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Progress of water, sanitation, and hygiene facilities in public primary schools of south Gondar zone, Northern Ethiopia

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Abstract

Introduction: *school water, sanitation and hygiene initiatives are the first steps towards improving health, education outcomes, and gender parity. Sustainable development goals (goal 6: "water and sanitation for all by 2030") and specifically goals 6.1 and 6.2 focus on drinking water, sanitation, and hygiene. This study evaluated the progress of the water, sanitation and hygiene facilities in public primary schools.* ***Methods:*** *a school-based cross-sectional survey was used, and primary data were collected by questionnaires through a face-to-face interview with school principals. Data input and cleanup were performed using EPI INFO (version 3.1), and statistical analyzes were performed using SPSS (version 23). Dependent variables were measured according to the indicators of the sustainable development goals such as basic, limited, and no services. The Chi-squared test was used to investigate the relationship of categorical outcome variables and a P-value of < 0.05 was considered significant and a 95% confidence interval was considered.* ***Results:*** *urban (68.8%) and rural (51.4%) public primary schools had access to drinking water through basic services, while 26% of rural public primary schools do not have drinking water sources. Regarding the ladder of services for sanitation in public primary schools, urban (66.7%) and rural (42.3%) had access to basic sanitation services, and 57.7% of rural public primary schools do not have sanitation services. The handwashing facilities in these schools were very low in both urban (35.4%) and rural (3.6%). Only urban public primary schools (8.3%) provide soap and water at handwashing stations. The solid waste disposal methods in public primary school methods consists mainly of burning (71.3%), followed by disposal (25%).* ***Conclusion:*** *the public primary schools were far from the way to achieve the sustainable development goals. Half of rural public primary school (PPSs) had limited or no services. More than half of rural were accessed with no sanitation services. The proportion of handwashing facilities in public primary schools was very low. Even though there were better water, sanitation, and hygiene facilities among urban public primary schools compared with rural, strong emphasis should be given for both school managements in the remaining time.*

Introduction

School water, sanitation and hygiene (WaSH) is the first step that refers to the combination of technical and human development components which are indispensable for effective learning, enrollment and retention of girls, reduction of diseases and worm infestation, environmental cleanliness, cleanliness, and implementation of child rights [1]. Sustainable development goals (SDGs) of the goal 6: "water and sanitation for all by 2030" and specifically SDGs 6.1 and 6.2 focus on drinking water, sanitation and hygiene [2]. It is well known that improving WaSH is essential for reducing infant mortality and improving health in a sustainable manner. However, 2.5 billion, 748 million, and 1 billion people lack improved sanitation facilities, improved drinking water sources, and practice open defecation, respectively [3].

Each year 1.7 billion under five diarrheal case, 3 million cholera cases, and 11 million typhoid cases reported [4]. From 1.4 million diarrheal deaths, 485,000, 432,000, and 165,000 were attributable to inadequate water, sanitation, and hygiene, respectively [5]. In Ethiopia, school-aged children lack the habit of handwashing after using the toilet, which is the leading cause of intestinal parasitic infection [6], with prevalence ranging from 16% in Dessie [7] to 66.7% in Jimma [8]. The majority of Ethiopian primary schools have sanitation facilities, with 86% having at least one latrine. The majority, however, are traditional pit latrines, and only 31% of school latrines are classified as "improved sanitation" [9]. Data on WaSH progress should be disaggregated, equitable, and of high quality for national and international comparable [10]. Sustainable development goals indicators (SDGIs) were

developed to track WaSH progress in schools as advanced, basic, limited, and no services [11]. This study investigated the progress of WaSH facilities in public primary schools (PPSs) based on SDGI (defined and consistent indicators established by JMP), which can be considered as an input for the implementation of the SDGs.

Methods

Study area: the South Gondar zone is located in the Amhara region, northern Ethiopia, approximately 666 km from the capital of Ethiopia, Addis Ababa. South Gondar zone has a total population of 2,239,077 (2017 estimation) with an area of 14,095.19 km^2. South Gondar zone has 13 districts and two town administrations (Debre Tabor and Woreta) and a total of 401 kebeles.

Study design: south Gondar Zone as a study area are because of study feasibility and a baseline to show international based indicator assessment of WaSH facilities coverage in PPSs. Public primary schools in the southern Gondar zone were surveyed using a school-based cross-sectional survey. The research was carried out during October and November 2020. All PPSs found in the south Gondar zone in the 2020 academic year were the source population. Urban and rural PPSs were considered a study unit. In this study all urban PPSs (48) found in the South Gondar zone and all rural PPSs (113) found in Farta Woreda were included.

