On Prevention of Diarrheal Disease: Assessing the Factors of Effective Handwashing Facilities in Bangladesh

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Abstract

People in Bangladesh usually do not utilize handwashing facilities properly, which makes it challenging to implement hygiene practices of handwashing to reduce diarrhea and other health risks. Against this backdrop, this research attempts to assess the factors associated with Effective Handwashing Facilities (EHFs) in Bangladesh utilizing the Multiple Indicator Cluster Survey 2019. This study utilizes descriptive statistics techniques and also bivariate and multivariable logistic regression methods by representing odd ratios to identify the relationship between associated factors and EHF in Bangladesh. The descriptive statistics show that about 74.22% of the households in Bangladesh have EHFs. Gender, education, ethnicity, male-head households, household wealth status, source of water, sanitation status, sharing toilet facility are identified as the potential determinants of EHF. As a result, we recommend that all levels of society in Bangladesh have continuous access to handwashing equipment and facilities to reduce hygiene-related illnesses especially diarrheal disease.

Keywords

Bangladesh; diarrheal diseases; effective handwashing facility (EHF); handwashing

Introduction

Handwashing or hand hygiene is regarded as one of the most important measures to control cross-transmission of microbial pathogens and other health-related infections (Jumaa, 2005). In 2005, World Health Organization (WHO) started the maiden 'Global Patient Safety Challenge 2005-2006' with the slogan 'Clean Care is Safer Care' to prevent healthcare-related contagion on a broader scale (World Health Organization & WHO Patient Safety, 2009). Experts of international disease control and other counseling bodies and agencies participated in an assembly to construct a novel WHO Guidelines relating to 'Hand Hygiene in Healthcare' (Whitby et al., 2007).

Severe transmittable gastroenteritis in children and adults is mainly caused by viruses (Pizzorno et al., 2015). This acute level of virus transmission draws the attention of health experts worldwide, and they suggest handwashing practices for preventing the spread of diarrhea diseases. The health experts usually hint at decontaminating hands through washing with soap or waterless hand sanitizers, which are very useful for removing or killing organisms (Bloomfield et al., 2007). In the *Guideline for Hand Hygiene in Health-Care Settings* (Boyce & Pittet, 2002), 'handwashing,' which replaced the old section entitled 'Antiseptics, Handwashing, and Handwashing Facilities,' contained updated recommendations for handwashing with plain soaps or detergents and with antimicrobial-containing products. In this way, the Effective Handwashing Facility (EHF) has emerged as a vital tool for maintaining health hygiene, especially the prevention of diarrhea.

In Bangladesh, diarrheal diseases are the second greatest cause of death for children under five years of age. Every year about 500,000 children die from diarrheal diseases (Alexander, 2020). Notably, 1.57 million people globally died in 2017 because of diarrheal diseases, approximately 30 deaths per 100,000 people (Dadonaite et al., 2018). This scenario of diarrheal diseases requires adopting preventive measures, including handwashing among all people in the Bangladeshi society. Many earlier studies confirmed the causal relationship between hand hygiene and handwashing and waterborne diseases, e.g., cholera or diarrhea (Aiello & Larson, 2002a, 2002b). Although there is ample support literature and health expert suggestions of proper handwashing, the hygiene habits among the people of developing countries are not sufficient to control diarrhea-related contagion (De Buck et al., 2017). As a result, these countries are still carrying a considerable load of deadly diseases like diarrhea. As a developing country, Bangladesh has witnessed the same diarrheal disease phenomenon, which prompted the government and relevant departments to emphasize adopting hygiene mechanisms, especially the handwashing approach, to tackle these infectious diseases.

This research aims to examine the handwashing practice scenario among the people of Bangladesh in the case of diarrhea disease abatement utilizing the Multiple Indicator Cluster Survey (MICS - 2019) data produced by UNICEF (2019). UNICEF produces large amounts of data used to delineate this study's comprehensiveness. Hence, the study's findings will be appropriate in generalizing the handwashing practices of the Bangladesh people. Earlier studies hardly covered the determinants of handwashing practices in the context of Bangladesh. Thus, findings addressing this study gap will be a significant contribution to the health-related literature. The findings would mainly contribute to providing helpful insight for policymakers of Bangladesh

while adopting health-related policy measures in the case of diarrhea or virus prevention in the context of Bangladesh.

