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Mothers' hand washing practices and associated factors among model and non-model households in the rural community of Bibugn district, north west Ethiopia: The context of the Ethiopian health extension package

Agerie Abebe [b], Berhanu G. Debela [a,*], Daniel Sisay W/tsadik [a], Getachew Assefa Zenebe [a], Habtamu Endashaw Hareru [a], Zemachu Ashuro [a]

[a] School of Public Health, College of Health and Medical Science, Dilla University, Ethiopia
[b] Bibugn District Health Office, Ethiopia

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ABSTRACT

Background: Hand-washing with soap is one of the most cost-effective ways of reducing the global infectious disease burden, particularly diarrhea and acute respiratory infections. The World Health Organization and United Nations Children's Fund report shows that in twenty-eight developing countries, more than one quarter of the population had no hand washing facility at home. This study aimed to assess hand washing practice and associated factors among mothers from model and non-model households in Bibugn district, North West Ethiopia.

Methods: A community-based comparative cross-sectional survey was employed. A multi-stage sampling technique was used to select households. Data was collected using a structured interview questionnaire and analyzed using SPSS version 20. A descriptive analysis was presented using texts, tables, and figures. Bi-variable and multivariable logistic regression was used to detect the potential difference between variables.

Results: Mothers' hand washing practice with water and soap/ash at critical times was 20.3%. Hand washing practice at critical times shows significant differences between model and non-model households. Mothers' who had knowledge 3.49 times (AOR: 3.49, 95% CI: 2.05, 5.96), access to adequate water 2.22 times (AOR: 2.22, 95% CI: 1.36, 3.77), and hand washing facilities 1.88 times (AOR: 1.88, 95% CI: 1.18, 2.98) were more likely to practice hand washing than their counterparts.

Conclusion: One fifth of mothers practice hand washing with water and soap or ash at critical times in the study area. Model households were better at hand washing practice than non-model households'. Expanding the model household program, availing hand-washing facilities, increasing water accessibility, and strengthening awareness creation were important to improving hand-washing practice.

* Corresponding author.
E-mail address: berhanug@du.edu.et (B.G. Debela).

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1. Introduction

Hand washing with soap and water is one of the most effective infectious disease prevention measures, reducing the risk of diarrhea by half and acute respiratory infections (ARI) by about a quarter [1–4]. Hand washing practices at critical times, such as after using the toilet, cleaning a child up after defecation, before preparing food, before meals, and after meals, are critical for preventing fecal-oral disease transmission [5]. Mothers or care givers are engaged in fecal-oral disease transmission, particularly during disposing of feces and urine, attending to sick people, handling waste, and contact with domestic animals, in which their hands unintentionally pick up micro-organisms and other materials that may be harmful to children [5].

The World Health Organization (WHO) estimates that 3.8 million children under the age of five die each year from diarrhea and acute respiratory tract infections [6]. Water, sanitation, and hygiene (WASH) interventions could prevent almost the same number of child deaths as hand washing alone, which was estimated to avert about 170,000 deaths from diarrhea and pneumonia [7]. Approximately 86, 000 children under five in Ethiopia die every year from inadequate WASH services and practices. Even though people around the world wash their hands with water, many do not wash their hands with soap at critical moments [8]. The challenge is to transform hand washing with soap from an abstract good idea into an automatic behavior carried out in homes and communities [9]. Globally, the rates at which hands are washed with soap range from 0 to 34% of the time [10]. In developing countries, hand washing practices with soap have remained low [11]. In Ethiopia, the low status of WASH practices is a critical public health problem. The government of Ethiopia has planned to increase poor community-level hand washing practices by 35% by the end of 2019 [12].

