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.[1,2] Children with stunted growth are short for their age, typically due to chronic malnutrition, placing them in the stunting category.[3,4] 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.[5]

Linear growth retardation, as measured by height at a given age, remains a significant public health problem worldwide.[6–8] According to WHO, approximately 149 million children under 5 years old were estimated to be stunted globally in 2020.[9] 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.[10] In Indonesia, the stunting prevalence slightly decreased from 21.6% (Indonesian Nutritional Status Survey, 2022) to 21.5% in 2023.[11] In Central Sulawesi, stunting rates were recorded at 29.7% in 2021 and 28.2% in 2022.[12]

In developing countries, poor sanitation is closely linked to stunting through its association with inadequate clean water and WASH (Water, Sanitation, and Hygiene) conditions.[3,13,14] Studies have shown that poor sanitation correlates with higher vulnerability to stunting.[15–17] 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.[18–22] Stunted children are at increased risk of lower cognitive development, reduced future productivity, susceptibility to non-communicable diseases, and poverty.[23]

Stunting remains one of the most serious public health challenges, particularly due to sanitation's direct impact on health, lifestyle, and environmental conditions.[24–26] In Indonesia, involving community health cadres has become a critical strategy in stunting prevention efforts.[27,28] 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.[27]

Improving community nutritional knowledge and implementing Community-Led Total Sanitation (CLTS) has been shown to help reduce stunting.[29–31] 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.[31,32] 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.

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).

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.[33] 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.[34,35] Another study concluded that community-led WASH interventions positively impact social factors, particularly for primary caregivers.[36,37] 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.[38,39] 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.[40] Psychological aspects can also influence negative behaviors related to open defecation.[41,42] Research in Nepal revealed that practices of defecating away from homes are influenced by cultural, religious, and spiritual factors.[43,44] Ownership and use of latrines, as well as perceived social status and privacy, further impact open defecation behaviors.[45]

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 hight school	85	46.7
Senior hight 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	0000
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.[41,46] 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.[47] 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.[48]

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.[49] Studies have shown that food insecurity, climate change, and economic development also impact household waste management practices.[49–53] Research in Guinea indicated a correlation between low educational backgrounds and low incomes with household waste disposal practices.[28,50] However, this contrasts with findings in southern Africa, where individuals demonstrated practices of reusing household waste.[54,55] A study in the UK highlighted that personal roles and individual differences in securing household waste are influenced by personality traits and prior experiences.[55]

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.[56,57]

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.[58,59] Effective wastewater management can reduce pathogen exposure and minimize pollution through reduced wastewater discharge.[60,61]

This study has limitations, particularly in the initial characteristics of the experimental and control groups, which showed significant differences in factors such as education level and socioeconomic 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.

References

1. Namiiro FB, Batte A, Rujumba J, et al. Nutritional status of young children born with low birthweight in a low resource setting: an observational study. BMC Pediatr 2023;23:1–11.
2. UNICEF. WHO Low Birth Weight. 2019.
3. Subramanian S V, Karlsson O, Kim R. Revisiting the stunting metric for monitoring and evaluating nutrition policies. Lancet Glob Heal. 2022;10:e179–80.
4. Wolf J, Hubbard S, Brauer M, et al. Effectiveness of interventions to improve drinking water, sanitation, and handwashing with soap on risk of diarrhoeal disease in children in low-income and middle-income settings: a systematic review and meta-analysis. Lancet 2022;400:48–59.
5. WHO. Levels and trends in child malnutrition: UNICEF/WHO/The World Bank Group joint child malnutrition estimates: key findings of the 2021 edition. 2021.
6. Heidkamp RA, Piwoz E, Gillespie S, et al. Mobilising evidence, data, and resources to achieve global maternal and child undernutrition targets and the Sustainable Development Goals: an agenda for action. Lancet 2021;397:1400–18.
7. Nutrition D of, Health and Development W. Growth velocity based on weight, length and head circumference. 2009. 2 p.
8. Taqwin T, Ramadhan K, Hadriani H, et al. Prevalence of stunting among 10-year old children in Indonesia. J Glob Pharma Technol 2020;12:768–75.
9. Organization WH. Malnutrition. 2021.
10. UNICEF/WHO. Levels and trends in child malnutrition. 2023.
11. Helmiyati. Getting to Know Detection, Impact, and Prevention of Stunting. 2022. Available from: https://pkgm.fk.ugm.ac.id/en/2022/04/05/getting-to-know-detection-impact-and-prevention-of-stunting/.
12. Dinas Kesehatan Provinsi Sulawesi Tengan. Profil kesehatan Provinsi Sulawesi Tengah 2023.
13. Mudadu Silva JR, Vieira LL, Murta Abreu AR, et al. Water, sanitation, and hygiene vulnerability in child stunting in developing countries: a systematic review with meta-analysis. Public Health 2023;219:117–23.
14. WHO, UNICEF U. Tanoto Foundation and UNICEF continue partnership to reduce stunting prevalence in Indonesia. 2022.