Literature review

Previous studies revealed that proper handwashing behavior minimizes respiratory, bacterial, and viral infections (Capps et al., 2017; Friedrich et al., 2017; Mbakaya et al., 2017). Handwashing is the most cost-effective intervention to reduce the under-5 mortality attributed to childhood pneumonia and diarrhea (Bangladesh Bureau of Statistics & UNICEF, 2019). Like many other South Asian developing countries, Bangladesh has progressed towards safe water, sanitation, and hygiene practices through different governmental and non-governmental programs. The availability of handwashing facilities in the household is one of the vital indicators of handwashing behavior.

In Bangladesh, surveys indicated that the practice of handwashing using soap before eating a meal is substantially lower than after defecation, and there appears a gap between perception and appropriate practice of handwashing using soap (Rabbi & Dey, 2013). Another empirical research output in the context of the rural areas in Bangladesh depicted that 14% of respondents wash hands using soap after defecation, whereas only slightly more than 1% of people use soap and water to wash hands before eating (Halder et al., 2010).

The Sustainable Development Goals (SDGs 1.2 and 6.2) target mass access to minimum handwashing facilities at home (Bangladesh Bureau of Statistics & UNICEF, 2019). In 2017, about 35% of the people living in Bangladesh had basic handwashing facilities at home, while 60% in India, 48% in Nepal, 60% in Pakistan, 96% in the Maldives, and 79% in Myanmar (UNICEF &World Health Organization, 2019, p. 37). The percentage of households in Bangladesh facilitating a specific place for handwashing has increased from 59.1% in 2012-2013 to 74.8% in 2019 (Bangladesh Bureau of Statistics & UNICEF, 2014, 2019). Various socioeconomic characteristics are associated with the availability of this handwashing facility. A study in rural Bangladesh identified that the availability of water and soap at the handwashing station is significantly associated with the handwashing practice (Luby et al., 2009). Moreover, previous literature identified education, ethnicity of the household head, household-level of poverty, sanitation and improved water facility, media exposure, and desire to smell aromatic as the influential factors associated with handwashing facility and practice (Hirai et al., 2016; Luby et al., 2009; Schmidt et al., 2009; To et al., 2016).

Bangladesh is confronted with several problems in the areas of water, sanitation, and hygiene. In Bangladesh, water and sanitation-related illness are regarded as one of the most severe child ailments. Non-fatal chronic diseases such as diarrhea are also sourced from water and improper sanitation practice. Improper hygienic practices, such as inadequate handwashing, are principal risk factors for diarrheal and waterborne illnesses. The Government of Bangladesh has taken steps to attain 100% effective sanitation and water coverage to achieve Sustainable Development Goals (SDGs). This research will add value to the Bangladesh government's initiatives on public health (Rabbi & Dey, 2013).

Methods

Data overview

The Multiple Indicator Cluster Survey 2019 (MICS-2019) Bangladesh, a national survey funded by UNICEF (UNICEF, 2019) that provided data on public health indicators of the eight geographical divisions in Bangladesh, was used in this study. The MICS-2019 adopted two-stage stratified sampling techniques to select households. The sampling frame was first stratified into regions and then regions divided into rural and urban areas. Census enumeration areas (EAs) were sampled in the first stage, and then a systematic sample of 20 households was drawn from each EA, respectively. The EAs, also known as clusters, were selected from each region. The MICS conducted in 2019 included 3220 EAs.

Dependent and independent variables

A household having an effective handwashing facility (EHF) and a specific place for washing hands and the interviewer observed the presence of water and soap (bar or liquid)/detergent (powder, liquid, or paste) at that place in the household, was coded as 1; otherwise, it was coded as 0 (To et al., 2016). The following independent factors were considered in this study: age of household head (X_1: min=16 years, max=95 years); sex of head of household (X_2: Male, Female); the ethnicity of the head of household (X_3: Bengali, others); geographical divisions (X_4: Barisal, Chattogram, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet); area of residence (X_5: rural, urban); wealth index (X_6: poorest, poorer, middle, richer, and richest); the education level of head of household (X_7: no education, primary, secondary, higher secondary or above); improved sanitation status (X_8: no, yes); improved water status (X_9: no, yes); media exposure (X_{10}: no access to TV or the internet, access either TV or internet); own house (X_{11}: own house, rent or others) and toilet facility (X_{12}: shared, not shared).

