

# Magnitude and Factors Associated with Hygiene Practice Among Primary School Children in Mareko District, Southern Ethiopia: A Cross-Sectional Study

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**Background:** Poor school hygiene practice is a major health problem in developing countries, including Ethiopia, and is a leading factor for children's school absenteeism due to hygiene-related illnesses. To our knowledge, little is known about hygiene practice conducted in southern Ethiopia including our study area. Therefore, the objective of this study was to assess magnitude and associated factors of hygiene practice among primary school children in Mareko District.

**Methods:** A school-based cross-sectional study design with multi-stage sampling was conducted from January 15–30, 2018 in Mareko district. Out of 25 second cycle primary schools in the district, eight schools (30%) were recruited with a simple random method. Then, a sample size of 829 students was selected by a simple random method. A self-administered questionnaire was used to collect data. Data were entered into Epi Info V. 7 and then analyzed in SPSS V. 20. Multivariate logistic regression analysis was used to identify independent factors of hygiene practice.

**Results:** The magnitude of overall good hygiene practice was 252 (30.4%) with 95% CI (27.3–33.5%). Practices of hand washing, latrine utilization, and water handling were found to be 191 (23%), 387 (46.7%), and 238 (28.7%), respectively. In multivariate analysis, factors associated with hygiene practice were found to be knowledge on hand washing (AOR = 5.1, 95% CI 2.86–9.1) and latrine use (AOR = 1.99, 95% CI 1.06–3.75); ever visited model school (AOR = 2.44, 95% CI 1.28–4.64); being 14–18 years old (AOR = 1.42; 95% CI 1.3–1.88); and cleanliness of toilets (AOR = 3.4; 95% CI 1.77–6.55).

**Conclusion:** Overall, good hygiene practice among primary school children in Mareko District was low. Therefore, there should be continuous awareness of good hygiene practice and its impact on health through health education, strengthening and motivation of water, sanitation, and hygiene clubs, and also visits to model primary schools in the district.

**Keywords:** primary schools, school children, hygiene practice, Mareko, Ethiopia

## Introduction

Poor school Water, Sanitation, and Hygiene (WASH) is a major problem in developing countries and remains a high-risk behavior among primary school children.<sup>1,2</sup> Hand Washing Practice (HWP) with soap, safe latrine (pit latrine) Utilization Practice (LUP), and safe Water Handling Practice (WHP) are among key WASH practices that can be carried out in schools. They are most important because changing a single key Hygiene Practice (HP) can make an enormous difference,

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impact on school children, and are the easiest to change at the lowest costs. The total global economic losses associated with inadequate water supply and sanitation have been estimated at US\$ 260 billion annually.<sup>1</sup> In Ethiopia, 60% of communicable disease burden is related to poor WASH, and more than 250,000 children die every year from WASH-related diseases. Thus, they are considered as major causes of illness, death, and disability in Ethiopia.<sup>3</sup> Schools with poor hygiene and intense person-to-person contact are high-risk environments for children. An estimated 88% of diarrheal disease is caused by poor WASH.<sup>4,5</sup>

Poor HP in children may have a significant economic and social impact beyond direct effects on the health of the child; significant school absences, transmission of infectious diseases to other people, and loss of working days for parents/guardians.<sup>6</sup> Approximately 443 million school days are lost each year due to water-related illnesses, making this a leading factor for school absences in the developing world.<sup>7</sup> Poor hygiene is related to two neglected and biggest killers of children: diarrheal and respiratory diseases.<sup>8</sup> A study conducted in Ethiopia among primary school students indicated that poor HP accounted for 38.3%.<sup>9</sup>

Evidence shows that a high prevalence of Intestinal Parasitic infections (I/Ps) are related to lack of awareness, poor hygiene, poor living conditions, inadequate health services, inadequate sanitation, and water supply facilities.<sup>9,10</sup> School children are vulnerable to the neglect of key HPs due to lack of knowledge.<sup>11</sup> Poor HP is influenced by education, illnesses like diarrhea and scabies, and knowledge.<sup>12</sup> In Ethiopia, the existing health information dissemination in schools mainly uses didactic approaches that lack a strong skill-building component.<sup>7,34</sup> Similarly, other studies also indicated that schools lack practical dimensions in equipping children with everyday life skills.<sup>9,17,19,20,33</sup>

Even though diseases related to inadequate WASH are a huge burden<sup>12</sup> and in the front rank of childhood diseases in developing countries, they are preventable. Hand washing at critical times reduces the risk of diarrheal diseases by 42–48%.<sup>1</sup> Adequate HP is the most important factor in reducing infectious diseases.<sup>14</sup> The World Health Organization (WHO) indicated that fundamental hygiene behaviors such as washing hands with soap, removing stools safely, and using clean water are beneficial for improving health.<sup>13</sup> This is more effective if interventions are undertaken through coordinated education measures by parents, teachers, and

the media.<sup>35</sup> To our knowledge, no study on HP has been conducted in southern Ethiopia that includes our study area.

