

# The effectiveness of community-led total sanitation cadre intervention in improving stunting knowledge and behavior

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## Abstract

The prevalence of stunting remains high in Central Sulawesi Province, Indonesia. Poor sanitation is a significant risk factor for stunting, and community-based interventions such as Community-Led Total Sanitation (CLTS) show promise in addressing this issue. Despite the government's multi-sectoral and integrated approach, encompassing both specific and sensitive nutrition interventions, the problem of stunting persists. This study aimed to assess the effectiveness of cadre-led interventions in improving

community knowledge and behavior related to CLTS as a means of stunting prevention. A quasi-experimental, non-randomized design was used, with proportional stratified random sampling applied to a population of 332, resulting in a sample size of 182 individuals. Data collection was conducted from July to September 2023. The intervention involved CLTS cadres delivering counseling and triggering activities to mothers of stunted children. Knowledge and behavior regarding the five pillars of CLTS were measured as the dependent variables using a CLTS questionnaire with a scoring system. Data analysis was performed using SPSS version 22.0, specifically employing the independent-sample t-test with a significance threshold of  $p < 0.05$ . Results indicated a significant increase in knowledge across the five pillars of CLTS ( $p = 0.000$ ), as well as a significant improvement in behavior concerning handwashing with soap, drinking water, food management, and household wastewater management ( $p = 0.000$ ). The findings suggest that cadres play an effective role in enhancing community knowledge and behavior regarding CLTS, contributing to stunting prevention efforts.

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## Introduction

Stunting is defined as short stature for age, measured by length/height below -2 Standard Deviations (SD) on the World Health Organization (WHO) growth curve. It occurs due to irreversible conditions caused by inadequate nutrient intake and repeated or chronic infections during the first 1,000 days of life.<sup>1,2</sup> Children with stunted growth are short for their age, typically due to chronic malnutrition, placing them in the stunting category.<sup>3,4</sup> Reducing stunting is a global priority, as reflected in Sustainable Development Goal 2 and WHO's aim to mitigate global public health issues, including stunting.<sup>5</sup>

Linear growth retardation, as measured by height at a given age, remains a significant public health problem worldwide.<sup>6-8</sup> According to WHO, approximately 149 million children under 5 years old were estimated to be stunted globally in 2020.<sup>9</sup> In 2021, stunting prevalence varied widely across regions; for example, it was 8.2% among school-aged children in West Ethiopia, while in Indonesia, it was 30.8% in 2018, making Indonesia the second-highest in Southeast Asia. By 2022, an estimated 148.1 million children under 5 were stunted globally.<sup>10</sup> In Indonesia, the stunting prevalence slightly decreased from 21.6% (Indonesian Nutritional Status Survey, 2022) to 21.5% in 2023.<sup>11</sup> In Central Sulawesi, stunting rates were recorded at 29.7% in 2021 and 28.2% in 2022.<sup>12</sup>

In developing countries, poor sanitation is closely linked to stunting through its association with inadequate clean water and WASH (Water, Sanitation, and Hygiene) conditions.<sup>3,13,14</sup> Studies have shown that poor sanitation correlates with higher vulnerability to stunting.<sup>15-17</sup> Stunting not only impacts the health and cognitive development of children but also has significant long-term effects on a country's economy, with potential losses in per capita

income estimated between 5-7% due to stunting.<sup>18–22</sup> Stunted children are at increased risk of lower cognitive development, reduced future productivity, susceptibility to non-communicable diseases, and poverty.<sup>23</sup>

Stunting remains one of the most serious public health challenges, particularly due to sanitation's direct impact on health, lifestyle, and environmental conditions.<sup>24–26</sup> In Indonesia, involving community health cadres has become a critical strategy in stunting prevention efforts.<sup>27,28</sup> Despite a multi-sectoral governmental approach—integrating national, local, and community programs at central and regional levels through specific and sensitive nutrition interventions—the problem persists. Nutrition-specific interventions include additional food and iron supplementation for pregnant women from lower-income groups, while sensitive interventions improve drinking water and sanitation access. However, these efforts alone have not resolved the stunting issue.<sup>27</sup>