Sanitation facilities that have been improved are more likely to provide privacy and hygienic usage (flush or pour-flush toilets, sewerage systems, or latrine; vented upgraded pit latrine, pit latrine with slab, and composting toilet) (World Health Organization & UNICEF, 2013). Furthermore, improved drinking water technologies (piped water, pipe well/borehole, protected well, protected spring, and rainfall) are more likely than unimproved technologies to produce safe drinking water (World Health Organisation & UNICEF, 2013).

Statistical analysis

The primary association between socio-demographic and socioeconomic factors with Effective Handwashing Facilities (EHFs) was determined through the bivariate analyses. Variables with a p-value < 0.05 were preferred through the independent logistic regression model (Hosmer & Lemeshow, 2000; Menard, 2002) and calculated unadjusted odds ratio (OR). The significance of the relationship between factors and EHFs was assessed through the multivariable logistic regression model (Khan & Shaw, 2011; Ovaskainen et al., 2010). The mathematical form of logistic (Model-1) and multivariable (Model-2) logistic regression model:

Model-1

$$\log(\frac{P_U}{1-P_U}) = \beta_0 + \beta_i X_i,\ i = 1,2,\dots 12$$

Model-2

$$\text{Level 1: } \log(\frac{P_U}{1-P_U}) = \beta_0 + \sum_{i=1}^{12} \beta_i X_i$$

$$\text{Level 2: } \beta_0 = \delta_0 + u_{0j}$$

Here, P_U is the probability of being EHF and u_{0j} is the random cluster effect. STATA statistical software was used for data analysis (*STATA*, 2015). Moreover, as the MICS implemented a complex survey design, we considered survey design and sampling weights to report percentages and OR. The goodness of fit of the model has been assessed by using Wald -χ^2 test and likelihood ratio test.

Results

Among the 64,400 samples, a total of 61,166 samples were included in this study. The cases with missing information and not permitting to show the handwashing place were excluded from the study.

Table 1: Socio-Demographic Characteristics of the Household (n= 61,166).

Variables	Percentage (%)
Age of household head (Continuous)	47.01[a] (14.26)[b]
Sex of head of household	
Male	87.28
Female	12.72
Ethnicity of head of household	
Bengali	98.84
Others	1.16
Geographical division	
Barishal	5.68
Chattogram	17.53
Dhaka	25.34
Khulna	11.91
Mymensingh	7.45
Rajshahi	14.28
Rangpur	11.79
Sylhet	6.02
Living Area	
Urban	22.14
Rural	77.86
Wealth index	
Poorest	21.09
Poorer	20.32
Middle	19.43
Richer	19.63

Variables	Percentage (%)
Richest	19.53
Education level of head of household	
No education	35.01
Primary	27.10
Secondary	25.57
Higher Secondary or Above	12.32
Improved sanitation status	
No	4.15
Yes	95.85
Improved water status	
No	1.99
Yes	98.01
Media exposure	
No	38.20
Yes	61.80
Own house	
No	15.96
Yes	84.04
Sharing of toilet facility	
Yes	30.29
No	69.71

Note: a=mean, b=Standard deviation

Table 1 shows the socio-demographic characteristics of the households. The findings showed that 95.85% of the households had improved sanitation status, whereas about 30.29% shared toilet facilities with others, and 98.01% had improved water sources. The majority of the heads of households were male and from the Bengali ethnic group. About 77.86% of the households were in rural areas. About one-third of the heads of households had no education, 27.10% primary, 25.57% secondary, and 12.32% had higher education.

Table 2: The Percentage of Household Socio-Demographic Characteristics with Handwashing Behavior and Odds Ratio of Handwashing Behavior with Household Characteristics.

Variables	Total (%)	Model 1 OR (95% CI)	Model 2 AOR (95% CI)
Age of head of household (Continuous)	47.08[a] (14.04) [b]	0.99 (0.99-0.99) **	0.99 (0.99-1.00)
Sex of head of household			
Male	39,647.59 (74.27)	1	1
Female	5,749.65 (73.91)	0.98 (0.91-1.04)	0.80 (0.71-0.91)*
Ethnicity of head of household			
Bengali	45,046.4 (74.51)	1	1
Others	350.83 (49.31)	0.33 (0.24-0.44)**	1.69 (1.14-2.51)*
Geographical division			
Barishal	1,597.44 (45.97)	1	1
Chattogram	7,337.70 (68.43)	2.54 (2.28-2.84)**	2.26 (1.69-3.02)**
Dhaka	13,642.09 (88.03)	8.64 (7.67-9.74)**	18.37 (11.39-29.60)**
Khulna	5,373.32 (73.75)	3.30 (2.94-3.69)**	6.40 (4.41-9.31)**

