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# Predictors of Hand-Washing Practices at Critical Times Among Mothers of Under-5 Years Old Children in Rural Setting of Gedeo Zone, Southern Ethiopia

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## ABSTRACT

**BACKGROUND:** Various communicable and infectious diseases could be contained by proper hand washing leading to a reduction in mortality and morbidity of children.

**OBJECTIVE:** To assess predictors of hand-washing practices at critical times among mothers of under 5 years old children in rural setting of Gedeo zone, Southern Ethiopia.

**METHOD:** An institutional-based cross-sectional survey was conducted among 422 women with children under the age of 5 attended the Dilla Zuria health facility and were chosen using a systematic sampling method. Data was gathered using pre-tested interview-administered structured questionnaires. Data was entered into EPI info version 17 and analyzed using SPSS version 25. Binary logistic regression was employed to identify the association between dependent and independent variables. Finally, for variables with a  $P < .05$  in multivariable analysis, adjusted odds ratio (AOR) with a 95% confidence interval (CI) was determined and interpreted.

**RESULTS:** The hand washing practice of mothers at critical times was 44.9% [95% CI: 40.1, 49.7%]. The pertinent predictors were favorable attitude [AOR = 7.77, 95% CI: 4.56, 10.37], availability of water source near the household [AOR = 5.31, 95% CI: 3.56, 10.37], and constant availability of soaps at household [AOR = 2.32, 95% CI: 1.33, 6.70].

**CONCLUSION:** In our study, hand-washing practices at critical times was low. The pertinent predictors were attitude, the presence of a water source near the household, and the presence of soap. Therefore, it is advised to encourage domestic hygiene education to improve mothers' attitudes and to increase the availability of water and soap close to the household to promote handwashing with soap and water at critical times.

**KEYWORDS:** Hand washing at critical times, health facilities, mothers, predictors, Southern Ethiopia

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## Introduction

Hand washing on a regular basis is one of the best ways to remove germs, avoid getting sick, and prevent the spread of germs to others.<sup>1</sup> Hand washing at critical times in the community includes washing hands with water and soap after defecation, cleaning the child's defecated buttock, before cooking, before eating, and before feeding the child.<sup>2</sup> There are 5 main fecal-oral transmission routes (fluids, fingers, fields, flies, and food) through which pathogens can reach under-5 years old children in the home and cause enteric infection, which is a leading cause of under-5 years old mortality in low-income countries.<sup>3,4</sup> Diarrhea is more common among children under the age of 5 years old in communities

that lack adequate sanitation and hygiene. There has been a significant increase in diarrhea among children under the age of 5 as a result of a lack of hand washing facilities.<sup>5-7</sup>

In many countries, mothers play a central role in children's health, and their knowledge, attitudes, and practices have a significant effect on the maintenance of child health.<sup>8-12</sup> Inadequate water, sanitation, and hygiene (WASH) contribute to 88% of diarrhea cases.<sup>13</sup> According to a World Health Organization (WHO) report in 2010, 1 in every 5 households had at least 1 child under the age of 5 years old who had been infected with diarrhea due to polluted water and poor hygiene practices<sup>14</sup> and globally, 8 million children had died by 2012, mostly as a result of poor sanitation and unhygienic



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living circumstances.<sup>15</sup> Poor water, sanitation, and hygiene in developing countries contributes to malnutrition, delayed physical development, and early childhood mortality in children under the age of 5 years old, implying an underlying role of exposure to pathogenic bacteria and infection.<sup>12,16</sup>

Water, sanitation, and hygiene interventions focus on improving latrine facilities, communal and household water supply, and adult hygiene practices to prevent infectious disease via both primary (sanitation) and secondary (water treatment and handwashing) barriers, which could result in a significant reduction in environmental fecal contamination,<sup>17,18</sup> which contributes to the achievement of Sustainable Development Goal 3 (SDG-3) that focuses on the development of healthy lives and well-being for all children and assists in the prevention of preventable deaths among children under the age of 5 years old, with all countries aiming to reduce under-5 mortality to no more than 25 deaths per 1000 live births between 2017 and 2030.<sup>19,20</sup>

From hand hygiene maintaining methods hand washing with soap and water (HWWS) is considered the most cost-effective method to prevent the spread of the microorganisms.<sup>21-23</sup> Washing hands with soap and water at important recommended times (after defecation, cleaning the child's buttock who had defecated, before cooking, before eating, and before feeding the child) is the most effective method to prevent infections.<sup>2,24,25</sup> Handwashing with pure soap, on the other hand, is efficient at eliminating harmful microbes.<sup>21-23</sup> According to the current meta-analysis study, maternal hygiene intervention should result in a significant reduction in the risk of diarrheal disease in children under the age of 5 years old.<sup>26</sup> HWWS reduces respiratory and skin infections, including trachoma.<sup>13</sup> Hand washing at critical times with soap and water can also reduce cholera and dysentery by 48% to 59%.<sup>27</sup>