In the last two decades, the government of Ethiopia has implemented various strategies in order to prevent and control diseases and provide primary health care (PHC) services at the community level by developing the Health Sector Development Program (HSDP). In addition, the government of Ethiopia introduced a community-level intervention called the Health Service Extension Package (HSEP) to improve preventative, promotive, and basic health care services at the household level [13]. These health extension packages comprise sixteen packages, of which seven cover hygiene and environmental sanitation: excreta disposal, solid and liquid waste disposal, water quality control, food hygiene, proper housing, vector control (arthropods and rodent control), personal hygiene, and health education (a cross-cutting activity for all packages) [14]. The strategy to implement health extension packages is to make every household a model household by providing a minimum of 72 h of training to bring about positive behavioral change in hygiene and sanitation practices [14].

Studies conducted after the implementation of health extension packages indicated that there was an increase in latrine coverage and utilization, a reduction in childhood diarrhea, awareness of different health issues, an increase in immunization coverage, and increased maternal service utilization [15–18]. Model households are the priority area and are expected to know and practice the "hand washing" component as innovators and benchmark their activities against those of non-model households. Although there are many studies on hand washing practices in Ethiopia, little is known about the hand washing behavior of mothers from model and non-model households at critical moments. Hence, this study aimed to assess mothers' hand washing practices and associated factors among mothers from model and non-model households in Bibugn district, North West Ethiopia.

2. Methods

2.1. Study area and period

Bibugn district is located 383 km and 187 km north of Addis Ababa (Ethiopia's capital city) and Bahir Dar (Amhara region's capital city), respectively. The total population of the district is 94,153, of which 46,157 are males and 47,997 are females, and there are 12,748 under five age children. The district comprises 18 kebeles (smallest administrative unit), 3 urban and 15 rural, having a total of 21,896 residential houses, of which 2,630 are model households for the health extension program. The district's water supply coverage was 96%. In this district, there are four health centers, 18 health posts and two private health centers [19].The study was conducted from February 15–30, 2019 in the Bibugn district.

2.2. Study design

A community-based comparative cross-sectional study was conducted to assess the magnitude and associated factors of critical time hand washing practices among mothers who had at least one child under five in model and non-model households in Bibugn district.

2.3. Population

The source population was all mothers in the rural kebeles of the district. The study population was mothers who had at least one child under the age of 5 years in the selected kebeles (smallest administrative unit). The study unit was a mother who was randomly selected from total mothers found in selected kebeles.

2.4. Eligibility criteria

Inclusion criteria: Mothers who have been living in the study area for at least six months.
Exclusion criteria: Mothers who were severely ill during the survey were excluded from the study.

2.5. Sample size determination

The sample size was calculated for each objective, and the objective with the largest sample size was chosen. The sample size was determined by using Epi Info (Epidemiological Information) version 7 and considering the following assumptions: Odds ratio of 2.00, P1 = proportion of hand washing among non-model households 37%, p2 = proportion of hand washing among model households 54%, r = allocation of ratio among groups 2:1, CI (confidence level) = 95% and β = power of the study = 80%. The sample size was n1 = 108, n2 = 216; using design effect 2 and 10% non-response rate; the final sample size was 720 (240 model households and 480 non-model households).

2.6. Sampling technique and procedure

A multistage sampling method was used to get the required sample size. At the first stage, the sampling procedure was stratified into model and non-model kebeles. Of the total kebeles in the district, there are three model kebeles and twelve non-model kebeles. Two kebeles from the model and four kebeles from the non-model are selected using a simple random sampling technique. The number and list of eligible households were obtained from Kebeles Health Post registration. A proportional allocation of the sample size was made to determine the number of households that had to be included in the study from each kebele. Finally, the study subjects were selected using a simple random sampling technique using the total households of selected kebeles as a sampling unit. A randomly selected study subject who is not available on three consecutive days during data collection is substituted by the next household from the same kebele and model status category.

2.7. Variables

Dependent variable: Hand washing practice

Independent variables:

Socio-demographic and economic characteristics: age, family size, education level, marital status, occupation, wealth index, and number of children under the age of five.

Hand washing facilities: water access, availability of soap, availability of a water container, and a soap container.

