, behavioral modification programs, and locally relevant technology solutions is needed to close these gaps. To achieve sustained sanitation and hygiene improvements in the community, it is imperative to develop sanitation infrastructure, raise awareness, and strengthen social capital.

CONCLUSION

The achievement of the five pillars of CLTS in the Lempake sub-district, Samarinda, which is a rural area, shows that these pillars have not been achieved. Achievement of Pillar 2 hand washing with soap showed high percentage. Limited resources available in the community, particularly for the construction of infrastructure such as latrines and the supply of clean water.

Enhancing community awareness via mentorship is crucial for assisting in the realization of the five CLTS pillars. The spatial distribution of CLTS achievement shows significant disparities, with most RTs failing in Pillar 1 (No Open Defecation) and struggling with waste and wastewater management (Pillars 4 & 5). Higher compliance is observed in handwashing (Pillar 2) and safe drinking water (Pillar 3), but targeted interventions are needed in lowachieving RTs to improve sanitation infrastructure and behavior.

ACKNOWLEDGEMENTS

This study was supported by Research and Community Service Department (LPPM), Universitas Muhammadiyah Kalimantan Timur in Competitive Research / PEKOM Grand No. 105.3/LPPM/A.4/C/2023.

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