Under 5 years old, diarrheal disease is a major public health problem in Ethiopia, and it is one of the top 15 countries where nearly three-fourths of child deaths occur per 1000 live births. According to the Ethiopian Demographic Health Survey Report in 2016 (EDHS-2016) and other community-based studies, diarrheal diseases are a major public health problem in Ethiopia, causing excess morbidity and mortality among children, with a prevalence ranging from 12% to 28%.<sup>28-34</sup> As a result, mothers' hand washing practice at critical times is crucial to avoid under-5 years old children's morbidity and mortality from diarrheal diseases.

Based on our knowledge, there are few studies available,<sup>27,35,36</sup> and no published studies have been done on handwashing practice at critical times and associated factors among mothers of children under the age of 5 years old in the study area, despite the fact that the study area has a high prevalence of diarrhea (30.9%)<sup>37</sup> and frequent occurrences of cholera.<sup>38</sup> Therefore, this study aimed to assess hand washing practice at critical times and its associated factors among mothers of under-5 years old children to target the interventions in the study area. Improving

under-5 diarrhea prevention practices have the potential to benefit the entire community in the study area.

## Materials and Methods

### *Study setting, design, and period*

From January 1, 2021 to February 1, 2021, an institutional-based cross-sectional study was conducted in Gedeo zone, Dilla Zuria health facilities in Southern Ethiopia. Dilla Zuria Woreda is 359 km from Addis Ababa, Ethiopia's capital city, and 90 km from Hawassa, the capital of the Sidama regional state. According to a report from the wereda administration office in 2020, there are 19 kebeles with a total population of 139 014, out of which 21 700 were children under the age of 5. There are 5 government-owned health centers and 28 health posts in the woreda.

### *Population*

All mothers with under-5 year old children attended health facilities were considered as the source population. Mothers with under-5 year old children who presented in under-5 outpatient departments (OPD) and pediatrics services during the data collection period were the study population. Mothers with at least 1 under-5-year-old child attended the outpatient department and pediatric services were included, and the unit of analysis was under-5 years old children. On the other hand, mothers who were unable to communicate and had a severely ill child were excluded.

### *Sample size determination and sampling technique*

*Sample size determination.* The sample size was calculated under the assumption of a single population proportion formula, 2-sided confidence level (95% CI), 5% margin of error.

$$n = (z_{\alpha/2})^2 p (1 - p) / d^2 = (1.96)^2 (0.522) (0.478) / (0.05)^2 \approx 384;$$

where,  $n$  = Sample size,  $Z_{\alpha/2}$  = critical value (1.96),  $p$  = magnitude of hand washing practice at the critical times from a previous study conducted at Debarq town in 2018 was 52.2%,<sup>2</sup>  $d$  = margin of error = 0.05. Finally, by considering a 10% non-response rate, the final sample size for the first objective was 422.

Sample size for associated factors was also determined using a study conducted in Debarq town, northwest Ethiopia where maternal knowledge about handwashing was associated with hand washing practice at critical times,<sup>2</sup> and a study done in Hadaleala District, Afar Region, Northeast Ethiopia revealed maternal educational status was a significant factor associated with handwashing practice.<sup>39</sup> EPI Info version 7 Stat Calc software was used to determine the sample size for a cohort or cross-sectional study, assuming a 95% confidence interval (CI), an 80% power ( $P$ ), and an unexposed to exposed ratio (1:1), the result showed that by considering 10% non-response rate, the sample size was 136 and 163 for maternal knowledge on handwashing and educational status, respectively. Therefore, the final sample size for this study was 422.

*Sampling technique.* There are 5 health centers in the dilla zuria woreda of Gedeo zone (ie, Chichu, Sisota, Andida, Udo, and Tunticha) and all health centers were considered for the study. According to a monthly record report from health facility registration books, 856 mothers with children under the age of 5 attended health centers to get care for their children. The computed sample size (422) was allocated proportionally to each health center based on their monthly records of mothers with under the age of 5. A systematic sampling method was used to choose mothers from the daily patient record until the sample size was met ( $K$  (interval) =  $856/422 = 2$ ). Every second mother was interviewed after the first mother was chosen using the lottery method.