Data collection methods: data were collected by questionnaires and observational checklist. The data collection tools used to collect data were containing sections of school characteristics, water supply, sanitation, and hygiene assessment. The questionnaire and the checklist were prepared based on SDGI and definitions from previous tools [11]. The English version of the data collection tool was translated into the local language (Amharic) and back to English, and consistency was checked. Data collectors and supervisors were selected based on WaSH and survey experience. Public health professionals and health extension workers were participated in data collection after two days of training. Data were collected from the head of the school and their delegates in the absences of school heads and returned to each school up to three times to ensure the highest possible response rate.

Public primary school: includes the first primary cycle (1-4 grades) and the second primary cycle (5-8 grades) [9]. Improved water sources: piped water, boreholes, protected well, or spring rainwater [11]. Unimproved water source: water from a tanker, surface water, unprotected well, or spring [11]. Measurement of the outcome variables (WaSH): the progress of water, sanitation and hygiene was measured based on SDGI described by [11] and reported as basic, limited and no services for each outcome variable (Table 1) [12].

Data quality control: a pretest was conducted among the PPSs not included in the study to ensure the completeness and internal consistency of the questionnaire and checklist. Based on this, the questionnaire and checklist was refined to take into account the regional context. Data were cleared by identifying those who had incomplete responses and no responses and categorizing, editing, coding, classifying and tabulation of the collected data. Data quality was checked in the field to ensure that all data were collected and recorded, and was checked centrally in the office after the fieldwork was completed and returned.

Data processing and analysis: data entry, cleaning, and verification were performed using EPI INFO (version 3.1). Statistical analyzes were calculated based on excel and SPSS (version 23). The data were summarized and presented using tables and figures in addition to narration. A P-value of ($p<0.05$) was considered significant and a 95% confidence interval was considered.

Results

General characteristics: the survey was completed and returned by 159 (48 urban and 111 rural) PPSs (response rate 98.8%). There were 19,694 (boys), 22,815 (girls) and 176 (special need) students in urban PPSs. In rural PPSs, 36,673 (boys), 43,632 (girls) and 36 (special needs) students attended their education in Farta Woreda, South Gondar zone.

Water sources in public primary schools: both urban (100%) and rural (73.4%) PPSs participated in this study were accessed their drinking water from improved sources (Figure 1). Based on drinking water service ladders, 68.6% of urban and 26% of rural PPSs have access to basic services and no services, respectively (Figure 2). Pipe water was the main drinking water source for urban (87.5%) and rural (41.4%) PPS4s. In this study, (3.6%) and 10.8% of rural PPSs had access to their main drinking water from surface water sources and without available drinking water sources in the school, respectively (Table 2). This difference was statistically significant at the 5% level ($p<0.001$). The proportion of PPSs with improved drinking water sources was higher in urban areas than in rural areas, 100% compared to 75.7%. This difference was statistically significant at the 5% level ($p<0.001$). In this study, 10.4% (urban) and 27% (rural) PPSs were accessed for drinking water sources available throughout the year and there was no drinking water source available throughout the year in 17.1% (rural) PPSs (Table 3). This difference was statistically significant at the 5% level ($p=0.025$). Only 18.8% (urban) and 5.4% (rural) drinking water sources were comfortable for small children and special need students.

Sanitation facilities in public primary schools: Urban (66.7%) and rural (42.3%) PPSs were accessed for improved sanitation sources. According to the sanitation ladders, 57.7% of rural PPSs do not have sanitation services (Table 4). The percentage of PPSs with improved toilet facilities were higher in urban than those in rural, 67% as compared to 42.3%. This difference was statistically significant at the 5% level ($p<0.001$). In the overall sanitation service ladders, 49.7% (66.7% urban and 42.3% rural) PPSs had basic sanitation services (Figure 3). There was no single toilet facility for small children in rural PPSs, whereas 16.7% of urban PPSs had at least one toilet for small children´s students (Table 5). This difference was statistically significant at the 5% level ($p<0.001$). Urban (83.3%) and rural (40.6%) PPSs emptied the toilet when full (Figure 4).

Hygiene facilities in public primary schools: the handwashing facilities in PPSs were very low in rural areas (3.6%) compared to urban areas (35.4%) (Figure 5). Handwashing facilities (12.5%) urban and (0.9%) rural PPSs had comfortable handwashing facilities for small children and special-need students. The common type of effort made for Menstrual Hygiene Management (MHM) among PPSs was providing health education on MHM (79.2%) urban and (72%) rural and 28% (rural PPSs) did not perform any activities related to MHM (Table 6). Solid waste management system of urban 41 (85.4%) and rural 73 (65.8%) PPSs were mainly based on burning in the school compound (Table 7).