## Objectives of the Study

### General Objective

To assess magnitude and associated factors of hygiene practice among primary school children in Mareko district, Southern Ethiopia.

### Specific Objectives

To assess magnitude of hygiene practice among primary school children in Mareko District.

To identify factors associated with hygiene practice among primary school children in Mareko District.

## Methods and Materials

### Study Area, Design and Period

A school-based cross-sectional study design was conducted in Mareko District from January 15–30, 2018. Based on records from the Central Statistics Agency of Ethiopia 2007, its population in 2017/18 was 82,754, of which 42,039 (50.8%) were females.<sup>15</sup> It is located at 1800–2076 m above sea level; 88.7% of it has a warm-humid climate, with an average annual temperature of 15–27°C and rainfall of 750–1100 mm. It is bordered in the south by the Silte zone and Oromia region; east and north by Oromia region; and in the west by Meskan district. There are 29 primary schools (25 of them are the second cycle i.e. schools having grades 5–8) and three secondary and preparatory schools in the district. There are no private schools with the second cycle but three are first cycle schools. A total of 20,234 primary school children (12,824 females) were enrolled in all primary schools in 2017/18, of which 10,621 (6824 females) were second cycle primary school children. Mareko District was one of the districts in which the “One WASH project” was implemented. A District Health Office 2017 annual report shows that latrine coverage, latrine utilization, and drinking water coverage were 100%, 99%, and 61% respectively.

### Source and Study Population

All primary school children attending second cycle (grade 5–8) in the District were the source population and those who attend the selected eight primary schools were the study population.

## Inclusion and Exclusion Criteria

All grade 5–8 students of the academic year 2017/18 in eight primary schools in the Mareko District were included in this study and those critically ill were excluded from this study.

## Sample Size Determination

### Sample Size Determination for Magnitude of HP Among Primary School Children in Mareko

The sample size was estimated by using a single population proportion formula with the following assumptions:  $P$  = proportion of primary school children with good HP in Mereb-Leke District as 61.7%,<sup>9</sup>  $Z_{1-\alpha/2}$  = standard normal distribution at 95% CI = 1.96. Design effect of two<sup>9</sup> and non-response rate of 10% was considered. Thus,  $n = (2*363) + (0.1*2*363) = 799$ .

### Sample Size Determination for Factors of HP Among Primary School Children in Mareko

Two population proportion formulae were used to calculate sample size using OpenEpi software with risk factors by taking findings from a similar study in Ethiopia.<sup>9</sup> Population size of  $N = 10,621$ ; precision ( $d$ ) = 5%, design effect = 2, Power = 80% and 95% CI were taken (Table 1)

By taking the maximum sample size (754) from Table 1 and adding 10% non-response, the total  $n = 754 + (0.1*754) = 829$ . To achieve the overall stated objectives, the larger sample size estimated by magnitude and factors of HP was taken i.e. 829.

## Sampling Procedures/Techniques

A multi-stage probability sampling procedure was used to select participating students. In the district there are 29 primary schools and among those 25 schools teachstudents in grades 5–8. Among these 25 we selected 30% of the schools using a simple random sampling technique. A total of 3453 students were enrolled in grades 5–8 in the 2017/18 academic year in the selected schools. A total of 829 samples were proportionally allocated to selected schools, grades and sections, using name lists of students in each

section as sample frame. Then students were selected using a simple random sampling technique (Figure 1).

