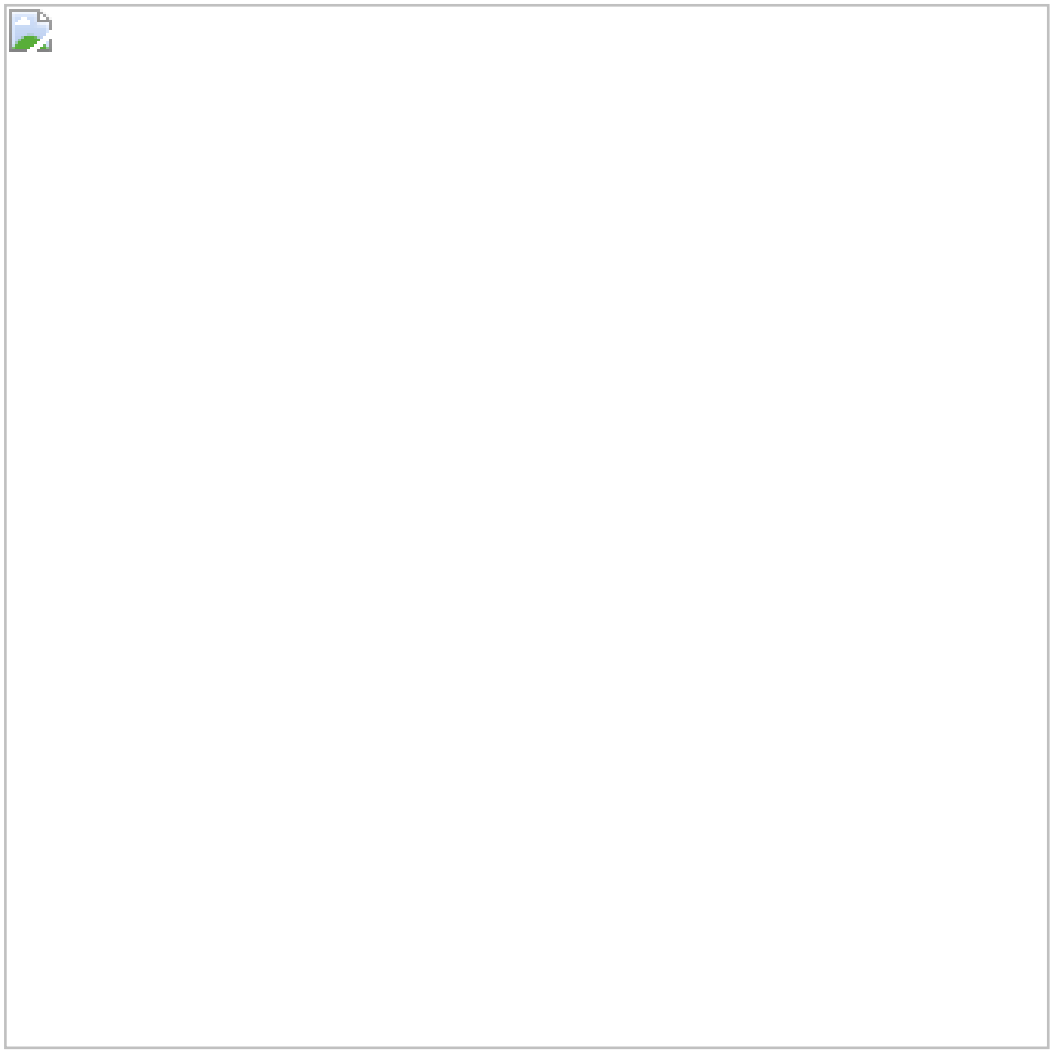

Handwashing Practices and Associated Factors Among School Children in Kirkos and Akaki Kality Sub-Cities, Addis Ababa, Ethiopia

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ABSTRACT

BACKGROUND: Provision of handwashing facilities and proper practices are essential for preventing fecal-oral and acute respiratory infectious diseases. The aim of this study was to assess availability of handwashing facilities and predictors to students' good hygiene practices in Addis Ababa, Ethiopia.

METHODS: A mixed-methods study design was conducted in schools of Addis Ababa from January to March 2020 in 384 students, 98 school directors, 6 health clubs, and 6 school administrators. Data were collected using pretested interviewer-administered questionnaires, interview guide, and observational checklists. The quantitative data were entered into EPI Info version 7.2.2.6 and analyzed using SPSS 22.0. A bivariable at $P < .2$ and multivariable logistic regression analysis at $P < .05$ for quantitative and thematic analysis for qualitative data were used.