Variables	Total (%)	Model 1 OR (95% CI)	Model 2 AOR (95% CI)
Mymensingh	2,789.40 (61.20)	1.85 (1.64-2.09)**	3.47 (2.39-5.03)**
Rajshahi	5,852.05 (67.00)	2.38 (2.12-2.67)**	4.78 (3.35-6.81)**
Rangpur	6,047.26 (83.84)	6.10 (5.46-6.80)**	58.48 (31.17-109.71)**
Sylhet	2,757.96 (74.96)	3.51 (2.92-4.22)**	12.44 (7.64-20.26)**
Living Area			
Urban	11,711.37 (86.49)	1	1
Rural	33,685.87 (70.73)	0.37 (0.34-0.41)**	1.09 (0.90-1.32)
Wealth index			
Poorest	5,634.68 (43.68)	1	1
Poorer	8,293.60 (66.72)	2.58 (2.42-2.75)**	5.50 (4.22-7.18)**
Middle	9,320.86 (78.43)	4.68 (4.35-5.05)**	19.03 (12.40-29.20)**
Richer	10,584.21 (88.16)	9.60 (8.78-10.50)**	79.18 (43.31-144.76)**
Richest	11,563.88 (96.80)	39.04 (33.55-45.42)**	904.75 (366.43-2,233.89)**
Education level of head of household			
No education	13,933.81 (65.07)	1	1
Primary	11,905.00 (71.82)	1.36 (1.30-1.43)**	1.18 (1.07-1.31)*
Secondary	12,653.64 (80.90)	2.27 (2.14-2.40)**	1.41 (1.25-1.60)**
Higher Secondary or Above	6,904.80 (91.64)	5.88 (5.30-6.53)**	2.30 (1.87-2.82)**
Improved sanitation status			
No	1,228.74 (48.46)	1	1
Yes	44,168.5 (75.33)	3.24 (2.92-3.60)**	2.58 (2.06-3.24)**
Improved water sources			
No	515.41 (42.30)	1	1
Yes	44,881.82 (74.87)	4.06 (3.24-5.08)**	2.80 (2.00-3.88)**
Media exposure			
No	13,845.15 (59.26)	1	1
Yes	31,552.09 (83.07)	3.47 (3.30-3.64)**	0.96 (0.88-1.06)
Own house			
No	8,264.50 (84.64)	1	1
Yes	37,132.74 (72.24)	0.47 (0.43-0.51)**	1.26 (1.08-1.48)*
Sharing toilet facility			
Yes	13,052.65 (70.45)	1	1
No	32,344.59 (75.86)	1.31 (1.25-1.38)**	1.18 (1.08-1.29)**
Different level variances			
Cluster level			
Household | Cluster level			2.23 (1.69-2.95)**
Intracluster correlation (ICC)			5.86 (3.93-8.75)**
Cluster level ICC			0.20 (0.18-0.20)**
Household | Cluster level ICC			0.71 (0.63-0.77)**
Log-likelihood			-39,476.179
Wald -χ^2			<0.001
Likelihood ratio test			<0.001

*Note: P-values: ** <0.001, * <0.05*

Table 2 presents the frequency of the socio-demographic factors and the percentage of EHFs in parenthesis. Additionally, it shows the unadjusted odds ratios (Model 1) and adjusted odds ratios (Model 2) from multivariable logistic regression of EHFs by household characteristics. Our findings revealed that 74.22% of the households had a specific place for washing hands and

cleaning materials (soap or detergent) and water. Among them, 74.87% of households had improved water source status.

In Table 2, unadjusted odds ratios (OR) shows that the age, ethnicity, and level of education of head of household were associated with effective handwashing facilities. Moreover, the findings also identified the living area, geographical division, household wealth quantile, water source, sanitation status, ownership of the household, sharing toilet facility, and media exposure as potential factors for EHFs. Table 2 presents factors associated with effective handwashing facilities in households. The findings revealed that households with a female, rather than a male, head of household had lower odds of having EHFs (AOR: 0.80, CI: 0.71-0.91). Moreover, Bengali ethnic groups had higher odds of having EHFs than the non-Bengali ethnic groups (AOR: 1.69, CI: 1.14-2.51). Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet divisions had higher odds of having EHFs than the Barishal division.