### Study variables

#### Dependent variable

*Hand-washing practices at critical times.* Measured using 5 items of hand washing practice (ie, after defecation, after cleansing the child's defecated buttock, before cooking, before eating, and before feeding the child) with a 4-point Likert scale (1 = always, 2 = usually, 3 = sometimes, and 4 = never). The responses were coded as 1 for always and usually, 0 for sometimes, and never. We have reclassified the study participants as "yes" for those who answered "always" or "usually" for hand washing practice at critical times and "no" for those who responded "sometimes" or "never" for hand washing practice at critical times in order to obtain a binary outcome.<sup>21,23,40</sup>

#### Independent variables

*Socio-demographic variables.* Such as age, education level (informal education, primary, secondary, college, and above), marital status (single, married, divorced, separated, and widowed), employment status (unemployed, private worker, government employee, merchant, and student), family size (in number), and monthly income (in Ethiopian Birr).

*Health-related/availability and accessibility variables.* Have you ever been attended by health extension workers (yes or no), the duration of the visit (at least once per month and never within a month), the types of water sources near the household (protected versus unprotected), the location of the hygiene facility (near to latrine, near to household, not separate place), the availability of the water source near the household (yes or no), and the constant availability of soaps near to the hand-washing location (yes or no).

*Maternal factors.* Knowledge (good, poor), attitude about hand washing at critical times (favorable or unfavorable).

### Operational definitions

*Hand washing.* Is the practice of washing hands with water and soap to get rid of dirt, grime, and microbes.<sup>41</sup>

*Hand-washing practices at critical times.* Washing hand with soap and water after toilet visiting, after cleansing the child's defecated buttock, before cooking (preparing food), before eating, and before feeding the child.<sup>42</sup>

*Knowledge about hand washing at critical times.* Mothers were asked 7 "Yes" or "No" knowledge questions (with a Cronbach's alpha of .86) about their knowledge of critical times for hand washing. Finally, the study participants whose scores were above the mean score of the sum of the knowledge questions were considered to have good knowledge.<sup>21,23</sup>

*Attitude about hand washing at critical times.* Mothers were asked about their attitude on 12 attitudinal questions (with a Cronbach's alpha of .89) on a 4-point Likert scale (1 = strongly agree, 2 = agree, 3 = disagree, and 4 = strongly disagree). Finally, we dichotomized the 4-point Likert scale attitude items for those respondents who responded strongly agree and agree as having a favorable attitude toward handwashing and disagree and strongly disagree as having an unfavorable attitude.<sup>23,43</sup>

### Data collection techniques and procedure

A structured, interview assisted pre-tested questionnaire adapted from different literature<sup>2,21,23,42-47</sup> was used to collect the data. The questionnaire was translated from English to the local languages (Amharic and Gedeuffa) for the sake of convenience for data collectors to easily conduct their interviews. The questionnaires were divided into 3 sections: socio demographic characteristic; the availability and accessibility of hygiene facilities; and knowledge, attitude, and practice of hand washing during critical times. A total of 8 female health professionals (2 environmental health, 4 Bachelor of Science (BSc) Nurse, and 2 BSc midwifery) were involved in the data collection process. One-day training was given for the data collectors about the data collection tool, techniques of interview, selection of study participants, and ethical issues throughout the data collection process.

The data collectors attended all health facilities and interview selected mothers of under-5 years old children. To avoid double recruitment, the identification number was indicated on the child medical card presented by mothers who had already been recruited.

### Data quality control/management

Maximum effort was made to ensure data quality by giving morning remarks on how to eliminate or minimize errors and take corrective actions on time. Data collectors and supervisors were trained to ensure that they understood the study's goal and the data collection procedure. In order to ensure accurate answers to questions with asterisks and maintain the instruments' original meaning, the questionnaire was pre-tested on

5% of the sample in Wenago town, which has many of the same characteristics as the study area. The number and contents of the items measuring knowledge, attitude, and hand-washing at critical times were modified. Daily, immediate supervisors and principal investigators checked the collected data for completeness. After ensuring consistency and completeness, the supervisors handed over the completed questionnaire to the principal investigator, who double-checked it to ensure the data's quality. Daily field supervision and spot-checking was carried out in a continuous and strict manner.

#### Data processing and analysis

The data was entered into EPI info version 17 and then exported to the Statistical Package for Social Sciences (SPSS) version 25 for analysis. In order to describe categorical variables, frequency and percentage were utilized. The mean and standard deviation were applied to continuous variables. Both bivariable and multivariable logistic regression analysis was employed to identify the association of independent variables with the outcome variable. Those variables having a *P*-value less than .25 in the bivariable logistic regression analysis were entered into the multivariable logistic regression analysis. Finally, those variables with a *P*-value of less than .05 in multivariable logistic regression analysis were declared significant factors associated with hand washing practice at critical times. The result of the final model was estimated and interesting using the adjusted odds ratio (AOR) with 95% confidence intervals (CI).