## Operational Definitions

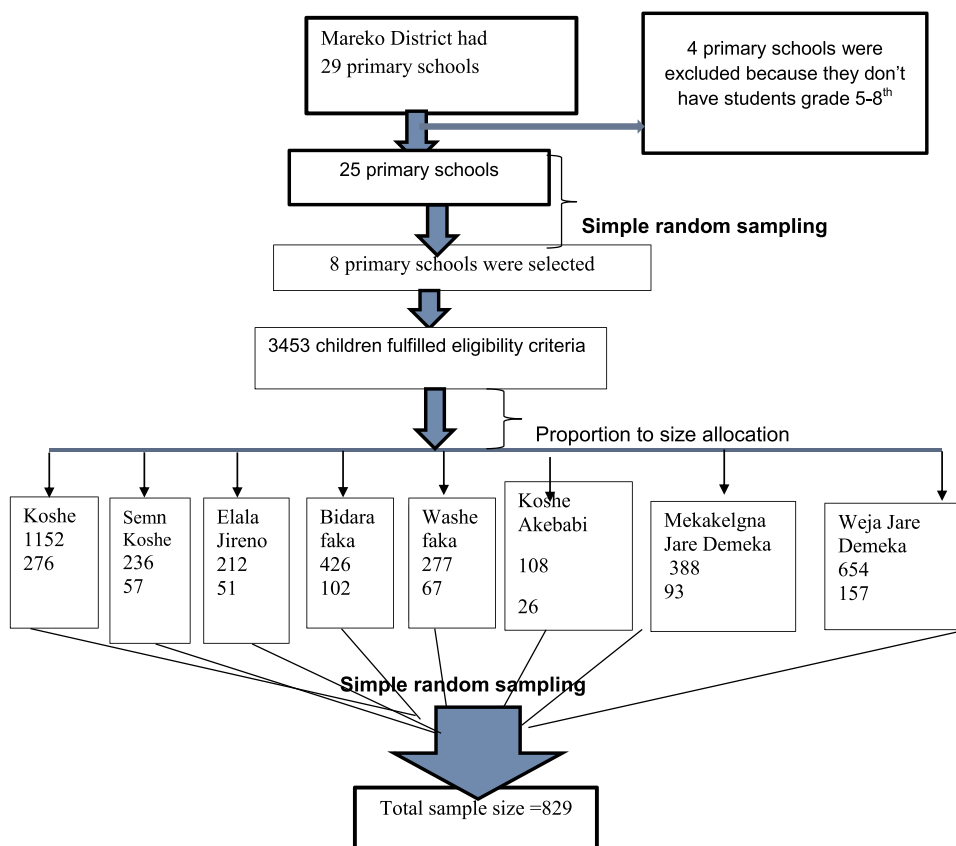
- To assess students' hygiene practice we used 16 hygiene practice-indicator items related questions (Cronbach's alpha 0.85). These were four water handling practice-indicator items, four latrine utilization practice-indicator items, and eight hand-washing practice-indicator items. This is adapted from the WHO three key hygiene practice-indicators and similar studies conducted in Ethiopia. These are coded as 0 if the student says no/never, 1 if yes/always. To categorize a student's practice we used a composite score for students who answered yes/always and/or no/never for skill of water handling, latrine utilization, and hand washing. Then children who scored  $\geq 67\%$  overall on practice-indicator items were categorized as "good hygiene practice", and those who failed to score on at least 67% of the items as "poor hygiene practice."<sup>4,9,35</sup>
  - Good Hand Washing Practice: Students who wash their hands with soap/ash at least at the three critical times (before eating, after eating, and after defecation) and who answered 'yes/always' to two of four questions.
  - Good Latrine Utilization Practice: Students who always use a latrine regardless of where they defecated (home, school, or communal latrines).
  - Good Water Handling Practice: Students who at least "always" clean and cover drinking water containers, and don't touch drinking water with dirty hands.
- Knowledge about HP: A child was classified as having good knowledge of:<sup>32,35</sup>

Water handling: If answered "yes" to at least three of six (50%) questions of knowledge of it.

**Table 1** Sample Size Determination for Associated Factors of Hygiene Practice, 2018

Associated Factors	Good HP in Unexposed Subjects	AOR	Sample Size	References
Knowledge of water handling	90 (48.6%)	2.24	754	<sup>9</sup>
Knowledge of hand washing	220 (58%)	1.7	736	<sup>9</sup>
Have ever visited a model school	197 (61.6%)	1.73	715	<sup>9</sup>
Ever trained on WASH	168 (63.2%)	1.37	715	<sup>9</sup>

**Abbreviations:** WASH, water, sanitation and hygiene.



**Figure 1** Schematic presentation of the sampling procedure for study to assess magnitude of hygiene practice among primary school children in Mareko District, South Ethiopia.