Behavioral variables: knowledge about the importance of hand washing, attitude towards hand washing, and utilization of soap.

2.8. Operational definitions

Critical times: This includes before preparing food, before eating a meal, before feeding a child, after visiting a latrine, after cleaning child's bottom/dispose of child stool, and after cleaning a house [9].

Model household: Household who nominated as 'model household' by health extension workers and health officials after fulfillment of the required health extension packages.

Non-model household: Household who were not nominated as 'model household' by health extension workers and health officials.

Good knowledge: mothers who answered ≥80% of knowledge questions correctly.

Positive attitude: mothers who answered ≥80% of attitude questions correctly.

Good practice: mothers who wash their hands with water and soap/ash at four or more critical times.

2.9. Data collection tool and procedure

Data collection was conducted using a pre-tested interviewer-based structured questionnaire and observation checklist, which were adapted from similar previous studies [20–24]. The questionnaire was prepared in English and then translated into Amharic (local language) and back to English to maintain consistency. The questionnaire was designed in three parts: socio-demographic and economic characteristics of the household (12 items); hand washing practice (9 items); and mother's knowledge (17 items); mother's attitude (9 items); and environmental characteristics (9 items). Face-to-face interviews were used to collect data from study participants by 24 trained data collectors, and the data collection process was supervised by two supervisors and the principal investigator. In addition, an observation checklist was used to collect data regarding the availability of hand washing facilities, such as water access, availability of soap, availability of water container.

2.10. Data quality control

Adequate training was given to data collectors and supervisors before the actual data collection regarding the aim of the study, the data collection tool, and the procedures for going through the questionnaires. The questionnaire was checked and pretested on 21 mothers (5% of the total sample size) before the actual data collection started. The completed questionnaires were spot-checked and reviewed by the principal investigator and supervisors to ensure the completeness and consistency of the information collected. Before data analysis, each questionnaire was checked for completeness, and appropriate data cleaning was performed.

2.11. Data management and analysis

Data was entered using Epi Info (Epidemiological Information) version 7 and exported to SPSS (Statistical Package for Social Science) version 20 for data management and analysis. Descriptive statistics such as frequency and percentages were computed and presented by text, tables and graphs. The household's wealth index was determined using Principal Component Analysis (PCA) in SPSS. To compute the household wealth index the household assets such as farm land, domestic animals, mobile phone, radio, household utilities, types of housing materials, availability of toilet and light source were assessed. Principal Component Analysis (PCA) was carried out using 10 variables. Five of the variables were binary, while five variables were recoded to a meaningful variable. It was measured by giving a score of "1″ for possessing each of 5 items in the list, and those five variables having a different scoring system were used according to their value. Finally, we ranked the extracted component into terciles (three groups) each group holding about one third of households. The household that belongs to the first group was categorized as the "poor" and the households that belong to the second, third were classified as "Middle" and "Rich" respectively.

Bi-variable and multivariable logistic regression analysis were used to assess the association between factors and hand washing practice The assumptions of logistic regression (model adequacy and multicollinearity of the independent variables) were checked using appropriate methods. The absence of multi-collinearity was checked by the variance inflation factor (VIF). Model adequacy was checked using the Hosmer and Lemeshow goodness of fit test. Variables that had a P value < 0.2 with a 95% confidence interval during the bi-variable logistic regression were included in the multivariable logistic regression analysis to see the relative effect of confounding variables and interactions of variables. An adjusted odd ratio with 95% confidence intervals and a significance level of $P < 0.05$ was used to see the association between factors and hand washing practice.

3. Results

3.1. Socio demographic characteristics

A total of 720 mothers (240 from model households and 480 from non-model households) participated in the study, with a response rate of 100%. The (Mean ± SD) age of mothers from non-model households was 34.8 ± 5.4 years, while mothers from model households were 29.6 ± 2.5 years. The majority (90.4%) of mothers from model households and 93.1% of mothers from non-model households were farmers. Of the study participants, 41.9% can't read and write, and only 41.2% of the households were in the rich wealth index category. (Table 1).