## Results

### Socio-demographic characteristics of mothers

A total of 408 mothers with children under the age of 5 who were attending Dilla zuria health facilities were participated in this study, with a response rate of 96.7%, the remaining 3.3% of non-respondents were due to lack of interest to participate and withdraw at the middle of the interview. The mean ( $\pm$  standard deviation (SD)) age was 31.9 ( $\pm$ 7.7) years with 173 (42.4%) of the participants were found in the age group of 25 and 34 years. The majority of mothers (90.0%) were married. Nearly half (47.5%) of the mothers finished primary school. Nearly half (49.0%) of the study participants were housewives. Half (50.2%) of the participants had more than 5 family members. Furthermore, the mean monthly ( $\pm$  SD) income of the participants were 3121  $\pm$  2249 Ethiopian Birr (ETB) with 263 (64.5) of the participants earns below 3121 ETB per month (Table 1).

### Availability and accessibility of hygiene facilities

Out of the total 408 participants, 297 (72.8%) of the households were ever attended by health extension workers (HEWs). Of these, 104 (35.0%) were attended by HEWs at least once per month.

**Table 1.** Socio-demographic characteristics of the mothers of under-5y children attended in Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021 (n=408).

VARIABLES	CATEGORY	FREQUENCY (%)
Age (y)	15-24	81 (19.9)
	25-34	173 (42.4)
	35 and above	154 (37.7)
	Total	408 (100)
Marital status	Single	10 (2.5)
	Married	367 (90)
	Divorced	12 (2.9)
	Separated	16 (3.9)
	Widowed	3 (0.7)
	Total	408 (100)
Educational status of the mother	No formal education	100 (24.5)
	Primary	194 (47.5)
	Secondary and above	114 (28)
	Total	408 (100)
Occupational status of the mother	Unemployed	211 (51.7)
	Employed	57 (14)
	Merchants	140 (34.3)
	Total	408 (100)
Family size ( in number)	<5	203 (49.8)
	$\geq$ 5	205 (50.2)
	Total	408 (100)
Monthly income (mean)	<3121	263 (64.5)
	$\geq$ 3121	145 (35.5)
	Total	408 (100)

About 260 (63.7%) of the participants reported that they have no sufficient water for hand washing at home. Nearly two-third (63.2%) of the participants had a protected water source around the household, 174 (42.6%) had hand washing facilities near the household and more than 3-quarter (76.2%) of the participants had constant availability of soaps near the handwashing location (Table 2).

### Knowledge of hand washing practice at critical times

Participants were interviewed for 7 knowledge based questions about hand washing at critical times; Out of 408 study participants, 346 (84.8%) had ever heard about hand washing at critical times. About 186 (45.6%) know the importance of

**Table 2.** The availability and accessibility of hygiene facilities among mothers of under-5y children attended Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021 (n=408).

VARIABLES	CATEGORY	FREQUENCY (%)
Ever been attended by health extension workers (HEWs)	No	111 (27.2)
	Yes	297 (72.8)
	Total	408 (100)
If you visted by HEWs, how often do the health extension workers attended you	At least once per month	104 (35.0)
	Never attended within a month	193 (65.0)
	Total	297 (100)
Availability of water source near the households	No	260 (63.7)
	Yes	148 (36.3)
	Total	408 (100)
If “Yes”for the above questions, what ypes of water sources are available near the households	Protected water source	71 (47.9)
	Unprotected water source	77 (52.1)
	Total	148 (100)
Type of hand washing facility	Water only	74 (18.1)
	Water and soap	253 (62.0)
	Water and ash	81 (19.9)
	Total	408 (100)
The location of your hand washing facility	Near to latrine	120 (29.4)
	Near to household	174 (42.6)
	Not separate place	114 (27.9)
	Total	408 (100)
Constant availibility of soaps near the handwashing location	Yes	311 (76.2)
	No	97 (23.8)
	Total	408 (100)

handwashing at critical times, 179 (43.9%) participants know critical times of hand washing helps to reduce gastrointestinal disease, 194 (47.5%) know hands need to be washed at least for 20seconds (Table 3).

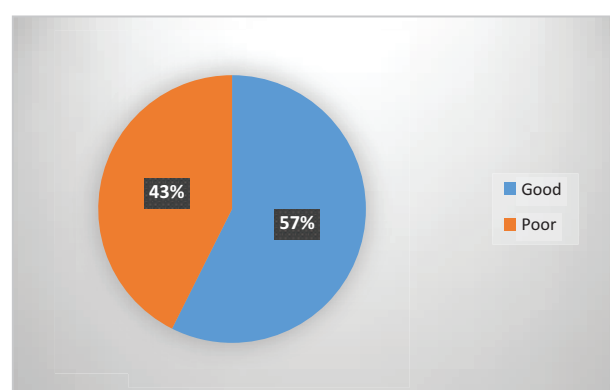
Out of the total 408 participants, 234 (57.4%) had a good knowledge about hand washing practice at critical times (Figure 1).