RESULTS: Handwashing stations were available in 85 (86.7%) of the schools. However, 16 (16.3%) schools had neither water nor soap near the handwashing facilities while 33 (38.8%) of schools had both. There was no high school that had both soap and water. Approximately one-third (135, 35.2%) of students practiced proper handwashing, among which 89 (65.9%) were from private schools. The handwashing practices were significantly associated with gender (AOR = 2.45, 95% CI: (1.66-3.59)), having trained coordinator (AOR = 2.16, 95% CI: (1.32-2.48)) and health education program (AOR = 2.53, 95% CI: (1.73-3.59)), school ownership (AOR = 0.49, 95% CI: (0.33-0.72)), and training (AOR = 1.74, 95% CI: (1.82-3.69)). Water supply interruption, and lack of budget, adequate space, training, health education, maintenance, and coordination were the main barriers that prevent students from practicing proper handwashing.

CONCLUSIONS: Handwashing facilities and materials provision and good handwashing practices of students were low. Moreover, providing soap and water for handwashing was insufficient to promote good hygiene practices. There should be regular hygiene education, training, maintenance, and better coordination among stakeholders to create a healthy school environment.

KEYWORDS: Hygiene, hand hygiene, hygiene facilities, school health, water, sanitation, and hygiene

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Introduction

Safe hygiene service provision and practices in the schools are pre-requisites for the right to basic education for school children and it is highly linked with the Sustainable Development Goal 6.[1-3] Handwashing is the simplest, most affordable, and most effective means of stopping the spread of infection via feces, body fluids, and inanimate object contacts.[1,3-5] Over 900 million children worldwide lacked basic hygiene services at their school and in Ethiopia, it is estimated from 39 million school-age children 37 million lack basic hygiene services.[6,7]

The close proximity and contact of children in schools increases the risk of infectious disease transmission. As a result, providing school hygiene facilities and materials, as well as promoting frequent handwashing, are critical for protecting humans from diarrheal and acute respiratory infections such as COVID-19.[8,9] Students who didn't properly wash their hands and lack access to hygiene services are highly exposed to health risks. Furthermore, in developing countries where access to hygiene and sanitation services is limited, schools serve as a breeding ground and epicenter of infectious disease transmission to the community.[8-10]

School is a place where children developed a foundation for lifelong behavior for the practice of good personal hygiene and serve as behavior change agents in their families and communities.[11] However, lack hygiene enabling facilities such as running water or soap at schools and homes prevented children from practicing proper handwashing.[12] Only about 60% of public primary schools in Ghana's Kintampo Municipality had handwashing stations near the toilets.[13] Besides, only 30% of the schools had running water. In this study, the handwashing practice after using the toilet with soap was about 40%. A similar study in Zambia found that 58.4% of schoolchildren washed their hands after using the toilet.[14]

Poor handwashing practices in schools were found to have a negative impact on health and attendance[15-17] The prevalence of good handwashing practice in primary school children of Yirgalem town,[18] Damote Woide district, Mareko District,[19] and Arbaminch town were 39.1%, 28.10%, 23%, and 22.23%

respectively.[20,21] An institutional-based cross-sectional study that was conducted to assess handwashing practice of students in 6 public primary schools in Harar town, the capital of Harari Regional State in eastern Ethiopia, reported lower handwashing practice at critical times such as 13.3% after using the toilet and 51.3% before eating.[22] Besides, more than half of the students were washing their hands for less than 20 seconds, indicating insufficient practice. According to,[23] 32% of primary school children in Sebeta town, Oromia Regional State (Ethiopia), which is adjacent to Addis Ababa City, practiced proper handwashing. In general, the prevalence of good handwashing practice among students in Ethiopia schools was low, ranging 13.3% to 39.1%

The Addis Ababa City Administration recently launched a school feeding program, making safe hand hygiene services more important than ever before in preventing disease outbreak at schools. The current handwashing facility provisions, practices, and barriers that hinder the students' school hygiene practices have not been studied. Therefore, this study assessed availability of handwashing services, practices of students, and factors contributing to lower school hygiene facility usage rates. The study suggested improvement measures for promoting proper hand hygiene practice among schoolchildren.

Materials and Methods

Description of the study area

Addis Ababa is Ethiopia's capital city, with 10 sub-cities and 123 woredas, the city lowest administrative unit. The city had 2147 schools, of which 527 are public and 1620 are private. There were 795 primary, 219 secondary, and 1133 kindergartens (KG) schools that hosted more than 863 357 students.[24] This study was conducted in Kirkos and Akaki Kality sub-cities, which had 97 and 230 schools, respectively.

Study design and period

A mixed-methods study design was used to assess hand hygiene provisions and hygienic practices of students in Addis Ababa city, Ethiopia from January to March 2020.

Sample size determination

For the handwashing facilities and materials provision assessment, 98 (30%) schools were selected from Kirkos sub-city and Akaki Kality sub-cities using proportional allocation method. The schools were selected by considering school ownership and level for assessment of handwashing facilities and conditions.