3.2. Availability of hand washing facilities

Hand washing facilities were more common among model households (64.2%) than non-model households, which were at 40.4%. Regarding soap availability, 57.5% and 44.6% of model households and non-model households have soap for hand washing, respectively (Table 2).

Table 1
Socio-demographic characteristics of respondents from Bibugn district, Northwest Ethiopia, 2019. (n = 720).

Variables	Categories	Non- model HH (n = 480)	Model HH(n = 240)
		n (%)	n (%)
Age	≤24	12 (2.5)	6 (2.5)
	25–34	199 (41.5)	225 (93.8)
	≥35	269 (56)	9 (3.8)
	Mean ((±SD)in years	34.8 + 5.47	29.6 ± 2.5
Marital status	Married	418 (87.1)	216 (90.0)
	Others*	62 (12.9)	24 (10)
Occupation	Housewife	11 (2.3)	24 (10.0)
	Farmer	449 (93.5)	216 (90.0)
	Others**	20 (4.2)	0 (0)
Educational level	Unable to read & write	256 (53.3)	46 (19.2)
	Able to read & write	194 (40.2)	188 (78.3)
	Primary	24 (5.0)	3 (1.3)
	Secondary& above	6 (1.3)	3 (1.3)
Wealth index	Poor	172 (35.8)	104 (43.3)
	Middle	89 (18.5)	58 (24.2)
	Rich	219 (45.6)	78 (32.5)
Family size	≤5	211 (44)	116 (48.3)
	>5	279 (56.0)	124 (51.7)
Number of children <5 year old	1	324 (67.5)	215 (89.6)
	≥2	156 (32.5)	25 (10.4)

*Single, widowed, separate & divorced; ** government employee & private employee HHs: Households, SD: standard deviation.

Table 2
Access to hand washing facilities in Bibugn district, Northwest Ethiopia (n = 720).

Variable	Categories	Model household N (%)	Non model household N (%)
Water availability	≥20 L	92 (61.7)	135 (28.1)
	<20 L	148 (38.3)	345 (71.9)
Time to fetch water (minutes)	<15	36 (15)	36 (11)
	15–30	181 (75.4)	295 (61.5)
	>30	23 (9.6)	131 (22.3)
Soap availability	Yes	138 (57.5)	214 (44.6)
	No	102 (42.5)	266 (55.4)
Availability of hand washing facilities	yes	154 (64.2)	194 (40.4)
	No	86 (35.8)	286 (59.6)

3.3. Respondents knowledge, and attitude about hand washing practices

The majority (89.7%) of mothers from model households have good knowledge on the importance of hand washing as compared to mothers from non model households, who have less knowledge (40.5%) (Fig. 1).

3.4. Respondents hand washing practices

At critical times, one fifth (20.3%) of mothers have good hand washing practices with water and soap/ash. The proportion of mothers who practice hand washing during critical times ranged from the highest, 33% before meals, and the lowest, 12.6% after visiting the toilet. The proportion of good hand washing practices with water and soap/ash was 26.7% among mothers from model households and 11.5% among mothers from non-model households. Specifically, 45.5%, 40%, 39.2%, and 22.9% of mothers from model households wash their hands with soap and water before meals, before child feeding, before preparing food, and after visiting the toilet, respectively. Hand washing with soap and water at all critical times was found to be lower among mothers from non-model households (Fig. 2).

3.5. Factors associated with critical time hand washing practices

In bi-variable logistic regression; age of mother, family size, number of <5 children, mother's educational status, wealth index, knowledge, availability of hand washing facility, distance from water source, soap availability, and availability of water were found to be candidates for multivariable regression analysis at a p-value ≤0.2 (Table 3).