Ethical considerations: initially, letter of approval was obtained from Debre Tabor university research and ethics review committee. Permission from South Gondar zone education office also was to be obtained.

Discussion

Access to better drinking water sources in schools is an opportunity to improve health and education. In general, 56.6% (68.8% urban and 51.2% rural) PPSs accessed drinking water from basic services. Generally, 83% of PPSs had drinking water from improved sources (100% urban and 73.4%) rural). Based on measures of sanitation ladders, 66.7% (urban) and 57.7% (rural) PPSs were served from basic sanitation services and do not have sanitation services, respectively. Urban

PPSs with basic hygiene services (handwashing facilities with water and soap) were only 8.4% and rural PPSs (96.4%) was with no handwashing services (with only water and/or no handwashing facilities).

Drinking water sources from improved sources have an essential role in reducing communicable diseases. In this study, 83% of PPSs obtained drinking water from improved sources, which is in line with the global baseline report [13], and higher than 68% of the schools have an improved source of drinking water [14] and much higher than study in Uganda as government primary school only 14% [15], got their drinking water from piped water sources and this variation might be due to study setting. Drinking water from improved sources is not evidence of drinking water accessibility and should be available at all times. Based on drinking water service ladders, in this study about 57% of PPSs accessed from basic drinking water sources, which was lower than 69% [13] and much higher than 7% of the study [16]. All urban PPSs assessed drinking water from protected sources of which 69% of urban primary schools accessed water at the time of visit, which is better than 56% of Mozambique and 10% of Ethiopia [17] and the study [18] that 40% of primary school got from piped water sources. In this study, rural PPSs (51%) had access to drinking water from basic services, which is much higher than the study [19] that 4% of rural schools in low and middle income countries had basic water sources. In the current study, 14.4% of rural PPSs do not have drinking water sources and is lower than 24% of the study [19].

Water sources should consider students with special needs and small children. In this study, 9% of the PPSs water sources were comfortable for special-need students and small children, and this is very far from the study [20] that the majority of the schools (74%) had no facilities accessible to students with physical disabilities. In this study, half (49%) of the PPSs were accessed for improved toilet facilities, which is very far lower than 90% of the toilets were improved latrines [20]. This study showed that 54.5% of PPSs accessed from basic sanitary service and 67% of urban PPSs had access to basic sanitation, which is lower than the global reports of 63% and 90%, respectively [21]. Hand hygiene is the most important practice to limit the transmission of diseases. The prevalence of handwashing facilities in the current study was very low with 13%, and only 3%of basic hygiene services, which is lower than 56% of primary schools had a basic hygiene service [21]. In this study, all rural PPSs had no hygiene services and were far from the report, with 41% of rural primary schools without hygiene services. Solid waste disposal options in this study showed that most of the urban and rural schools were practicing open burning.

Limitations of the study: current water quality data would have offered further insight into the water quality utilized in the investigated schools, but they were unavailable. The authors, on the other hand, follow the Joint Monitoring Programme (JMP) indicators and operational definitions.

Conclusion

In this study, it is possible to conclude that PPSs were far from the way to achieve SDGs. Regarding drinking water sources, half of rural PPSs were under limited service and had no services. More than half of rural PPSs were accessed with no sanitation services. The proportion of handwashing facilities in PPSs was very low. Even though there were better water, sanitation, and hygiene facilities among urban PPSs compared with rural, strong emphasis should be given for both school managements in the remaining time. Immediate opportunities to increase equitable access to WaSH in schools in these settings include improved WaSH construction facilities, ready for users and providing soap, water, and drying materials in handwashing facilities during school days. These changes highlight opportunities for health officials, practitioners, and school administrators to improve WaSH services in study

regions, improve health, access to education, and gender parity among students.

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What is known about this topic

- *Coverage of WaSH in schools using traditional tools;*
- *School WaSH coverage at national level still based on inconsistent indicators.*

What this study adds

- *Progress of WaSH facilities in public urban and rural primary schools independently;*
- *Investigation was done based on international school WaSH indicators;*
- *Baseline for the study region (new for the study region).*

Competing interests

The authors declare no competing interests.

Authors' contributions

AA wrote the manuscript, including tables and figures. GA, WT and AT. have contributed to methods section. All the authors have read and agreed to the final manuscript.