*Attitude toward hand washing practice at critical times*

Out of the total 408 study participants, 48 (11.8%) strongly agreed on washing hands after toilet visits could prevent disease. While, 33 (8.1%) and 22 (5.43%) were agree and strongly agree on nail cleanliness is important to prevent foodborne

**Table 3.** Knowledge of hand washing practice at critical time’s among mothers of under 5y children attended Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021 (n=408).

KNOWLEDGE ITEMS	CATEGORY	FREQUENCY (%)
Ever heard about critical times of hand washing	Yes	346 (84.8)
	No	62 (15.2)
	Total	408 (100)
Know importance of hand washing at critical times	Yes	186 (45.6)
	No	222 (54.4)
	Total	408 (100)
Critical times hand washing helps to reduce gastrointestinal disease	Yes	179 (43.9)
	No	229 (56.1)
	Total	408 (100)
Know hands need to be washed at least for 20s	Yes	194 (47.5)
	No	214 (52.5)
	Total	408 (100)
Hands not washed properly can transfer disease	Yes	190 (46.6)
	No	218 (53.4)
	Total	408 (100)
Know mothers have a significant role in the hand hygiene	Yes	223 (54.7)
	No	185 (45.3)
	Total	408 (100)
Long nails can harbor and easily transfer disease	Yes	209 (51.2)
	No	199 (48.8)
	Total	408 (100)

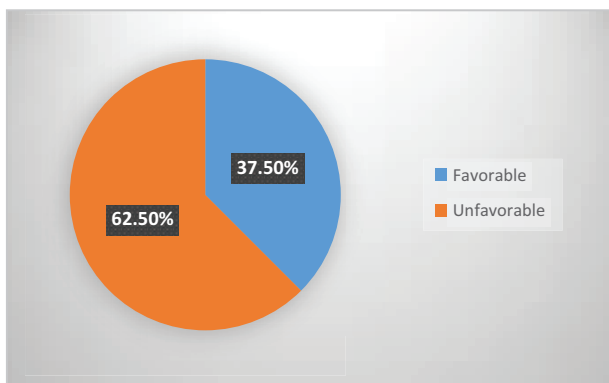


**Figure 1.** Knowledge of hand washing practice at critical times among mothers of under 5 years old children attended Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021.

diseases, respectively. Only 36 (8.8%) and 31 (7.6%) agree and strongly agree, respectively using hand towels after washing hands reduces the bacterial load on hands (Table 4). Therefore, out total 408 participants, 153 (37.5%) had a favorable attitude toward hand washing practice at critical times (Figure 2).

**Table 4.** Attitude toward hand washing practice at critical time's among mothers of under-5y old children attended Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021 (n=408).

ATTITUDE ITEMS	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
	N (%)	N (%)	N (%)	N (%)	N (%)
Washing hands after toilet visit prevent disease.	95 (23.3)	106 (26.0)	113 (27.7)	46 (11.3)	48 (11.8)
Washing hands with soap and water after toilet visit is a crucial practice.	91 (23.3)	123 (30.1)	80 (19.6)	66 (16.2)	48 (11.8)
Washing hands with soap and water before eating reduces diseases.	94 (23.0)	106 (26.0)	106 (26.0)	46 (11.3)	56 (13.7)
Nail cleanliness is important to prevent foodborne disease.	119 (29.2)	124 (30.4)	110 (27.0)	33 (8.1)	22 (5.4)
Using hand towels will reduce bacterial load.	116 (28.4)	117 (28.7)	108 (26.5)	36 (8.8)	31 (7.6)
It is the responsibility of mothers to teach their children about washing hands at critical time.	133 (32.6)	104 (25.5)	106 (26.0)	34 (8.3)	31 (7.6)
Knowledge on proper hand washing procedure at critical times helps for better hand washing practices.	119 (29.2)	103 (25.2)	120 (29.4)	40 (9.8)	26 (6.4)
Washing hands at critical times is the main priority in disease prevention.	118 (28.9)	113 (27.7)	119 (29.2)	40 (9.8)	18 (4.4)
Following standard procedures for hand washing is my habitual action.	95 (23.3)	124 (30.4)	109 (26.7)	35 (8.6)	45 (11.0)
Frequently and appropriately washing hands can reduce disease burden among families.	102 (25.0)	129 (31.6)	107 (26.2)	32 (7.8)	38 (9.3)
Do you agree that the absence of soap is the reason for not washing hands.	87 (21.3)	91 (22.3)	127 (31.1)	39 (9.6)	64 (15.7)
Health education helps to improve hand hygiene	103 (25.2)	113 (27.7)	106 (26.0)	34 (8.3)	52 (12.7)



**Figure 2.** Attitude toward hand washing practice at critical time among mothers of under-5years old children attended Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021.