The results showed that the richest households were about 904.75 times more likely to have EHFs than the poorest households, followed by 79.18 times, 19.03 times, and 5.50 times more likely in richer, middle, and poor households, respectively. Besides, the odds of having EHFs were gradually increased with the increment of the education level of the head of household. Households with higher educated heads of household were more than 2 times more likely to have EHF than households with uneducated heads of household, where the AOR was found 1.41 (1.25-1.60) and 1.18 (CI: 1.07-1.31) for secondary and primary educated heads of household, respectively. Moreover, a household facilitated with improved sanitation facilities and improved water sources had higher odds (AOR 2.58 and 2.80, respectively) than their counterparts concerning EHFs. Besides, the households sharing toilet facilities with others were less likely to have EHFs than households not sharing that facility. The study also found that household ownership increased the odds of having EHFs (AOR: 1.26; CI: 1.08-1.48).

The result for cluster level and household by cluster level variances and intracluster correlation (ICC) is shown in Table 2. The variance at the cluster level only explained (2.23/8.09 = .275) 27.5% proportional change of the total variance while the household level variance showed (5.86/8.09= .7234) 72.34% of the total variation. The result of ICC at the cluster and household level was 0.19 and 0.71, respectively, which indicated households in the same cluster have a higher chance of correlation of EHF as compared to households with a different cluster.

Figure 1: District-Level Percentages of Effective Handwashing Facilities in Bangladesh.

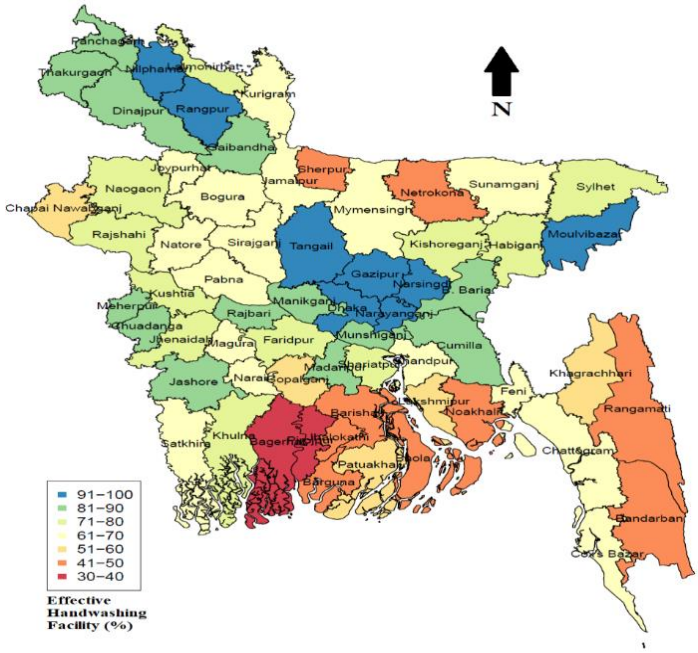

Figure 1 shows district-level percentages of EHFs in Bangladesh. The figure indicates a lack of EHFs at the Southwestern regions and hill districts – Khagrachhari, Rangamati, and Bandarban districts. The highest percentages of EHFs were found in the middle and northern regions of Bangladesh. The figure also depicts an apparent regional variation of EHFs in Bangladesh that suggests considering regional variation in the analysis.

Discussion

This study identified socio-demographic factors associated with effective handwashing facilities (EHFs) in Bangladesh using the most recent nationally representative cross-sectional Multiple Indicator Cluster Survey 2019 conducted by the Bangladesh Bureau of Statistics and UNICEF (2019). The MICS considered a large number of study samples across different geographic regions in Bangladesh. The findings reveal that the female-headed households were less facilitated with EHFs compared to male-headed households. Bangladesh is mainly a patriarchic society where the male is the head of the family. The male is the decision-maker, and he has enormous scope to work in every sphere of life. He also has greater income opportunities than the female class. This income status of the male class helps purchase handwashing materials to clean hands (Ejemot-Nwadiaro et al., 2021). The influence of a male in a male-dominated family can compel his family members to wash their hands. That is hardly possible in a female-dominated family because female heads of households cannot force their children and other household members to wash their hands. This implies that female-dominated households may be less facilitated with EHF practice in the context of Bangladesh (Parveen et al., 2018).