The sample size of students for handwashing practice was determined by employing the single population formula.[25] Because there was no prior national or local data in a similar setting on the handwashing practice of students, a proper practice proportion of 50% was used to maximize the sample size. By using $P=0.5$, $d=$ margin of error ($d=0.05$), and $Z=$ level of confidence at 95% confidence interval ($Z=1.96$) in a single population formula, the sample size (N) was calculated as:

$$N = \frac{\left(Z_{\alpha/2}\right)^2 \text{x P}\left(1-\text{P}\right)}{d^2} = 384$$

The key informants for the in-depth interview were school administrators and heads of school clubs. We stopped looking for more key informants for in-depth interviews after interviewing the fifth key informant in each participant category because we did not get extra information relevant to our research questions and objectives. A total of 12 in-depth interview participants, with an equal number of administrators and heads of student health clubs, were used to assess the quality of school hygiene services and provisions, as well as the major challenges that can hinder hygiene services.

Sampling techniques

Purposively 30% of the schools were selected from both sub-cities proportionally (31 from Kirkos sub-city and 67 from Akaki Kality sub-city) for the assessment of the hand hygiene services provision. Besides, the selected schools in each sub-city were proportional in ownership and school level. The director of each selected school was interviewed about the existing hand hygiene services and materials provision. For handwashing practice, 384 students were recruited from 18 schools which had adequate handwashing facilities and material provisions and schoolchild feeding program using equal allocation method for location of school (inner vs peripheral), ownership (private vs public), school level (pre-primary vs primary vs secondary) and sex (male vs female). Because these factors were selected as predictor for the proper handwashing practice among students. We used the quota sampling method to select students for observational handwashing practices studied at 2 critical times that is, after using the toilet and before eating at each school. Handwashing practice of students were studied only from KG and primary schools since all high schools did not have adequate handwashing material provision.

Data collection methods

Data on school ownership, level, handwashing station and materials availability, and hand hygiene provisions such as having trained health/hygiene coordinator, health/hygiene education program, and training on handwashing were collected from school directors using a semi-structured questionnaire On-site observation using a checklist was used to verify the presence of functional handwashing stations, clean running water, and soap. The students' handwashing practice at 2 critical times that is, after using the toilet and before eating was assessed by undisguised observation of the students following the WHO handwashing practice assessment techniques.[26-28] A

structured observation checklist was used to record the students handwashing practice after defecation and before meal particularly whether or not students washed their hands at all, washed one or both hands, use of soap, and properly rubbed hands for at least 20 seconds. An in-depth interview of selected 6 health club representatives and 6 school administrators was done using interview guide questions. The main contents of in-depth interview were level of stakeholders' involvement and coordination, challenges to handwashing services, and on solutions. The qualitative interview was conducted by the principal investigator while the quantitative interview and observational data were collected by trained environmental health officers who have bachelor university degree.

Study variables and definitions

School geographic location, school level, gender, owner of the school, trained hygiene coordinator, model teacher trained on hygiene, teaching program on health, training, and handwashing time were independent variables while proper handwashing practice according was dependent variable evaluated based on WHO (2009) definition. According to WHO (2009), *proper handwashing practice is the act of cleaning one's hands with soap and water to remove disease causing microorganisms, and dirt from the hand by rubbing for at least 20 seconds using 2 hands.* Therefore, handwashing practice was classified as good for students who wash their hands with soap and water at 2 critical times, namely after using the toilet and before eating by rubbing for at least 20 seconds using 2 hands. If not, the students' handwashing practices were rated as poor. The evaluation was carried out by observing the practice and documenting it in an observational checklist. Hand hygiene provision is the availability of water, and soap near the handwashing facility at the time of the study.

Data processing and analysis

The quantitative data was coded and then entered using EPI Info 7.2.2.6 before being exported to SPSS version 22.0 for data cleaning and analysis. Frequency and percent were used to summarize data. A bivariable logistic regression model was used to select input variables for multivariate analysis based on the crude association of the independent variables using an odds ratio with a *P*-value of less than .2 in bivariate analysis. Variables which were statistically significant in bivariate analysis included in multivariate logistic regression analysis to select the appropriate predictor variable based on independent effects on the handwashing behavior of children regarding school and student characteristics setting $P < .05$ for 95% CI. Thematic analysis method was used to evaluate and provide narrative descriptions for the qualitative data on the students' school hygiene practices and related issues. The following 3 themes emerged from the interview: the main stakeholders of the school WASH, hygiene provision and practices in the schools, and challenges and solutions for good hygiene practices. The narratives are provided to explain the broad themes, and direct quotes from the participants are used to highlight the different views. The results of both quantitative and qualitative approaches were triangulated and interpreted.