Latrine utilization: If answered “yes” to at least three of five questions about knowledge of it.

Hand washing: If students know three critical times and answered “yes” to three of five other questions of knowledge of it.

- Access to media: A schoolchild was categorized as having access to media if he/she has access to either TV, radio, newspaper/magazines, or any other media to have information.
- Trained on WASH: A schoolchild was categorized as trained on WASH if he/she has taken training on HWP, WHP and LUP by a health extension worker, nurse or WASH officer.

## Data Collection Tools and Procedures

A self-administered questionnaire (structured) was prepared using reviewed literatures.<sup>1,9,13,22,29,32,35</sup> It was prepared in English and translated to Amharic for data collection. One supervisor (WASH officer) from DHO was assigned to supervise the overall process. Four teachers, who are school supervisors in District Education

Office (DEdO), were recruited as data collection facilitators to guide the process. They work turn by turn in all selected schools as a team. All students were given an explanation about how to answer, then the tool was distributed and 35 minutes was given to fill it. Teacher of the concerned class cooperated in maintaining discipline.

## Data Quality Assurance Procedures

The questionnaire was translated back to Amharic for consistency. Five percent of questionnaires (41) were pre-tested in Dida Midore primary school to test for suitability for duration, language, and content. The team was trained for three days by the principal investigator on objectives, data collection techniques, and techniques of assisting study subjects for difficulties in completing questionnaires. As a first-line quality control check, we focused on completing questionnaires by participants. Once checked for completeness and accuracy, we numbered each questionnaire to give an identity number for easier handling. Data entry clerks typed and entered data into Epi Info 7.0. Two independent data clerks performed double-entry of 3% of questionnaires (25) to check for

consistency. Binary and multivariate analysis was performed using SPSS V.20 software. We had checked for model fitness using the Hosmer–Lemeshow goodness of fit test and found this to be not statistically significant ( $P=0.484$ ) meaning the model is doing well.

## Data Analysis Procedures

Frequency, percentages, and proportions were cross-tabulated by using variables included in our study. Multi-collinearity among independent variables was tested using variance inflation factor (VIF) showing that there was no multi-collinearity ( $1 < \text{VIF} < 2$ ). The data were analyzed in SPSS version 20.0. Logistic regression (COR and AOR) was used. Variables with  $P$ -value  $< 0.2^9$  in bivariate model were re-analyzed in multivariate model to identify factors associated with HP.

## Ethical Consideration

Before actual activities, ethical clearance was obtained from Hawassa University Institutional Review Board on January 1, 2018 (Ref. no: IRB/048/10). This study was conducted following the Declaration of Helsinki. Written permission from DEdO was obtained and a support letter was written to all selected primary schools on January 6, 2018 (Ref. no: ማወገ-2/691/51). Written informed assent was obtained from parents/guardians (on behalf of school children) after fully explaining the purpose of the study. Written informed consent from parents/guardians was collected two days before data collection through their children. Administrative permissions were taken from school directors. The information is kept confidential and anonymous.

The study had no risk and/or direct benefit to study subjects. The study subjects had a right to withdraw at any time. After data collection, a hand book on family health package was disseminated for each study participant after orienting its purpose.

## Results

### Socio-Demographic Characteristics of Participants

From eight primary schools, 829 school children participated with a response rate of 100%. Of them, 279 (33.7%), 208 (25%), 149 (18%), and 193 (23.3%) were from grade 5, 6, 7 and 8 respectively. Minimum and maximum ages were 12 and 18 years respectively. Mean and standard deviation of their age were  $14.3 \pm 1.45$  years (Table 2).