Improving community nutritional knowledge and implementing Community-Led Total Sanitation (CLTS) has been shown to help reduce stunting.<sup>29–31</sup> Poor sanitation is a key risk factor for stunting, especially among mothers of young children. CLTS focuses on five pillars: clean water, sanitation, hygiene, waste management, and household wastewater management. Among these, challenges persist particularly in clean water, sanitation, and hygiene, which contribute significantly to stunting incidence.<sup>31,32</sup> Research on CLTS cadre interventions to increase community knowledge and actions regarding these five pillars in stunting prevention has so far been limited to the Central Sulawesi region. This study aimed to evaluate the effectiveness of cadre interventions in enhancing community knowledge and practices related to CLTS for stunting prevention in Sigi Regency, Central Sulawesi, Indonesia.

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## Materials and Methods

### Research design

This study employed a quantitative, quasi-experimental, non-randomized design conducted from July to September 2023.

### Study participants

The study population included 332 mothers of two-year-old children diagnosed with stunting. The sample size was 182 participants, with 91 in the intervention group and 91 in the control group. Proportional stratified random sampling was used to select participants, and the sample size was calculated using the Slovin formula. Inclusion criteria were: mothers of stunted two-year-old children residing within the research location and willing to participate. Exclusion criteria included: mothers who did not meet the inclusion criteria or those unwilling to participate.

### Variable, instrument, and data collection

The independent variable was the intervention by Community-Led Total Sanitation (CLTS) cadres, which involved counseling and triggering activities aimed at increasing mothers' knowledge and attitudes regarding the five pillars of CLTS: open defecation, handwashing with soap, clean water and food management, waste management, and household wastewater management. The dependent variable was the knowledge and attitudes of mothers with two-year-old stunted children concerning these five CLTS pillars. Knowledge and attitudes were assessed before and after the intervention.

### Intervention preparation stage

**Cadre Training:** in the fourth week of July, CLTS cadres received training on CLTS concepts and stunting prevention, including counseling and triggering techniques.

**Target Mapping:** identification of mothers with stunted toddlers within the intervention area.

**Preparation of Educational Materials:** creation of educational materials, such as brochures, posters, and leaflets, designed to be engaging and easily understood by mothers.

**Stakeholder Coordination:** collaboration with community health centers and village government authorities.

### Implementation of intervention

Counseling and triggering sessions for mothers of stunted children were conducted at village halls and participants' homes. The intervention aimed to discourage open defecation, promote handwashing with soap, ensure access to clean water, and improve household waste and wastewater management. The control group received counseling on CLTS topics but did not participate in triggering activities.

### Instruments

The CLTS questionnaire, which used a scoring method, assessed the intervention's effectiveness. Knowledge and attitudes regarding the five CLTS pillars were measured using 25 questions for each indicator. Questionnaires were administered before and after the counseling and triggering intervention.

### Data analysis

Data analysis was conducted using SPSS version 22.0. First, univariate analysis was performed to describe the frequency distribution of each variable. Next, a paired-sample t-test ( $p < 0.05$ ) was conducted to determine average differences in knowledge and attitudes before and after the intervention.

### Ethics clearance

All respondents provided informed consent before participation, and confidentiality was maintained by using numerical codes instead of names. The study adhered to ethical principles, including informed consent, respect for human rights, beneficence, and non-maleficence. Ethical approval was granted by the Research Ethics Committee of the Palu Ministry of Health Polytechnic (Approval No. 0066/KEPK-KPK/VI/2022).

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## Results

Tables 1, 2 and 3 present the research findings on the effectiveness of community-based total sanitation cadre intervention in stunting prevention efforts.

The majority of respondents in this study were aged 31-35 years, making up 46.7% of the sample. In terms of education, most respondents had completed junior high school, also accounting for 46.7%. The predominant occupation among participants was that of a housewife, representing 70.3% of the group. Additionally, a slight majority of respondents, 55.5%, had an income below the Regional Minimum Wage (RMW). These findings highlight the dominant demographic and socioeconomic characteristics of the study population (Table 1).