Data quality control

Before data collection, the first author provided 2-days training for data collectors. All the data collectors had Bachelor of Science degree in environmental health. To evaluate the clarity of the questionnaire and the reactions of the respondents, a pretest was conducted in 2 schools (one at each sub-city) which were not part of the study. The questionnaire was initially prepared in English language and translated into Amharic, a local language for interview administration, and re-translated back to English to keep the consistency with the original questionnaire. To ensure the validity of qualitative data, the qualitative study was collected next to the qualitative data on hygiene facilities and materials availability and utilization. Such prior information was used to generate a crosschecking question that helped us to ensure the validity of the qualitative data. Besides, the data collectors and transcribers are well experienced in qualitative data collection, analysis and interpretation.

Ethical considerations

The Ethiopian Institute of Water Resources at Addis Ababa University wrote a letter of support to the Addis Ababa Education Bureau to obtain the needed approval and collaboration for the study. The Education Bureau sent the approval letter to both sub-city offices. The sub-cities' education offices then wrote letters of cooperation to the sampled schools. Before beginning data collection, data collectors clearly explained the aim of the study to the school directors, and the study was conducted after obtaining verbal consent.

Results

Socio-demographics characteristics and handwashing practice of students

Our study had a 100% response rate. The proportion of students studied for their handwashing practices at school was set at 50% for each location (inner vs periphery), gender (girls vs boys), school ownership (private vs public), and school level (KG vs primary). About one-quarter (102, 26.5%) of the students that took part in the study didn't wash their hands at critical times. The prevalence of observed proper handwashing practice among students was found to be 1 out of 3 students (135, 35.2%) (Table 1). The handwashing facilities utilization had disparities between public and private schools, higher in public schools (72, 37.5%) than private schools (30, 15.6%).

The utilization of handwashing facilities by boys (127, 33.1%) was lower than the utilization of handwashing

Table 1. Socio-demographic characteristics and handwashing practice of students at schools in Addis Ababa, Ethiopia, 2020.

VARIABLES	CATEGORIES	PRIVATE, NUMBER (%)	PUBLIC, NUMBER (%)	TOTAL, NUMBER (%)
Geographic location, N = 384	Peripheral	96 (50)	96 (50)	192 (50)
	Inner	96 (50)	96 (50)	192 (50)
School level, N = 384	KG	96 (50)	96 (50)	192 (50)
	Primary	96 (50)	96 (50)	192 (50)
Gender of the student, N = 384	Female	96 (50)	96 (50)	192 (50)
	Male	96 (50)	96 (50)	192 (50)
Students using handwashing facilities, N = 384	Yes	162 (84.4)	120 (62.5)	282 (73.4)
	No	30 (15.6)	72 (37.5)	102 (26.6)
Number of students who used soap for handwashing, N = 282	Yes	135 (83.3)	78 (65)	213 (75.5)
	No	27 (16.7)	42 (35)	69 (24.5)
Techniques of handwashing, N = 282	One hand	32 (19.7)	61 (50.8)	93 (33)
	Two hands	130 (80.2)	59 (49.2)	189 (67)
Handwashing practice, N = 384	Poor	89 (46)	46 (24)	135 (35.2)
	Good	103 (53.6)	146 (76)	249 (64.8)

facilities by females (155, 40.3%) (Table 2). Approximately one-quarter (213, 75.5%) of students who washed their hands used soap. In this study, the prevalence of using soap for handwashing was 1.8 times higher in girls (136, 48.2%) than in boys (77, 27.3%).

Factors associated with handwashing practice

The bivariable analysis of the study participants' results was performed using "handwashing practice" as a dependent variable and others as independent variables. Among the socio-demographic characteristics, ownership (AOR: 0.49 (0.33-0.72), gender of student (AOR: 2.45 (1.66-3.59, hygiene teaching program (AOR: 2.53 (1.73-3.59), hand hygiene training (AOR: 1.74 (1.82-3.69), and trained coordinator for hygiene (AOR: 2.16 (1.32-2.48) were significantly associated with handwashing practice at P-value $< .05$. The students from private schools, females, availability of teaching program on hygiene, training on hand hygiene, and having trained coordinator for hygiene were 2 times, 2.45, 2.53 times, 1.74 times and 2.16 times more likely to practice proper handwashing than their counterparts (Table 3).

Handwashing provisions in Addis Ababa schools

Handwashing facilities and materials provided in Addis Ababa schools. Of the 98 schools surveyed, 85 (86.7%) had handwashing facilities, 33 (38.8%) had both soap and water, 34 (40%) had only water, and 16 (18.8%) had neither water nor soap. The soap provisions to students for handwashing at schools were from student families (45, 45.9%) and school administrations (29, 29.6%). Seventy-one (83.5%) handwashing stations were located near school latrines (Table 4).

Hygiene education in schools. Most schools (85, 86.7%) lacked a trained health coordinator, 83 (84.7%) did not have a health education program, and 20 (20.4%) did not provide training. Furthermore, only 14 (14.3%) schools provided hygiene and sanitation training (Table 5).