**Table 2** Socio-Demography of Participants in Mareko District, Southern Ethiopia. 2018

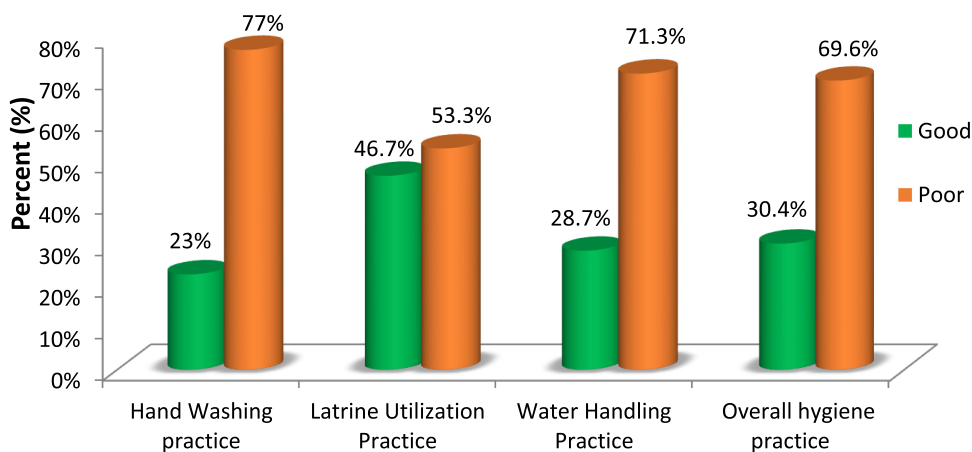
Characteristics		Frequency (n=829)	Percent (%)
Age group	≥14 years	557	67.2
	<14 years	272	32.8
Sex	Female	370	44.6
	Male	459	55.4
Educational level	Higher (Grade 7–8)	342	41.3
	Lower (Grade 5–6)	487	58.7
Residence	Urban	265	32
	Rural	564	68
Family size	>5	553	66.7
	≤5	276	33.3

### Magnitude of Hygiene Practice

The overall good HP among the students was found to be 252 (30.4%). Good knowledge of hand washing, latrine use, and water handling accounted for 341 (41.1%), 458 (55.2), and 697 (84%), respectively. Of those with good knowledge of hand washing, latrine use, and water handling, 139 (40.8%), 168 (36.7%), and 233 (33.4%) had good HP, respectively (Figure 2).

Of the students, 141 (17%) reported there always was queuing for using the toilet. One primary school (12.5%) had functional HWF close by the latrine. Hand washing before eating, after defecation, after eating, and at all three key critical times were found to be 241 (30%), 137 (17.1%), 86 (10.7%), and 222 (27.7%), respectively. Schoolchildren who “always” wash their hands with soap/ash at three critical times numbered 215 (26.8%). From who “usually/always” wash their hands, 330 (41.1%) had practiced correct hand washing procedure i.e. wet your hands with water and lather with a bar of soap; rub your hands and scrub all surfaces up to your wrists; clean under your fingernails; rinse your hands well with water; dry them in the air; continue for at least 30 seconds. Of all study subjects, 27 (3.3%) never wash their hands.

All primary schools had latrine facilities in their compound but these were not adequate. Among participants, 740 (89.3%) students defecated in the toilet the day before data collection. There were 355 (42.8%) school absences in the last two weeks due to all illnesses. Diarrheal diseases alone were responsible for 239 (28.8%) school absences.



**Figure 2** Magnitude of hygiene practice among primary school children in Mareko District, South Ethiopia.

Two primary schools (25%) had a drinking water supply from a protected source (pipe) in their compound. Overall 458 (55.2%), 231 (27.9%), and 134 (16.2%) of the respondents treat drinking water by boiling, using a water filter, and adding chlorine respectively. Out of those who boiled their drinking water, 307 (67%) boiled on the day before data collection. Of the total, 499 (60.2%) respondents cleaned and covered water containers and 553 (66.7%) never touched drinking water with dirty hands.

Our study indicated that 499 (60.2%) and 126 (15.2%) participants wash their hands mainly for disease avoidance and sensory benefits, respectively. Of the study subjects, 355 (42.8%) reported using a school latrine for the first time by themselves followed by 240 (30%) parents (Table 3).

**Table 3** Main Reasons Given for Hand Washing Among School Children in Mareko, Southern Ethiopia, 2018

Variables		Yes (%)	No (%)
Why children mainly wash hands? (n=829)	Comfort	43 (5.2)	786 (94.8)
	Sensory benefit	126 (15.2)	703 (84.8)
	Fun	59 (7.1)	770 (92.9)
	Disease avoidance	499 (60.2)	330 (39.8)
	Getting a better mark	102 (12.3)	727 (87.7)
What mainly makes you wash your hands? (n=802)	Comfort	126 (15.7)	676 (84.3)
	Disgust	43 (5.4)	759 (94.6)
	Nurture	499 (62.2)	303 (37.8)
	Status	102 (12.7)	700 (87.3)
	Fear	59 (7.1)	770 (92.9)
Who motivates to use school latrine for the first time? (n=829)	Self	355 (42.8)	474 (57.2)
	Parent	240 (30)	589 (70)
	Peer	98 (11.8)	731 (88.2)
	Teacher	136 (16.4)	693 (83.6)

## Factors Associated with Hygiene Practice

In the bivariate analysis, age of 15–19 years; knowledge on hand washing, water handling, and latrine use; ever trained on WASH; ever visited a model school; member of a WASH club; and cleanliness (i.e. no bad smell and no feces inside latrine structure) and safety of toilets were factors crudely associated with hygiene practice.