### Hand washing practice at critical time

Out of 408 mothers, 132 (32.4%), 102 (25.0), and 121 (29.7) of mothers always wash their hand with water and soap before eating, before food preparation, and after cleansing defecated child's buttock, respectively (Table 5). Consequently, 183 (44.9%); (95% CI: 40.1, 49.7) of mothers had hand-washing practices at critical times (Figure 3).

### Factors associated with hand washing practice at critical times

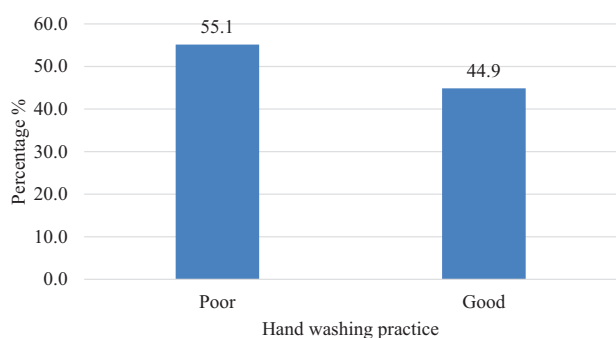
In the bivariable logistic regression analysis those factors that have  $P < .25$  were a candidate for multivariable logistic regression analysis were; age (years), women educational status, woman main occupation, household monthly income, household size, knowledge about hand washing at critical times, attitude about hand washing at the critical time, availability of water source at home and constant availability of soaps near the handwashing location.

In the multivariable logistic regression analysis those variables whose  $P < .05$ ; Mothers who had primary, secondary, and above in educational status, household monthly income above 3121 ETB, favorable attitude about hand washing at critical times, availability of water source at home, and constant availability of soaps near the handwashing location was declared as statistically significant factors associated with hand washing practice at a critical time.

Mothers who had primary in educational status [AOR = 3.68, 95% CI: 1.80, 7.48] and secondary and above educational status [AOR = 4.05, 95% CI: 1.87, 8.78] were more likely to practice hand washing practice at critical times. Mothers with the

**Table 5.** The level of critical times hand washing practice among mothers of under-5y old children attended Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021 (n=408).

HANDWASHING PRACTICE AT CRITICAL TIME ITEMS	NEVER	SOME TIMES	ALWAYS	USUALLY
	N (%)	N (%)	N (%)	N (%)
How often do you wash your hands with water and soap before eating?	88 (21.6)	104 (25.5)	132 (32.4)	84 (20.6)
How often do you wash your hands with water and soap before food preparation?	91 (22.3)	109 (26.7)	102 (25.0)	106 (26.0)
How often do you wash your hands with water and soap before feeding child?	110 (27.0)	84 (20.6)	110 (27.0)	104 (25.5)
How often do you wash your hands with water and soap after cleansing defecated child's buttock?	93 (22.8)	110 (27.0)	121 (29.7)	84 (20.6)
How often do you wash your hands with water and soap after toilet visit?	96 (23.5)	83 (20.3)	116 (28.4)	113 (27.7)



**Figure 3.** Critical time of hand washing practice among mothers of under-5 years old children attended Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021.

household monthly income of above 3121 ETB was 2.33 times more frequently had hand washing practice at critical times [AOR=2.33, 95% CI: 1.43, 3.48] as compared with those who with lower than 3121 ETB. Favorable attitude about hand washing at critical times [AOR=7.77, 95% CI: 4.55, 13.27] were significantly higher as compared with their counterparts. mothers with a water source near the household were 5 times more likely to practice good hand washing at critical times than those without [AOR=5.31, 95% CI: 3.56, 10.37]. Furthermore, mothers who had constant availability of soap near the hand-washing location were twice as likely as the counterpart to practice good hand washing at critical times [AOR=2.32, 95% CI: 1.33, 6.70] (Table 6).

**Discussion**

In this study, 44.9% [95% CI: 40.1, 49.7%] of participants had good hand washing practice at critical times. This is consistent with previous studies, which found that 47.5% of mothers in Oghara, Delta state<sup>48</sup> and 46.5% of mothers in Woldia Town, Ethiopia,<sup>34</sup> had good handwashing practice at critical time.