A study conducted by Xuan & Hoat (2013) in Bangladesh showed that ethnicity is associated with handwashing behavior, where Bengali ethnic groups are more prone to EHFs than their counterparts, which is consistent with our findings in Model 1 (Table 2). In Bangladesh, other (i.e., non-Bengali) ethnic groups live in remote places than Bengali ethnic groups; consequently, these non-Bengali ethnic groups are always facing hardships with proper water, sanitation, and hygiene.

Common perception and unadjusted odds ratio suggest that urban people have more access to handwashing facilities, but the adjusted results do not find any rural-urban distinction. This lack of distinction happens due to people's level of consciousness about handwashing practices that protect the human body from diseases like diarrhea. More importantly, different types of hygiene awareness programs sponsored by non-governmental organizations (NGOs) might be a significant factor in providing knowledge for the rural people to clean their hands using water or with handwashing equipment like soap, detergent powder, or ash. (De Buck et al., 2017; Dutton, 2011). However, we find that education plays a vital role in favor of EHFs. In general, educated people are more aware of appropriate hygiene practices, and our finding is congruent with previous literature (Schmidt et al., 2009; To et al., 2016).

Wealthier families can afford advanced municipal facilities and hygiene commodities, as they have more access to EHFs compared to middle and low-income families (Luby & Halder, 2008). Improved sanitation and protective water sources are also indicated as having better EHFs and proper hand hygiene behavior. These findings agree with previous studies conducted in Kenya (Schmidt et al., 2009) and Vietnam (To et al., 2016). Consistent with our present study, individuals with their own house had more odds of EHFs than their counterparts (Wichaidit et al., 2019). However, sharing toilets indicates additional gathering in the sanitation facility, which poses the difficulty of proper maintenance and scarcity of hygiene commodities. Our findings concur with this perception and identify smaller odds of having EHF in households that share toilets with others. Although media exposure may increase overall hygiene knowledge and practice (Schmidt et al., 2009) – which is also reflected by the unadjusted odds ratio; the adjusted model does not support the concept. Since there are lower odds of EHFs among households in Bangladesh with a lack of improved sanitation and water sources, it is still essential to take necessary steps to improve sanitation and water sources.

The geographical division is also significantly associated with EHFs, indicating a lack of EHFs in the Southwestern regions (Khulna and Chittagong) and hill districts – Khagrachhari, Rangamati, and Bandarban districts. Consistent with our findings, a previous study showed that Khulna lacks EHFs as it is situated in the coastal area of Bangladesh (Haque et al., 2010). Also similar to our findings, several previous studies conducted in Bangladesh observed that the Chittagong hill tracts areas (Khagrachhari, Rangamati, and Bandarban) have a lack of EHFs, which may be the result of lack of wealth and education access in those remote areas (Islam et al., 2021). As a result, the need for EHFs is a major concern in those areas in Bangladesh for increasing the availability of handwashing facilities.

In this paper, we discussed potential factors responsible for EHF availability in the household. Proper hygiene practice depends on the availability of a hygiene facility. According to Sustainable Development Goal 6.2, Bangladesh aims to provide adequate sanitation and hygiene for all by 2030 (Bangladesh Planning Commission, 2020). Appropriate hygiene practice is one of the critical

components of good health status, directly linked with death and morbidity from diarrheal disease. On top of that, remission of the current situation of diarrheal diseases calls for urgent measures, including frequently washing hands with soap or detergent.

Conclusion

This study finds potential obstacles in terms of associated factors responsible for the availability of effective handwashing facilities. This study finds that the likely contributing factors of having EHFs are gender, education, ethnicity, male-head households, household wealth status, water source, sanitation status, and sharing toilet facility. As far as the cost of hygiene equipment is concerned, we strongly recommend maintaining the uninterrupted supply of these commodities at the lowest price for the poorest people. Besides, the government should design and implement an awareness-building campaign to increase the knowledge and practice of appropriate hygiene behavior, especially for poorly educated people. Municipal facilities should be improved, continual, and accessible to achieve the successful reduction of diarrheal diseases. Moreover, the fight against diarrheal diseases cannot be succeeded without maintaining recommended hand hygiene and washing practices.

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