In the multivariate analysis, a child with good knowledge of hand washing and latrine use is 5.1 and 1.99 times more likely to have good HP as compared with those with poor knowledge, respectively. Schoolchildren who had ever visited model schools were 2.44 times more likely to have good HP than those who had never visited. Schoolchildren who use a latrine due to cleanliness (i.e. no bad smell and no feces inside latrine structure) were 3.4 times more likely to have good HP than those due to sex-separated latrines. Children with higher age were 1.42 times more likely to have good HP than those with lower age (Table 4).

## Discussion

This study was conducted to determine the magnitude of overall HP and to identify the factors associated with it among school-aged children. As a result, the magnitude of overall good HP was 252 (30.4%). A theory-based approach on key health practices such as HWP, LUP, and drinking WHP was found to be 191 (23%), 387 (46.7%), and 238 (28.7%), respectively. Knowledge of hand washing and latrine use; ever-visited model school; age of  $\geq 14$  years; and cleanliness of toilets significantly affected their overall hygiene practice.

The magnitude of overall good HP was 252 (30.4%) (95% CI: 27.3–33.5%). This finding was lower than a similar study done in Mereb-Leke District, which

**Table 4** Factors Associated with Hygiene Practice Among School Children in Mareko, Southern Ethiopia, 2018

Characteristics		Hygiene Practice (n=829)		COR (95% CI)	AOR (95% CI)
		Good (%)	Poor (%)		
Age group	≥14 years	155 (27.8)	402 (72.2)	0.69 [0.51, 0.95]*	1.42 [1.3, 1.88]**
	<14 years	97 (35.7)	175 (64.3)	I	I
Sex	Female	116 (31.4)	254 (68.6)	1.1 [0.8, 1.46]	
	Male	136 (29.6)	323 (70.4)	I	
Residence	Urban	74 (27.9)	191 (72.1)	0.84 [0.61, 1.15]	
	Rural	178 (31.6)	386 (68.4)	I	
Family size	> 5	174 (31.5)	379 (68.5)	1.17 [0.85, 1.6]	
	≤ 5	78 (28.3)	198 (71.7)	I	
Educational level	Grade 7–8342	66	276	0.39 [0.27, 0.81]	
	Grade 5–6487	186	301	I	
Knowledge of water handling	Good	233 (33.4)	464 (66.6)	2.99 [1.79, 4.98]*	2.13 [0.57, 7.99]
	Poor	19 (14.4)	113 (85.6)	I	I
Knowledge on latrine use	Good	168 (36.7)	290 (63.3)	1.98 [1.45, 2.70]*	1.99 [1.06, 3.75]**
	Poor	84 (22.6)	287 (77.4)	I	I
Knowledge on hand washing	Good	139 (40.8)	202 (59.2)	2.28 [1.67, 3.09]*	5.1 [2.86, 9.1]**
	Poor	113 (23.2)	375 (76.8)	I	I
Ever trained on WASH	Yes	206 (33.3)	413 (66.7)	1.78 [1.23, 2.57]*	0.9 [0.4, 2.01]
	No	46 (21.9)	164 (78.1)	I	I
Ever visited model school	Yes	139 (34.8)	260 (65.2)	1.5 [1.11, 2.02]*	2.44 [1.28, 4.64]**
	No	113 (26.3)	317 (73.7)	I	I
Member to WASH club***	Yes	62 (39.2)	96 (60.2)	1.33 [0.9, 1.97]*	1.15 [0.65, 2.04]
	No	109 (32.7)	224 (67.3)	I	I
Access to media	Yes	223 (30.3)	513 (69.7)	0.96 [0.6, 1.52]	
	No	29 (31.2)	64 (68.8)	I	
What mainly promotes to use of latrine?	Sex separated	119 (28.9)	293 (71.1)	I	I
	Cleanliness	57 (45.2)	69 (54.8)	2.03 [1.35, 3.07]*	3.4 [1.77, 6.55]**
	Privacy	67 (30.5)	153 (69.5)	1.08 [0.75, 1.54]	
	Safety	9 (12.7)	62 (87.3)	0.36 [0.17, 0.74]*	0.6 [0.23, 1.57]
Queuing to use latrine?	No	147 (32)	312 (68)	1.19 [0.88, 1.6]	
	Yes	105 (28.4)	265 (71.6)	I	