Interview with health club and school administrator

The following 3 themes emerged from the interview: the main stakeholders of the school WASH, hygiene provision and practices in the schools, challenges, and solutions for good hygiene practices. The narratives are provided to explain the broad themes, and direct quotes from the participants are used to highlight the different views.

Stakeholders of school WASH in Addis Ababa. The education office, the health office, the food and medicine office, the solid waste management agency, the NGO, and the Parent Teacher Association (PTA) were the primary stakeholders identified by the head of school administrator during the interview. Only 2 school administrators stated that they had no connection to collaborate, and almost all schools reported having a method for evaluating the success of their work. According to the school administrator in, all private schools, stakeholders participate only in monitoring and evaluation.

Table 2. Handwashing practice of students by gender at 2 critical times in schools of Addis Ababa, Ethiopia, 2020.

VARIABLES	CATEGORIES	BEFORE EATING (N = 192)			AFTER DEFECATION (N = 192)			TOTAL (N = 384)		
		MALE, NUMBER (%)	FEMALE, NUMBER (%)	TOTAL, NUMBER (%)	MALE, NUMBER (%)	FEMALE, NUMBER (%)	TOTAL, NUMBER (%)	MALE, NUMBER (%)	FEMALE, NUMBER (%)	TOTAL, NUMBER (%)
Students using handwashing facilities, N = 384	Yes	64 (33.3)	81 (42.2)	145 (75.5)	63 (32.8)	74 (38.5)	137 (71.4)	127 (33.1)	155 (40.3)	282 (73.4)
	No	32 (16.7)	15 (7.8)	47 (24.5)	33 (17.2)	22 (11.5)	55 (28.6)	65 (16.9)	37 (9.6)	102 (26.6)
No of students who used soap, N = 282	Yes	39 (26.9)	72 (49.7)	111 (76.6)	38 (27.8)	64 (46.7)	102 (74.5)	77 (27.3)	136 (48.2)	213 (75.5)
	No	25 (17.2)	9 (6.2)	34 (23.4)	25 (18.2)	10 (7.3)	35 (25.5)	50 (17.7)	19 (6.7)	69 (24.5)
Techniques of handwashing, N = 282	One hand	29 (20)	15 (10.3)	44 (30.3)	29 (21.2)	20 (14.6)	49 (35.8)	58 (20.6)	35(12.4)	93 (33)
	Two hands	35 (24.1)	66 (45.5)	101 (69.7)	34 (24.8)	54 (39.4)	88 (64.2)	69 (24.5)	120 (42.6)	189 (67)
The status of handwashing practice, N = 384	Good	23 (12)	42 (21.9)	65 (33.9)	25 (13)	45 (23.4)	70 (36.5)	48 (12.5)	87 (22.7)	135 (35.2)
	Poor	73 (38)	54 (28.1)	127 (66.1)	71 (37)	51 (26.5)	122 (63.5)	144 (37.5)	105 27.3)	249 (64.8)

A school administrator described stakeholders' participation as "*. . .health club and teachers by giving health education, community support by giving soap, and in Birr, school administrator and NGO by building and maintaining the facility, but there is no system for consultation and participation of students directly. . .*" (KII: 02 school administrator).

Hygiene provision and practices in the schools of Addis Ababa. The interviewed students' health clubs reported that water was utilized for handwashing, drinking, and food preparation in public schools but just for water only for handwashing in KG and private schools. Only 2 private KG schools said they had had water accessibility problem and some students had hygiene facility usage problems. In secondary schools, there was no active health club, hygiene education, and hygiene education program. From the quotes of the students "*. . .handwashing facilities are broken by students due to poor operation and usage; even when there is water and soap, they didn't use it. . .*" (KII: 01 school health club representative). Furthermore, the club representative stated that "*. . .school management did not allowed students to participate on clubs and the maintenance of handwashing facilities was done after long time delay. . .*" (KII: 04 from the student).

The school administration raised different reasons for the lack of proper hygienic facilities in both public and private institutions. In both public and private schools for not having adequate hygiene facilities. Quotes from the private school's administrator showed they have highly shortage of adequate space due to renting from privates: "*. . .we had no problem with the budget for construction of facilities and maintenance but, the main problem was schools are rented from private, lack of adequate space, and frequent water interruption. Therefore, we have no plan for construction and maintenance of hygiene facilities because the school is rented house. . .*" (KII: 02 from private school administrator)

Quotes from public school administrators revealed a severe budget shortfall and problem of water interruption "*. . .no enough budget* for facility maintenance and construction; *and even when we ask budget to higher level leaders* doesn't *approve the budget for hygiene facility provisions. In addition, there is water interruption, hygiene facility design and construction had quality problems, and the school budgets on maintenance in all schools were shifted for other activities . . .*" (KII: 04 and 03 public school administrator)

The solutions were also indicated by the interviewed school administrators "*. . .to work with all stakeholders, adequate budget allocation, use large volume tanker, immediate maintenance of the hygiene facility, educating students on the use of hygiene facilities and behavioral change, activating student health clubs, consulting students and professionals during design, maintenance, and construction facility. . .*" (KII: 03 in public school administrator)

A government-owned primary school student interviewed stated "*. . .we had hygiene education, awareness creation programs, and students participate in the school hygiene program by collecting*

Table 3. Factors associated with the handwashing practice of the students in Addis Ababa, Ethiopia, 2020.