15. Walker SP, Chang SM, Wright A, et al. Early Childhood Stunting Is Associated with Lower Developmental Levels in the Subsequent Generation of Children. J Nutr 2015;145:823–8.
16. Hoddinott J, Alderman H, Behrman JR, et al. The economic rationale for investing in stunting reduction. Matern Child Nutr 2013;9:69–82.
17. Vollmer S, Harttgen K, Subramanyam MA, et al. Association between economic growth and early childhood undernutrition: evidence from 121 Demographic and Health Surveys from 36 low-income and middle-income countries. Lancet Glob Heal 2014;2:e225–34.
18. Maulina R, Qomaruddin MB, Prasetyo B, et al. The Effect of Stunting on the Cognitive Development in Children: A Systematic Review and Meta-analysis. Stud Ethno-Medicine 2023;17:19–27.
19. Crookston BT, Penny ME, Alder SC, et al. Children Who Recover from Early Stunting and Children Who Are Not Stunted Demonstrate Similar Levels of Cognition. J Nutr 2010;140:1996–2001.
20. Galasso E, Wagstaff A. The aggregate income losses from childhood stunting and the returns to a nutrition intervention aimed at reducing stunting. Econ Hum Biol 2019;34:225–38.
21. World Bank. Reducing Childhood Stunting with a New Adaptive Approach. 2018.
22. Emanuela Galassoa AW. The Aggregate Income Losses from Childhood Stunting and the Returns to a Nutrition Intervention Aimed at Reducing Stunting. 2018.
23. Mustakim MRD, Irwanto, Irawan R, et al. Impact of Stunting on Development of Children between 1-3 Years of Age. Ethiop J Health Sci 2022;32:569–78.
24. Bogale TY, Bala ET, Tadesse M, Asamoah BO. Prevalence and associated factors for stunting among 6-12 years old school age children from rural community of Humbo district, Southern Ethiopia. BMC Public Health 2018;18:1–8.
25. Reese H, Routray P, Torondel B, et al. Assessing longer-term effectiveness of a combined household-level piped water and sanitation intervention on child diarrhoea, acute respiratory infection, soil-transmitted helminth infection and nutritional status: A matched cohort study in rural Odisha, . Int J Epidemiol 2019;48:1757–67.
26. Cumming O, Cairncross S. Can water, sanitation and hygiene help eliminate stunting? Current evidence and policy implications. Matern Child Nutr 2016;12:91–105.
27. Mediani HS, Hendrawati S, Pahria T, et al. Factors Affecting the Knowledge and Motivation of Health Cadres in Stunting Prevention Among Children in Indonesia. J Multidiscip Healthc 2022;15:1069–82.
28. Bushen G, Merga H, Tessema F. Effects of community-led total sanitation and hygiene implementation on diarrheal diseases prevention in children less than five years of age in South Western Ethiopia: A quasi-experimental study. PLoS One 2022;17:1–16.
29. Amaliyah E, Mulyati M. Effectiveness of Health Education and Nutrition Rehabilitation Toward Community Empowerment for Children Aged Less Than 5 Years with Stunting: A Quasi-Experimental Design. J Ners 2020;15:173–7.
30. Rachmawati PD, Triharini M, Suciningtyas PD. The contribution of family functions, knowledge and attitudes in children under five with stunting. Enferm Clin 2021;31:S296–300.
31. Fadilah M, Novita E, Roflin E, et al. Analysis Of The Relationship Between Implementation Of Stbm Program And Reduction Of Stunting's Risk Factors In Children Under Two Years Old In Palembang. Adv Soc Sci Res J 2020;7:395–407.
32. Kusumawardani DA, Irawan R, Purnomo W. Child health care practices and stunting in children aged 12-36 months in jember regency of Indonesia. Indian J Public Heal Res Dev 2019;10:1363–8.
33. Cronin-Golomb LM, Bauer PJ. Self-motivated and directed learning across the lifespan. Acta Psychol (Amst) 2023;232:103816.
34. Andrade EL, Bingenheimer JB, Edberg MC, et al. Evaluating the effectiveness of a community-based hygiene promotion program in a rural Salvadoran setting. Glob Health Promot 2019;26:69–80.
35. Zenbaba D, Sahiledengle B, Nugusu F, et al. Food hygiene practices and determinants among food handlers in Ethiopia: a systematic review and meta-analysis. Trop Med Health 2022;50.
36. Has EMM, Krisnana I, Efendi F. Enhancing Maternal Caregiving Capabilities Model to Prevent Childhood Stunting: A UNICEF-Inspired Model. SAGE Open Nurs 2024;10.
37. Malolo R, Kumwenda S, Chidziwisano K, et al. Social outcomes of a community-based water, sanitation and hygiene intervention. J Water, Sanit Hyg Dev 2021;11:483–93.
38. Paul B, Jean Simon D, Kiragu A, et al. Socio-economic and demographic factors influencing open defecation in Haiti: a cross-sectional study. BMC Public Health 2022;22:2156.
39. Mulaw GF, Adem OS, Belachew AB. Determinants of Stunting among Children Aged 6-23 Months of Age in Pastoral Community, Afar Region, Ethiopia: Unmatched Case-Control Study. Int J Child Heal Nutr 2020;9:191–201.
40. Devanarayana NM, Rajindrajith S. Bowel Habits and Behaviors Related to Defecation in 10- to 16-year-olds: Impact of Socioeconomic Characteristics and Emotional Stress. J Pediatr Gastroenterol Nutr 2011;52:569–73.
41. Ntaro M, Owokuhaisa J, Isunju JB, et al. Contextual and psychological factors influencing open defecation free status: an exploratory qualitative study in rural South Western Uganda. BMC Public Health 2022;22:414.
42. Bauza V, Majorin F, Routray P, et al. Child feces management practices and fecal contamination: A cross-sectional study in rural Odisha, India. Sci Total Environ 2020;709:136169.
43. Bhatt N, Budhathoki SS, Lucero-Prisno DEI, et al. What motivates open defecation? A qualitative study from a rural setting in Nepal. Pradhan PMS, editor. PLoS One 2019;14:e0219246.
44. Roy A, Rahaman M, Bannerji R, et al. Spatial clustering and drivers of open defecation practice in India: Findings from the fifth round of National Family Health Survey (2019-21). Glob Transitions 2023;5:55–63.
45. O'Connell K. What Influences Open Defecation and Latrine Ownership in Rural Households?: Findings from a Global Review. 2014.
46. Siswati T, Susilo J, Kusnanto H, Waris L. Risk Factors of Mild and Severe Stunting Children in Rural and Urban Areas in Indonesia. Iran J Public Health 2022.
47. Putri DUP, Mahmudiono T, Indriani D, Lisatriana B. The relationship between the competence and performance of family planning instructors in family assistance at risk of stunting in Lampung province. J Public Health Africa 2023;14.
48. Caruso BA, Sclar GD, Routray P, et al. Effect of a low-cost, behaviour-change intervention on latrine use and safe disposal of child faeces in rural Odisha, India: a cluster-randomised controlled trial. Lancet Planet Heal 2022;6:e110–21.
49. Xu L, Ling M, Lu Y, Shen M. Understanding Household Waste