**Notes:** \*P<0.2, \*\*P<0.05; \*\*\*Values with "Not Applicable" excluded, i.e. school children were not asked for membership if no WASH club in their school; I reference category.

**Abbreviations:** AOR, adjusted odds ratio; COR, crudes odds ratio; CI, confidence interval.

accounted for 61.7%.<sup>9</sup> This could be due to lower HWP, LUP, and WHP; lower levels of knowledge; and higher sample size in our study. It may be associated with measurements used; additional study designs used by the other study; and inadequate sanitation facilities.

In our study area, there were inadequate hygiene facilities such as latrine (one toilet seat for 49 girls and 63 boys), water supply (0.6L/person/day), and functional HWF close by latrine (12.5%). Inadequate hygiene facilities may contribute to lower WHP, HWP, LUP, and

overall HP. This idea is supported by the WHO (2009)<sup>4</sup>, UNICEF (2012),<sup>1</sup> Global Hand Washing Partnership report,<sup>16</sup> and studies conducted in Zimbabwe,<sup>17</sup> Senegal,<sup>18</sup> North Carolina,<sup>19</sup> and Ghana<sup>20</sup> that indicated hygiene enabling factors had a determinant role for HP. It is not supported by studies in Ethiopia,<sup>9</sup> Indonesia,<sup>21</sup> and India<sup>24</sup> that showed hygiene facilities did not play a role in determining good HP. This may be due to the higher sample size in our study, variation in time, and/or study settings.

Good WHP among primary school children in Mareko District was found to be 28.7%. This is very low compared with a similar study in Mereb-Leke District, which accounted for 83%.<sup>9</sup> This could be due to the higher sample size in our study, inadequate sanitation facilities, and the presence of children touching drinking water with dirty hands (33.3%).

Good LUP in our study was found to be 46.7%. This is much less compared with 74% found in South Ethiopia<sup>22</sup> and 57% in Mereb-Leke District.<sup>9</sup> It is also lower compared with 69% found in Nigeria, 88% in the Democratic Republic of Congo, and 62% in Ethiopia at federal level.<sup>23</sup> The reason could be attributed to the study time and area variation, and inadequate hygiene facilities.

Good HWP in this study was found to be 23%. This is lower compared with 28.2% in Indonesia,<sup>21</sup> 33% in Mereb-Leke District,<sup>9</sup> and 32.1% in rural India.<sup>24</sup> This may be attributed to higher sample size, variation in the study area, inadequate hygiene facilities like HWF, water and soap/ash, and presence of children washing hands without soap/ash at critical times (13.2%).

School children who “always” wash their hands with soap/ash at critical times were found to be 26.8%. This is higher compared with 5% in Tanzania, 13% in China, and 15% in India<sup>25</sup> but lower compared with 35% in nine African countries,<sup>26</sup> and 83% in Mereb-Leke District, Ethiopia.<sup>9</sup> This may be due to differences in study area and time, and in inclusion criteria used i.e. our study was restricted on grade level (5–8) but not on age (13–15 years for study in nine African countries).

Children with higher age (14–18 years) were 1.42 times more likely to have good HP than those with lower age. This is supported by studies in Aneded District,<sup>27</sup> in Chitungwiza,<sup>17</sup> and Allahabad District.<sup>28</sup>

Schoolchildren who use a latrine due to access to a clean latrine (i.e. no bad smell and no feces inside latrine structure) were 3.4 times more likely to have good HP than those who use one due to sex-separated latrines. This is supported by studies in South Ethiopia<sup>22</sup> and Aneded District, North Ethiopia.<sup>27</sup> The reason could be attributed to the fact that participant’s behavior will be motivated through an attractive environment, prevention of various diseases, and even satisfaction.