VARIABLES	CATEGORIES	HANDWASHING PRACTICES		COR (95% CI)	AOR (95% CI)
		PROPER (N = 135), N (%)	IMPROPER (N = 249), N (%)		
Owner	Public	46 (34.1)	146 (58.6)	0.36 (0.24-0.56)*	0.49 (0.33-0.72)*
	Private	89 (65.9)	103 (41.4)	1	1
Geographic location	Peripheral	66 (48.9)	126 (50.9)	0.93 (0.61-1.42)	_
	Inner	69 (51.1)	123 (49.1)	1	
School level	Pre-primary	65 (48.1)	127 (51)	0.89 (0.58-1.26)	_
	Primary	70 (51.9)	122 (49)	1	
Sex of the student	Female	87 (64.4)	105 (42.2)	2.48 (1.63-3.53)*	2.45 (1.66-3.59)*
	Male	48 (35.6)	144 (57.8)	1	1
Trained coordinator on hygiene	Yes	79 (58.5)	113 (45.4)	1.7 (1.11-2.42)*	2.16 (1.32-2.48)*
	No	56 (41.5)	136 (54.6)	1	1
Teaching program on health	Yes	97 (71.9)	95 (38.2)	4.14 (2.70-5.89)*	2.53 (1.73-3.59)*
	No	38 (28.1)	154 (61.8)	1	1
Training on handwashing	Yes	93 (68.9)	91 (36.5)	3.84 (2.51-5.47)*	1.74 (1.82-3.69)*
	No	42 (31.1)	158 (63.5)	1	1

Abbreviations: COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval.
*Statistically significant at $P < .05$.

Table 4. Schools' handwashing provision, siting, and practices in Addis Ababa, Ethiopia, 2020.

VARIABLES	RESPONSES	SCHOOL LEVELS			TOTAL
		KG (N = 56)	PRIMARY (N = 34)	HIGH SCHOOL (N = 8)	
Presence of a functional handwashing station	Present	52 (92.9)	28 (82.4)	5 (62.5)	85 (86.7)
	Absent	4 (7.1)	6 (17.6)	3 (37.5)	13 (13.3)
Available materials for handwashing	Water and soap	26 (46.4)	10 (29.4)	(0)	36 (36.7)
	Water only	20 (35.7)	12 (35.3)	4 (50)	36 (36.7)
	Soap only	2 (3.6)	(0)	(0)	2 (2)
	Neither water nor soap	8 (14.3)	12 (35.3)	4 (50)	24 (24.5)
Location of handwashing facility that had water and soap	Toilets	23 (41.1)	10 (29.4)	0 (0)	33 (91.7)
	Lounges and dining areas	17 (30.4)	10 (29.4)	0 (0)	27 (75)
	School yard	1 (1.8)	0 (0)	0 (0)	1 (2.8)
Student washed his/her hands after a toilet visit	Yes	22 (39.3)	12 (35.3)	1 (25)	35 (35.7)
	No	34 (60.6)	22 (64.7)	7 (75)	63 (64.3)
Student washed his/her hands before eating	Yes	20 (35.7)	11 (32.4)	0 (0)	31 (31.6)
	No	36 (64.3)	23 (67.6)	8 (100)	67 (68.4)
Reasons why students didn't wash their hands	Not near enough	9 (26.5)	4 (11.76)	1 (12.5)	14 (14.3)
	No water	28 (50)	18 (52.9)	8 (100)	54 (55.1)
	No soap	28 (50)	23 (67.6)	8 (100)	59 (60.2)
	Too crowded	1 (2.9)	1 (4.3)	0 (0)	2 (2)

Table 5. Health education and training status of schools in Addis Ababa, Ethiopia, 2020 (N = 98).