Separation Behaviour: Testing the Roles of Moral, Past Experience, and Perceived Policy Effectiveness within the Theory of Planned Behaviour. Sustainabilit 2017;9:625.
50. Mamady K. Factors Influencing Attitude, Safety Behavior, and Knowledge regarding Household Waste Management in Guinea: A Cross-Sectional Study. J Environ Public Health 2016;2016:1–9.
51. Humphrey JH, Mbuya MNN, Ntozini R, et al. Independent and combined effects of improved water, sanitation, and hygiene, and improved complementary feeding, on child stunting and anaemia in rural Zimbabwe: a cluster-randomised trial. Lancet Glob Heal 2019;7:e132–47.
52. Zheng J, Ma G, Wei J, et al. Evolutionary process of household waste separation behavior based on social networks. Resour Conserv Recyc 2020;161:105009.
53. Odagiri M, Thomas A, Listyasari M, et al. Safely managed on-site sanitation: A national assessment of sanitation services and potential fecal exposure in Indonesia. Int J Environ Res Public Health 2021;18.
54. Lange SL, Senekane MF, Naicker N. Understanding the Socio-Demographic Profile of Waste Re-Users in a Suburban Setting in South Africa. Resources 2022;11:45.
55. Swami V, Chamorro-Premuzic T, Snelgar R, Furnham A. Personality, individual differences, and demographic antecedents of self-reported household waste management behaviours. J Environ Psychol 2011;31:21–6.
56. Malika NM, Barbagelatta G, Penny M, et al. Impact of Housing and Infrastructure on handwashing in Peru. Int Health 2021;13:615–23.
57. Ray S, Zaman F, Laskar N. Hand washing practices in two communities of two states of Eastern India: An intervention study. Indian J Public Health 2010;54:126.
58. MacLeod C, Braun L, Caruso BA, et al. Recommendations for hand hygiene in community settings: a scoping review of current international guidelines. BMJ Open 2023;13:e068887.
59. Sitotaw B, Melkie E, Temesgen D. Bacteriological and Physicochemical Quality of Drinking Water in Wegeda Town, Northwest Ethiopia. J Environ Public Health 2021;2021.
60. United Nation. UN Water. 2017.
61. Aghalari Z, Dahms HU, Sillanpää M, et al. Effectiveness of wastewater treatment systems in removing microbial agents: a systematic review. Global Health 2020;16:13.