Multivariable logistic regression analysis shows mothers who had soap and hand washing facilities were 5.64 times (AOR = 5.64, 95% CI: 3.12–10.22) and 1.88 times (AOR = 95% CI: 1.88, 2.18–2.98) more likely to practice hand washing than their respective counterparts. Mothers with one child under the age of five were 2.2 times (AOR = 2.2, 95% CI: 1.79–6.09) more likely to wash their hands than mothers with two or more children under the age of five. Mothers who had good knowledge were 3.49 times (AOR = 3.49,

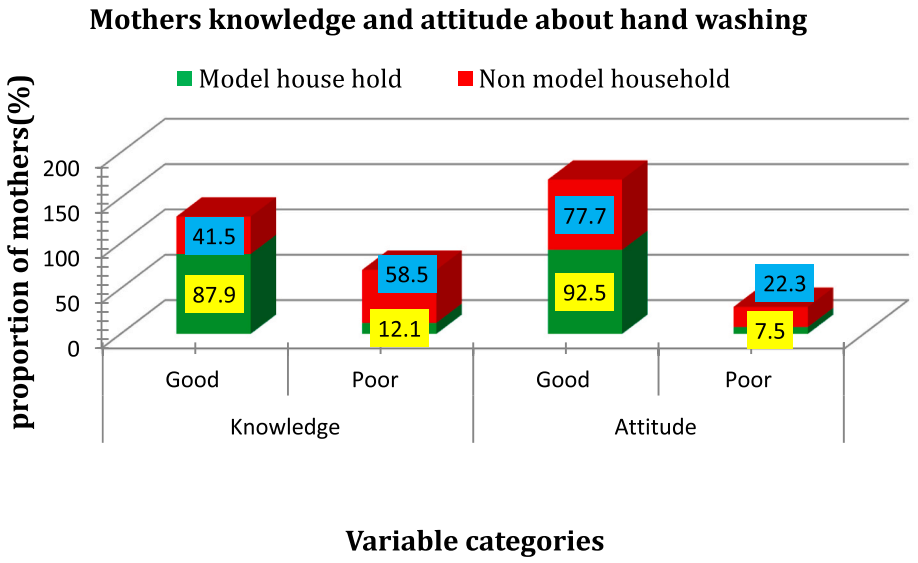

Fig. 1. Mothers knowledge and attitude about hand washing Bibugn district, Northwest Ethiopia.

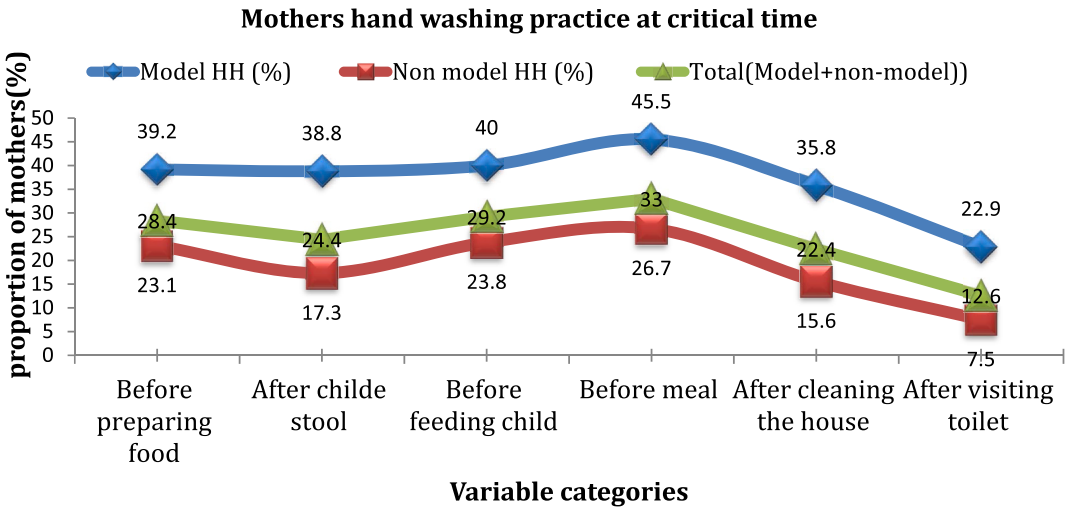

Fig. 2. Critical time hand washing practices among model and non model households, Bibugn district, Northwest Ethiopia.