VARIABLE	RESPONSE	FREQUENCY	%
Model teacher trained on hygiene	Yes	45	45.9
	No	53	54.1
Trained health coordinator	Yes	13	13.3
	No	85	86.7
Health education program availability	Yes	61	62.2
	No	15	37.8
Training provision	Yes	20	20.4
	No	78	79.6
Training topics	Hygiene and sanitation	14	14.3
	Menstrual hygiene	7	7.1
	HIV/AIDS	4	4.1
	Gender-related issues	19	19.4
Who give training	Teachers	14	14.3
	Health extension worker	6	6.1
	NGOs	2	2
	Club members	20	20.4

hygiene materials, money from their parents and they bought large water storage tanker. . ." (KII: 03 from public primary school student)

Challenges and solutions for good hygiene practices. The students and school admin raised the main challenges they face with their recommendations. The following are some quotes taken directly from key informants: -

"*. . .water interruption, improper usage of hygiene facility by students, non-functionality and lack of maintenance of facilities, absence of soap/lack of soap, in our high school water source broken due to design problem and no give service for 4 years. . .*" (KII: 05 in public secondary school student)

When the students asked the solutions to be used by the schools to work with the stake holders, to use more tanker water, maintenance of the hygiene facility immediately, educating students on the usage of hygiene facilities, and consulting students. From one interviewed student quotes "*. . .to work with Addis Ababa water and sewerage authority, to treat and use more tanker water, maintenance of the hygiene facility immediately, educating students on the usage of hygiene facilities and behavioral change, activate student health clubs, to allocate the budget specifically for WASH facilities, consult students, professionals during design, maintenance and construction facility. . ..*" (KII: 05 interviewed participant student)

The handwashing provisions and practices in public schools were poor due to lack of water and soap, some students did not wash their hands at critical times even when water and soap were present due to behavioral factors. "*. . .most students did not use handwashing facilities properly, they break them and almost all handwashing points are non-functional, due to finance rule which takes a long period for maintenance, and hygiene facility usage of students at all levels must be improved. . .*" (KII: 03 from public secondary and preparatory school administrator)

The handwashing provisions and practices in private schools were good in private schools, "*. . .we had responsibility for handwashing maintenance, our handwashing facilities are functional, we maintain facilities by paying per-diem for technicians/laborers without any bureaucracy that non-functionality was very small, and we follow our students handwashing practices. . ..*" (KII: 03 from private primary school administrator)

Discussion

This study was conducted to assess the handwashing practices and associated factors among school children in Kirkos and Akaki Kality sub-cities of Addis Ababa, Ethiopia. Handwashing stations were available in 85 (86.7%) of the schools and were used by 73.4% of the students. The proportion of schools with handwashing stations in this study was lower than the 60% proportion found in Ghana's Kintampo Municipality's public primary schools.[13] There were significant differences in the proportion of students who used handwashing facilities between private and public schools. In private schools, 46% of students wash their hands properly, compared to 24% in public

schools. This is likely due to the fact that private school students come from higher-income and more educated families, which can influence their behavior. Besides, the qualitative study that used in-depth interviews with club members and school administrators in all of the private settings found that there was good follow-up from teachers and school management to use handwashing facilities properly.

The good handwashing practice of students in schools included in this study was approximately one-third (135, 35.2%). This result was higher than the previous study conducted within the same city, in the Arada sub-city, where 99.9% of handwashing stations had no soap for handwashing.[29] This could be due to the school level variation and year of study. Similarly, the finding was also higher than the prevalence of good handwashing practice in primary school children of Sebeta town (32%),[23] Damote Woide district (28.1%), Mareko District (23%),[19] and Arbaminch town (22.2%).[20,21] The higher good handwashing prevalence in the current study might be due to the study location. As the nation's capital, it is more likely that students from schools in Addis Ababa to have better access to facilities, services, and hygiene information compared to students living in remote or rural areas with limited resources.

Among the students who used handwashing facilities, boys were less likely to use handwashing facilities than females, with 66.1% of males and 80.7% of girls. Similar trend was reported by[29] in Arada sub-city of Addis Ababa where 49.7% of boys washed their hands compared to 54.6% of girls.[29] Similarly, there were differences in the proportion students using soap for handwashing with gender: 60.6% males and 87.7% females. Of the students in the survey, 35.2% properly washed their hands, from these 64.4% and 35.6% were female and male students, respectively. Our study finding was also consistent with the study on the handwashing practice of university students in Ghana that reported that female students were more likely to wash their hands at all than males.[28] The higher good handwashing practice might be due to extra hygiene education opportunities for menstrual hygiene management for females. However, there is no sufficient evidence why females had better practice than males that demands further research.

Availability of clean running water and soap are essential inputs to ensure good hygiene behavior. Among 85 (86.7%) schools that had a handwashing facility, both soap and water was available in 33 (38.8%) schools which while 16 (18.8%) of schools had neither water nor soap at the time of the survey. These figures highlight the existence of unfavorable environment to practice proper handwashing at schools that needs ameliorative action. However, the result was by far better than the WASH baseline study report in Arada sub-city, where 99.9% of schools lacked soap and 88.1% lacked access to adequate number of handwashing facilities[29] The government and other stake holders' investment for better action to achieve the national Growth and Transformation Plan I and II as well as 2030 SDG targets may be responsible for the higher handwashing service in our study. The soap availability result in the current study was also better than similar study done in Nepal, and Lahore and Islamabad schools in Pakistan that none of the sampled school had soap and 86% of the schools had no soap for handwashing, respectively.[30,31] The reports for Nepal and Pakistan schools were for Millenium Development era while our study is recent by at least 5 years and is might be due to the study year that might be a justification for the difference besides the setting.