Table 2 indicates that all five CLTS pillar variables displayed significantly different levels of knowledge between the control group and the intervention group, with a p-value of 0.000. Table

3 shows that the action variable concerning open defecation obtained a p-value of 0.168, while managing household waste resulted in a p-value of 0.073. In contrast, handwashing with soap, clean water, household food management measures, and efforts to safeguard household wastewater all showed significant results with a p-value of 0.000.

## Discussion

The study results do not provide specific insights into how age influences increased knowledge through counseling. However, some articles suggest that motivation, trust, and the tendency to seek advice may change with age. For example, research indicates that the motivation to be recognized for achievements declines with age, while the incentive to help others strengthens.<sup>33</sup> Several studies have evaluated community-based interventions related to sanitation knowledge. One study assessed the effectiveness of a community-led hygiene promotion program in a rural Salvadoran setting, finding that the intervention increased knowledge and behavior related to hygiene.<sup>34,35</sup> Another study concluded that community-led WASH interventions positively impact social factors, particularly for primary caregivers.<sup>36,37</sup> In addition to increasing knowledge about open defecation, there were significant improvements in public knowledge regarding handwashing with soap, clean water management, food safety, household waste management, and wastewater management after receiving counseling, all with a p-value of 0.000.

Table 3 presents behavioral data regarding the five pillars of CLTS. The results indicated that two pillars (open defecation and household waste management) did not show significant differences in average values. The average behavior score for open defecation in both the intervention and control groups was not significantly different, with a p-value of 0.168. This lack of significant difference in open defecation behavior may be attributed to several factors, including a low level of community education, with only 17.6% having completed elementary school and 46.7% having completed junior high school. Research

indicates that education is a predisposing factor influencing open defecation behavior.<sup>38,39</sup> A study conducted in Haiti showed that education significantly impacts open defecation practices. In addition to educational factors, habitual practices play a role; many individuals do not use family latrines and instead defecate in gardens, rivers, or forests. Other studies indicate that factors such as age, gender, and diet also affect defecation patterns.<sup>40</sup> Psychological aspects can also influence negative behaviors related to open defecation.<sup>41,42</sup> Research in Nepal revealed that practices of defecating away from homes are influenced by cultural, religious, and spiritual factors.<sup>43,44</sup> Ownership and use of latrines, as well as perceived social status and privacy, further impact open defecation behaviors.<sup>45</sup>

**Table 1.** Characteristics of respondents to CLTS Cadres intervention for stunting prevention.

Variable	n	Percent (%)
Age (year)		
25-30	82	45.1
31-35	85	46.7
36-40	9	4.9
41-45	6	3.3
Education		
Elementary school	32	17.6
Junior high school	85	46.7
Senior high school	65	35.7
Occupation		
Housewife	128	70.3
Farmer	40	22.0
Trader	12	6.6
Honorary worker	2	1.1
Income		
Below regional minimum wage (RMW)	101	55.5
Above regional minimum wage (RMW)	81	44.5
Action		
Intervention	91	50
Control	91	50
Total respondent	182	100

**Table 2.** Result of knowledge difference tests between the intervention and control groups.

Variables	Intervention		Control		p
	mean	SD	mean	SD	
Knowledge of Open Defecation	76.26	13.63	42.85	8.20	0.000
Knowledge of Handwashing with Soap	70.10	16.43	43.07	14.27	0.000
Knowledge of Managing Household Drinking Water and Food	66.59	15.21	42.85	10.98	0.000
Knowledge of Managing Household Waste	75.16	15.00	52.08	17.35	0.000
Knowledge of Managing Household Liquid Waste	78.68	12.22	44.61	13.35	0.000