There was a gap between knowledge and HP. Of those with good knowledge of water handling, latrine use, and hand washing, 33.4%, 36.7%, and 40.8% had good WHP, LUP, and HWP, respectively. This finding corroborates with a study done among schoolchildren in Nigeria<sup>29</sup> and

India.<sup>12,31</sup> It is to be expected that a lesser percentage of students having good knowledge will be able to translate their knowledge into practice. This finding supports the principle of health education that knowledge does not necessarily lead to practice. Besides, inadequate supply of hygiene facilities such as drinking water supply and latrine with HWF may negatively affect HP.

A child with good knowledge of hand washing and latrine use is 5.1 and 1.99 times more likely to have good HP compared with those with poor knowledge, respectively. Thus, knowledge plays a determinant role for HP. This is supported by studies done in Ethiopia,<sup>9,10</sup> Nigeria,<sup>29</sup> Zimbabwe,<sup>17</sup> and India.<sup>12,32</sup> It is not consistent with a study in Indonesia<sup>21</sup> and nine African countries.<sup>26</sup> This may be attributed to variations in sample size (ours is larger than the study in Indonesia but smaller than the others) and study settings.

Poor knowledge, attitudes and practice of hygiene play a major role in the high incidence of diarrheal and other communicable diseases.<sup>12</sup> There were 42.8% of school absences in the last two weeks due to all illnesses. Diarrheal diseases alone were responsible for 28.8% of school absences. This is higher compared with 25% of school absences both from diarrheal diseases and I/Ps around the world.<sup>10</sup> This may be due to poor HP in our study area due to inadequate drinking water supply and latrines with functional HWFs; poor knowledge on key HP; the presence of children touching drinking water with dirty hands (33.3%) and washing hands without soap/ash at critical times (13.2%).

Schoolchildren who had ever visited model schools were 2.44 times more likely to have good HP than those who had never visited. This is supported by a similar study in Mereb-Leke District.<sup>9</sup>

In our study, 42.8% of schoolchildren themselves play a more important role in initiating the use of latrine followed by 30% of parents and 16.4% of schools. On contrary, an initiator to use latrines among schoolchildren in Zimbabwe and Ethiopia was found to be families (50%)<sup>17</sup> and teachers (16.3%),<sup>9</sup> respectively. School reinforcement (16.4%) in our study is comparable with a study in Mereb-Leke District (16.3%) but parent reinforcement (30%) is almost double in our study.<sup>9</sup> Being their own role models in our study may be due to the two main initiators that encourage them to go to the toilet: availability of separate toilets by sex (49.7%) and toilet privacy (26.5%). The reason that teachers do not act as role models for their students may be due to an insufficient



number of latrines, lack of toilet paper, and lack of adequately clean toilets in schools.

## Limitation of the Study

A cross-sectional study might not be strong enough to determine a direct cause and effect relationship. We were not able to control confounders such as a household's hygiene facilities, wealth index, and health risk behaviors such as substance use that might have contributed to HP. There could be recall bias on recalling illness within the last two weeks and who motivated the students to use a school latrine for the first time.

## Conclusions

Overall, good HP among primary school children in Mareko District was low. Knowledge of hand washing, latrine use, ever-visited model school, age of  $\geq 14$  years, and cleanliness of toilets was associated with good HP.

## Recommendations

Teachers, health extension workers and One WASH project officers are recommended to raise students' awareness on good hygiene behaviors through health education in a way that could lead to good hygiene practice. One WASH project, DHO, DEdO and District water office are recommended to strengthen and motivate model primary schools in the district. They are recommended to collaborate stakeholders (One WASH project with primary school managers and local authorities) to ensure children's access to adequate hygiene conditions in schools (water supply, latrine, and functional HWF).

Further study can be made to quantify factors of HP that were not addressed in our study: parental factors, hygiene facilities at home, wealth index, and health risk behaviors such as substance use.

## Abbreviations

AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; DHO, District Health Office; DEdO, District Education Office; HWF, hand washing facility; HWP, hand washing practice; HP, hygiene practice; I/Ps, intestinal parasitic infections; LUP, latrine utilization practice; WHP, water handling practice; WASH, water, sanitation and hygiene; WHO, World Health Organization.

## Author Contributions

All authors made a significant contribution during conception, study design, execution, acquisition of data, analysis and interpretation, in drafting, revising or critically

reviewing the article; gave final approval of the version to be published. All authors have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

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