Similarly, the students' handwashing practice with water and soap at critical times (135, 35.2%) in our study was better than in Nicaragua (located in Central America), where 81% of schools had no handwashing facilities, and among schools that had water and soap, 74% washed without soap.[32] The Nicaragua school's hand hygiene study was conducted solely in low socioeconomic regions the country that could be possible reason for lower hygiene services in Nicaragua. But our study proportion of students used water and soap for handwashing at critical times was lower than global studies on world school handwashing facilities reported to be 53% of schools had soap and water.[5] This is justifiable as Ethiopia a developing country in Sub-Saharan Africa region where the lowest handwashing services reported. Particularly, this may be due to an underbudgeting, poor planning poor handwashing materials support mobilization, less emphasis from NGOs and stakeholders foin Addis Ababa schools.

In 83.5% of the schools, handwashing facilities were positioned near the latrine facilities. This result was superior to the study conducted at South Wollo school, where none of the handwashing facilities were located near the latrine[33] and a study done in schools located in Kimbibit district, North Shewa where 6.3% of the school had handwashing facilities near latrine.[34] However, still distance of handwashing stations from the latrine needs to be seriously considered at the design stage to ensure frequent handwashing and improve the health status of school community in our study area.

Interviewed health club heads and school administrator stated budget as the main challenge since the City Administration had transferred the total WASH including training budget to students' mass feeding program that potentially complicates operation and maintenance of WASH facilities and capacity development trainings to hygiene education coordinators, clubs and students. In our study, 9 out of 10 schools lacked a trained health/hygiene education coordinator and only 62.2% had a health education program. But studies highlighted the importance of teachers on school handwashing promotion and the need of trainings for coordinators and clubs. For example, the study conducted in Bihar (India) to assess the impact of teacher-led school handwashing program on children's handwashing with soap reported improvements after the intervention.[35] Therefore, the future direction in Addis Ababa and similar settings should be to train and involve teachers and students for achieving high good

handwashing behavior. The health education program in Addis Ababa was better than in the Benishangul Gumz region where 59% of teachers mentioned that hygiene education was given to students.[36] This study also revealed that only 20.4% of teachers get training and 14.3% school directors mentioned they get training on hygiene and sanitation, when compared with studies in the Benishangul Gumz region that 27% of teachers get training on school WASH which was better than Addis Ababa schools.[36] This may be due to low attention from regional government to give training on hygiene and sanitation by the school and stakeholders assuming schools at the capital may not face resource constrains and access to hygiene information.

Limitation of the Study

Only the hygiene facilities and practices at the time of the survey were shown due to the cross-sectional nature of the study. We were unable to fully investigate the relationships between all socio-demographic and socio-economic characteristics and handwashing practices since we only used undisguised observational methods to collect the data. Students' handwashing habits were examined using an adjusted multivariable logistic regression model, but statistical adjustments can only account for confounders that were measured; they cannot account for variables that were not measured. Therefore, there could be residual confounding due to unmeasured variables.

Conclusions

Schools' handwashing facilities and materials provision and proper handwashing practice of students at school in Addis Ababa were quite low. More than 85% of the schools had functional handwashing stations. However, only around one-third of the students have provisions for handwashing materials provisions, and in schools that had water with soap, only one-third of the students practiced proper handwashing at critical times. This implies the provision of the necessary materials for handwashing is not sufficient to motivate encourage students to practice handwashing with soap and water at critical times. In addition, the attention given and involvement of stakeholders to student school hygiene provisions and practices at the different management levels of education and the school community was low. Due to this most schools lack the budget and adequate spaces for the implementation of hygiene activities. Availability of trained hygiene coordinator, hygiene education program, and training on hygiene were positive predictors of proper handwashing practice that should be promoted. Besides, there is a need to strength public schools' capacity and more efforts to improve male students proper hand hygiene practice at critical times of handwashing in schools. Hence, improving hand hygiene practice of students and realizing a healthy school learning environment requires adequate budgeting, coordination of school stakeholders, routine hygiene education, and training of coordinators and health clubs.

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Author Contributions

Abayneh Melaku: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; software; supervision; validation; visualization; writing original draft, review and editing. Taffere Addis: Conceptualization; data curation; formal analysis; investigation, methodology; project administration; supervision; validation; visualization; review and editing.

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