The finding of this study was lower than a study conducted in Debark town, northwest Ethiopia, reports good hand washing practice at critical times among of mothers of under-5 years old children was 52.2%,<sup>49</sup> and a Nigerian study which reports

56% of mothers practiced regular washing of hands at critical moments.<sup>21</sup> The lower hand washing practice in the study setting as compared to the previous study, might be due to poor health promotion activities on personal and environmental hygiene and lower media coverages. Furthermore, mothers in the study setting may have been unable to understand the risk of infection, sources of contamination, and fecal-oral transmission pathways, as well as a lack of safe water and soap for hand washing practices.

The current finding was higher than an institutional-based study conducted at Gonder University in northeast Ethiopia (39%),<sup>35</sup> and another community-based cross-sectional study conducted in the Mareka District of southern Ethiopia (21.5%).<sup>50</sup> Furthermore, the finding was higher than in other studies, where 26% of mothers reported always washing their hands with soap and water at critical times in a Bangladesh study,<sup>6</sup> and 38.2% in a Nigerian study conducted in Etsako, West local government area.<sup>51</sup> This discrepancy might be due to difference in socio-economic status, study design, study setting, household complies with Health extension package and data collection period. Furthermore, the difference could be due to differences in measuring tools, health-care coverage, and utilization and it also might be related to access to soap and access to good quality and quantity of running water.

The current study revealed that the mothers who had primary, secondary, and above education were more likely practice hand washing at critical times. This result was similar to a study conducted in Debark town northwest Ethiopia,<sup>49</sup> Northwest Ethiopia,<sup>35</sup> and in Port Harcourt, Nigeria showed that HWWS at critical times was positively associated with mothers' level of education.<sup>51</sup> This could be because educated mothers were more likely to be aware of the recommended hygiene practices provided by local health extension workers, as well as the links between handwashing and infection. Furthermore, they are more likely to properly handle drinking water in the home, aware of the source of contamination and might had more information diarrheal disease can be prevented by handwashing with soap and water.



**Table 6.** Logistic regression analysis of factors associated with critical time hand washing practice among mothers of under-5y old children attended Dilla zuria health facilities, Gedeo zone, Southern Ethiopia, 2021 (n=408).

VARIABLES	HAND WASHING PRACTICE		COR (95% CI)	AOR (95% CI)
	GOOD (%)	POOR (%)		
<b>Age (y)</b>				
15-24	38 (46.9)	43 (53.1)	1.95 (1.12, 3.39)	1.18 (0.63, 2.24)
25-34	97 (56.1)	76 (43.9)	2.81 (1.78, 4.44)	1.61 (0.80, 3.24)
35 and above	48 (31.2)	106 (68.8)	1.00	1.00
<b>Women educational status</b>				
No formal education	21 (21.0)	79 (79.0)	1.00	1.00
Primary	91 (46.9)	103 (53.1)	3.33 (1.89, 5.89)	3.67 (1.80, 7.48)*
Secondary and above	71 (62.3)	43 (37.7)	6.21 (3.36,11.45)	4.05 (1.87, 8.78)*
<b>Woman occupation</b>				
Unemployed	64 (30.3)	147 (69.7)	1.00	1.00
Employed	35 (61.4)	22 (38.6)	3.65 (1.98, 6.71)	1.17 (0.54, 2.52)
Merchants	84 (60.0)	56 (40.0)	3.44 (2.202, 5.39)	1.54 (0.86, 2.76)
<b>Household monthly income (mean)</b>				
Less than 3121 ETB	94 (35.7)	169 (64.3)	1	1
Greater or equal to 3121 ETB	89 ( 61.4)	56 (38.6)	2.86 (1.89, 4.35)	2.33 (1.43,3.48)*
<b>Total household size</b>				
<5	105 (51.7)	98 (48.3)	1.74 (1.17, 2.58)	1.68 (0.99, 2.85)
≥5	78 (38.0)	127 (62.0)	1.00	1.00
<b>Knowledge</b>				
Good	108 (46.2)	126 (53.8)	1.13 (0.76, 1.68)	1.48 (0.89, 1.93)
Poor	75 (43.1)	99 (56.9)	1.00	1.00
<b>Attitude</b>				
favorable	114 (54.5)	39 (25.5)	7.88 (4.99, 12.44)	7.77 (4.55,13.27)*
Unfavorable	69 (27.1)	186 (72.9)	1.00	1.00
<b>Availability of water source near household</b>				
Yes	106 (71.6)	42 (28.4)	6.00 (3.84, 9.37)	5.31 (3.56,10.37)*
No	77 (29.6)	183 (70.4)	1.00	1.00
<b>Constant availability of soaps near the handwashing location</b>				
Yes	157 (50.5)	154 (49.5)	2.78 (1.69, 4.59)	2.32 (1.33, 6.70)*
No	26 (26.8)	71 (73.2)	1.00	1.00

Abbreviations: NB: AOR, adjusted odds ratio; COR, crude odds ratio; ETB, Ethiopian Birr.