Table 3
Factors associated with mothers hand washing practice in Bibugn district, Northwest Ethiopia (n = 720).

Variables	Categories	Hand washing practice		COR (95%CI)	AOR (95%CI)
		Good (n = 146)	Poor (n = 574)		
Age	≤24	4	14	1.56 (0.49–4.97)*	–
	25–34	99	325	1.67 (1.12–2.47)	
	≥35	43	235	1.00	
Educational status	Unable to read & writ	106	355	1.05 (0.21–5.11)	–
	Abel to read & write	32	191	0.59 (0.12–2.95)	
	Primary	6	21	1.00 (0.16–6.14)	
	Secondary& above	2	7	1.00	
Number of children <5 year old	One	117	326	3.07 (1.98–4.76)**	2.22 (1.79–6.09)*
	Two or more	29	248	1.00	1.00
Wealth index	Poor	62	194	1.00	–
	Middle	28	119	0.74 (0.45–1.22)	
	Rich	52	245	0.66 (0.44–1.01)	
Knowledge	Good	130	339	5.63 (3.27–9.72)**	3.49 (2.05–5.96)*
	Poor	16	235	1.00	1.00
Attitude	Positive	31	94	1.38 (0.87–2.17)	–
	Negative	115	480	1.00	
Availability of soap	Yes	117	217	6.64 (4.27–10.31)**	5.64 (3.12–10.22)**
	No	29	357	1.00	1.00
Availability of hand washing facility	Yes	123	424	1.89 (1.17–3.07)*	1.88 (2.18–2.98)*
	No	23	150	1.00	1.00
Round trip Time to fetch water	<15 min	29	60	4.97 (2.46–10.07)**	3.27 (2.16–4.94)**
	15–30 min	103	370	2.86 (1.56–5.17)	1.9 (1.35–2.88)
	>30 min	14	144	1.00	

A multivariable logistic regression model when adjusted for Age, educational status, Number of children <5 year old, Wealth index, Knowledge, Attitude, Availability of soap, Availability of hand washing facility, Round trip Time to fetch water, *p value < 0.05, **p value < 0.001, 1: reference value, CI=Confidence Interval; COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio.

95% CI: 2.05–5.96) more likely to practice hand washing than mothers who had poor knowledge. Hand washing practices were 3.27 times more likely (AOR = 3.27, 95% CI: 2.16–4.94) among mothers who had the closest (15-min) water source compared to those who had to travel more than 30 min (Table 3).

4. Discussion

In this study, mothers' hand washing practices with water and soap/ash at critical times were low (20.3%). The finding is lower than the study conducted in Gondar, Northwest Ethiopia [22], in Kersa, Southwest Ethiopia [21], and Debark town, Northwest Ethiopia [23] which shows 39.1%, 50.9%, and 52.2% of mothers' practicing good hand washing, respectively. The differences could be due to differences in study settings, as this study was conducted in a rural setting while the studies done in Gondar and Debark Town were done in a hospital and urban setting, respectively. The other possible explanation could be a variation in sample size, because this

study used a larger sample size than the studies done in Kersa and Debark Town.

The proportion of mothers who practice hand washing with water and soap during critical times ranged from 33% before meals and to 12.6% after visiting the toilet. The finding is slightly similar with the study done in Gedeo zone, Ethiopia which shows 32.4% and 28.7% of mothers usually wash their hands before meals and after defecation [25]. In contrast, the finding is lower than the study conducted in Gondar, Northwest Ethiopia, which shows 86.3% and 64.9% of the mothers wash their hands before meals and after visiting the toilet, respectively [22]. The difference could be that the study conducted in Gondar considered hand washing with only water as well as hand washing with soap and water practice, whereas this study reported only hand washing practice with soap and water.