**Table 3.** Results of different behaviour tests between the intervention and control groups.

Variables	Intervention		Control		p
	mean	SD	mean	SD	
Open Defecation Behavior	38.02	13.35	35.38	12.32	0.168
Handwashing with Soap Behavior	82.63	14.96	43.73	10.71	0.000
Household Drinking Water and Food Management Behavior	86.37	12.24	58.68	15.43	0.000
Household Waste Management Behavior	59.56	11.14	56.92	8.39	0.073
Household Liquid Waste Management Behavior	83.29	11.64	41.09	10.04	0.000

Economic factors also contribute to open defecation habits. Among respondents, 101 (55.5%) reported incomes below the regional minimum wage in Central Sulawesi, which limits their ability to meet household needs, including constructing family latrines. With uncertain incomes, people prioritize daily food needs over building latrine facilities, leading to limited attention to sanitation infrastructure.<sup>41,46</sup> While income is often viewed as a primary factor contributing to open defecation, it is essential to consider additional factors when developing interventions to address this issue.<sup>47</sup> For example, low-cost behavior-change interventions have been shown to effectively increase latrine use and safe disposal of child feces in rural Odisha, India.<sup>48</sup>

The pillar concerning household waste management indicated average scores of 59.56 in the intervention group and 56.92 in the control group, with a p-value of 0.073. Although the intervention group received counseling and triggering, there was no significant increase in average scores for household waste management. Researchers suggest that the difference in average scores between the intervention and control groups is attributable to several factors, including education level, habits, and land conditions. Many community actions regarding waste management still result in littering due to low educational levels and a lack of understanding of the impacts of waste disposal.

Several factors influence household waste management behavior and perceptions, including demographics, age, education level, and economic status.<sup>49</sup> Studies have shown that food insecurity, climate change, and economic development also impact household waste management practices.<sup>49–53</sup> Research in Guinea indicated a correlation between low educational backgrounds and low incomes with household waste disposal practices.<sup>28,50</sup> However, this contrasts with findings in southern Africa, where individuals demonstrated practices of reusing household waste.<sup>54,55</sup> A study in the UK highlighted that personal roles and individual differences in securing household waste are influenced by personality traits and prior experiences.<sup>55</sup>

In addition to the two previously discussed pillars, the results for handwashing with soap in the intervention group scored an average of 82.63, while the control group scored 43.37. Clean water and household food management measures received average scores of 86.37 in the intervention group and 58.68 in the control group. The household wastewater security score in the intervention group was 83.29, compared to 41.09 in the control group. These three pillars demonstrated significant improvements with p-values of 0.000. Although not all households have dedicated handwashing facilities, such as those recommended during the COVID-19 pandemic, individuals continue to wash their hands in bathrooms or using faucets in shared homes. This contrasts with findings by Nipher M. Malika *et al.* in Peru, where individuals living in slums reported prolonged handwashing with limited access to soap.<sup>56,57</sup>

The level of community knowledge supports the habit of washing hands using soap and managing water and food safely. The significant differences in average values between the intervention and control groups are attributed to increased public knowledge about clean water sources that meet health standards. Through triggering and counseling activities, the intervention group exhibited considerable improvements in their practices. Consistent hand hygiene, particularly through handwashing with soap, is recommended for maintaining health.<sup>58,59</sup> Effective wastewater management can reduce pathogen exposure and minimize pollution through reduced wastewater discharge.<sup>60,61</sup>

This study has limitations, particularly in the initial characteristics of the experimental and control groups, which showed sig-

nificant differences in factors such as education level and socio-economic status that could influence study outcomes. Further research is needed to select respondents with more controllable characteristics to enhance the reliability of the findings.

## Conclusions

Cadre interventions are effective in increasing public knowledge about stopping open defecation, handwashing with soap, drinking water and food management, and household waste management. These interventions were also effective in improving attitudes toward handwashing with soap, household water management, and household wastewater management; however, they were not effective in changing attitudes toward open defecation and household waste management. The role of CLTS cadres is crucial in supporting government programs aimed at reducing the prevalence of stunting. It is recommended that STBM cadres be established in each work area of the health center to serve as the frontline health workers in efforts to prevent stunting.

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