\* $P < .05$  (statistically significant).

Participants with higher monthly income were more likely practice good handwashing at critical times. This could be because those with higher income have access to more water for hand washing and easily afford hand hygiene products.

Mothers with a favorable attitude reported more hand washing practice at critical times. This was in line with previous Nigerian,<sup>42,52</sup> Ethiopians,<sup>35,53</sup> and Ugandan<sup>54</sup> studies. This could be due to Mothers' access to information is important in

terms of influencing behavior because information dissemination and knowledge sharing are key behavioral determinants.<sup>52</sup> As a result, exposure to hand washing information will result in a high level of knowledge, which has resulted in a positive attitude and reception.

Mothers with a water source near the household more likely to practice good hand washing at critical. This is in line with previous studies.<sup>2,21</sup> which found water availability to be a crucial determinant of hand washing practice, which means having a reliable source of water at home must be a top priority for practicing proper hand washing at important times. This study finding was also supported by a study conducted in Kenya<sup>55</sup> among mothers which reported that, those mothers who didn't have adequate water at their home poorly practices hand washing. Therefore, mothers of children under the age of 5 should be educated on the availability of water and proper handling practices in the home in order to practice hand washing at all times.

Moreover, mothers with households of constant availability of soap near the handwashings location were t more likely to practice good hand washing at critical times. This finding is in line with previous study done in Karachi, India<sup>56</sup> which found that the lack of constant availability of hand washing facilities including access to water and soaps at home were key factors in lowering hand washing commitment among mothers. After critical events, proper hand washing; using safe water and soap removes transient potentially harmful pathogens from hands, and simple hand washing with merely water is insufficient.<sup>57</sup> This could be due to a lack of consistent hand washing facilities (water and soap), which could have an impact on hand washing practices during critical times. Mothers do not wash their hands if water and soap are not available, even though they are aware of the importance of handwashing.

The study's implication was that it contributes to SDG-3 achievement by initiating a maternal hygiene education intervention for mothers with children under the age of 5 in promoting domestic hygiene practice, which is one of the most effective means of reducing the global burden of diarrheal diseases, the spread of other infectious diseases, and improving the health and well-being of children under the age of 5, thereby contributing to the reduction of under-5 mortality.

#### *Strength and limitations of the study*

The study's strength is the use of primary data from mothers who had a significant impact on disease prevention and health promotion for children under the age of 5. As to the limitation, recall bias and social desirability bias (participants respond practice questions positively based on what they perceived to be expected of them), could result in an under estimation of practices of handwashing at critical times. Despite the fact that mothers play an important role in child health, the role of other partners, such as fathers, in disease transmission and child health cannot be assessed. Wealth index measurement and the

perception of the participants toward hand washing practice at critical times were not addressed. Moreover, other sources of contamination in the household, particularly from the viewpoints of children, were not measured and should be taken into account in future research. We urge researchers to conduct comparable research on additional household sources of contamination, particularly from the perspectives of children' and mothers' perceptions of the need of practicing handwashing at critical times using a qualitative approach.

#### **Conclusion**

In this study, hand-washing practices at critical times among mothers was found to be low. Mothers with primary and secondary education status, household income, and favorable attitudes toward hand washing practice at critical times, availability of water source, and constant availability of soaps near the handwashing location were positively associated with good hand washing practice at critical times.

Through house-to-house visits by health extension workers, mothers with children under the age of 5 would benefit from receiving hygiene education about the primary sources of contamination and the primary fecal-oral transmission pathways in order to improve their attitudes toward handwashing practice at crucial times. Moreover, it is advised that the government endeavor to increase household water accessibility by providing each home with access to clean water and sanitary facilities and encouraging mothers to wash their hands at crucial moments.

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#### **Author Contributions**

AA, HEH, WA, and AAG involved in the conceptualization, design, analysis, interpretation, and drafting of the original manuscript, as well as critical revision for intellectual content. TM, AWK, DSW, BN, MTL, ZA, MBA, and NES involved in the study design, data analysis, data interpretation, and revision. All authors agree to be accountable for all aspects of the work and have approved the final version of the manuscript to be published.

#### **Availability of Data and Materials**

All data underlying the findings described in the manuscript are fully available without restriction.

#### **Ethical Consideration**

Ethical approval was obtained from the Institutional Review Board (IRB) of Dilla University College of Medicine and Health Science. After explaining the objective of the study oral

consent was obtained from each participant. The participants were explained that they can withdraw from the study without any explanation and any penalty. The right of each respondent to refuse or answer for limited or all questions was respected. Omitting names of the study subjects from the questionnaire is a way to assure confidentiality of the information and during and after the interview, every effort was made to maintain the respondent's privacy.

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