In this finding, a critical time hand washing practices among mothers from model and non-model households was (26.7%) and (11.5%) respectively. The findings are similar to those of a study conducted in the Sheko district of south-west Ethiopia, which found that 34.3% of model households and 9.5% of non-model households practice hand washing [24]. The study findings are also supported by the findings from the study conducted in Hawassa, which showed differences in hand washing practices between model and non-model households [16]. The finding is lower than the study conducted in Wama Hagelo District, Western Ethiopia [26], which showed 74.9% of model and 50.3% of non-model households practicing hand washing during a critical time. The difference could be that model households have had different exposures to factors such as frequent training, technical support, and follow-up by health extension workers.

This study found that mothers who had good knowledge about hand washing were 3.49 times (AOR = 3.49, 95%CI = 2.05, 5.96) more likely to practice hand washing than their counterparts. The finding is in line with other studies that show knowledge adds positive outcomes to community health practices [27]. Mothers who had enough water ($\geq$20 L) were 2.22 times more likely (AOR = 2.22, 95% CI: 1.36–3.77) to wash their hands than those who did not. The finding is similar to the study conducted in Kenya, which reported that factors like poor availability of water affect hand washing practices and hand washing practices among mothers [28].

The odds of practicing hand washing among households who had one under-five child were 2.13 times (AOR = 2.13, 95% CI: 0.88-5-14) higher than households who had two or more children. The finding is supported by a study done in Indonesia which stated that mothers who have many children can be too busy for hand washing practices [29]. Another predictor of mothers' hand washing was the availability of hand washing facilities. Mothers who had access to hand washing facilities were 1.88 times (AOR = 1.88, 95% CI: 2.18–2.98) more likely to wash their hands than their counterparts. The finding is similar to those found in Karachi, which showed non-availability of hand washing facilities was reported as an important factor for poor adherence to hand washing [30]. Among variables entered into multivariable logistic regression Age of mother, educational status, attitude and wealth index were not significantly associated with mothers' hand washing practices during critical times.

Limitation of the Study: Data on hand washing practices were self reported by mothers and could be prone to under reporting. Social desirable bias due to lack of direct observation of hand washing at critical time were major limitation of the study.

5. Conclusion

One fifth of mothers of the study area practice hand washing at critical times. Hand washing practice at critical times shows significant differences between model and non-model households. Hand washing practices were predicted by knowledge, the availability of a hand washing facility, the availability of water, the availability of soap, and the number of children under the age of five. Availing hand-washing facilities through social marketing, increasing water accessibility, and strengthening awareness creation were important to improving hand-washing practices. Moreover, the strategy of making model households has to be expanded as model households have special focus of awareness creation, technical support, and follow-up by health extension workers to improve mothers' hand-washing practices.

Ethical consideration

Ethical clearance was obtained from Bahir Dar University College of Medicine and Health Science School of Public Health. A formal letter was submitted to the district. Permission was obtained from the head of district/kebele leaders and the community. During data collection, informed consent was obtained from each study respondent. All participants' right to be interviewed and their autonomy were respected.

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Author contribution statement

Agerie Abebe: conceived and designed the experiments, performed the experiments, analyzed and interpreted data, and wrote the paper.

Berhanu G Debela: performed the experiments, contributed reagents, materials, analysis tools or data, and wrote the paper.

Daniel Sisay W/tsadik: analyzed and interpreted data, and wrote the paper.

Getachew Assefa Zenebe: analyzed and interpreted data, contributed reagents, materials, analysis tools or data, and wrote the paper.

Habtamu Endashaw Hareru: analyzed and interpreted data, and wrote the paper.
Zemachu Ashuro: analyzed and interpreted data, and wrote the paper.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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