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Figure 5: proportion of PPSs handwashing facilities, South Gondar Zone, Northern Ethiopia, 2020

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Table 1: SDGI used to measure the progress of WaSH, the South Gondar zone, 2020			
Service level	**Drinking water**	**Sanitation**	**Hygiene**
Basic service	"Drinking water from an improved source and water is available the time of survey"	"Improved sanitation facilities at the school that are single-sex and usable (available, functional, and private) at the time of the survey"	"Handwashing facilities with water and soap are available at the school at the time of the survey"
Limited service	"Drinking water from an improved source but water was not available at the school at the time of the survey"	"Improved sanitation facilities in the school that are not single-sex or are not usable at the time of the survey"	"Handwashing facilities with water but no soap available in the school at the time of the survey"
No service	"Drinking water from an unimproved source or no water source at the school"	"Unimproved sanitation facilities or no sanitation facilities in the school"	"No handwashing facilities or no water available at the school"

Table 2: main drinking water source of the school by location, South Gondar zone, Northern Ethiopia, 2020, 2020 (N=159)			
Main drinking water source in PPSs	**School location**		
	Urban	**Rural**	**p-value**
Pipe (stand pipe in PPSs)	42 (87.5%)	46 (41.4%)	0.000*
The improved well	6 (12.5%)	36 (32.4%)	
From tanker		11 (9.9%)	
Surface water		4 (3.6%)	
Other sources (rain water and packed water)		2 (1.5%)	
No drinking water source		12 (10.8%)	
* Correlation is significant at the 0.01			

Table 3: proportion of PPSs with drinking water sources availability, South Gondar zone, Northern Ethiopia, 2020, 2020 (N=159)				
Variables		**School location**		
		Urban	**Rural**	**p-value**
Drinking water sources available during the survey	Yes	33 (68.8%)	57 (51.4%)	0.192
The drinking water source was available throughout the day during the past two weeks	Yes	28 (58.3%)	67 (60.3%)	0.267
Drinking water source available throughout the year	Yes (the whole year)	5 (10.4%)	30 (27%)	0.025*
	Yes, almost (if <30 days not available)	40 (83.3%)	62 (55.9%)	
	No (if >30 days not available)	3 (6.3%)	19 (17.1%)	
*correlation significant at the 0.025				

Table 4: proportion of PPSs by types of toilet facilities in relation to school location, South Gondar Zone, Northern Ethiopia, 2020 (N=159)			
Types of toilets	**School location**		
	Urban	**Rural**	**p-value**
Water flushed	8 (16.7%)	1 (0.9%)	
Pit toilet with slab	24 (50.0%)	46 (41.4%)	0.000*
Pit toilet without slab	16 (33.3%)	55 (49.6%)	
Other		7 (6.3%)	
No toilets		2 (1.8%)	
***correlation significant at the p<0.001**			

Table 5: proportion of PPSs toilets by school location, south Gondar zone, northern Ethiopia, 2020				
Variables		**School location**		
		Urban	**Rural**	**p-value**
Separate toilets for boys and girls	Yes.	44 (91.7%)	81 (73%)	0.039
Menstrual hygiene waste bin available in the toilet of female students	Yes	12 (25%)	7 (6.3%)	0.002
School manages menstrual hygiene related waste	Yes	9 (18.8%)	11 (9.9%)	0.166
At least one toilet for small children	Yes	8 (16.7%)		0.000
At least one toilet for special needs students	Yes	7 (14.6%)	3 (2.7%)	0.007
Anal cleansing materials for students in the toilets	Yes	13 (27.1%)	6 (5.4%)	0.000

Table 6: the PPSs effort done for MHM, South Gondar zone, Northern Ethiopia, 2020		
Efforts for MHM	**School location**	
	Urban	**Rural**
Preparation of washing place	2 (4.2%)	
Providing MHM, materials, and maintenance	2 (4.2%)	
Health education on MHM	38 (79.2%)	80 (72%)
No any activities done by the school	6 (12.5%)	31 (28%)

Table 7: solid waste management in PPSs by school location, southern Gondar zone, northern Ethiopia, 2020 (n=159)			
	Solid waste management options	**School location**	
		Urban	**Rural**
Solid waste management in the school	Collected by the municipal		3 (2.7%)
	Burning in the school compound	41 (85.4%)	73 (65.8%)
	Burring in the school compound	1 (2.1%)	2 (1.8%)
	Deposited in the school compound	6 (12.5%)	33 (29.7%)
Total		48 (100%)	111 (100%)

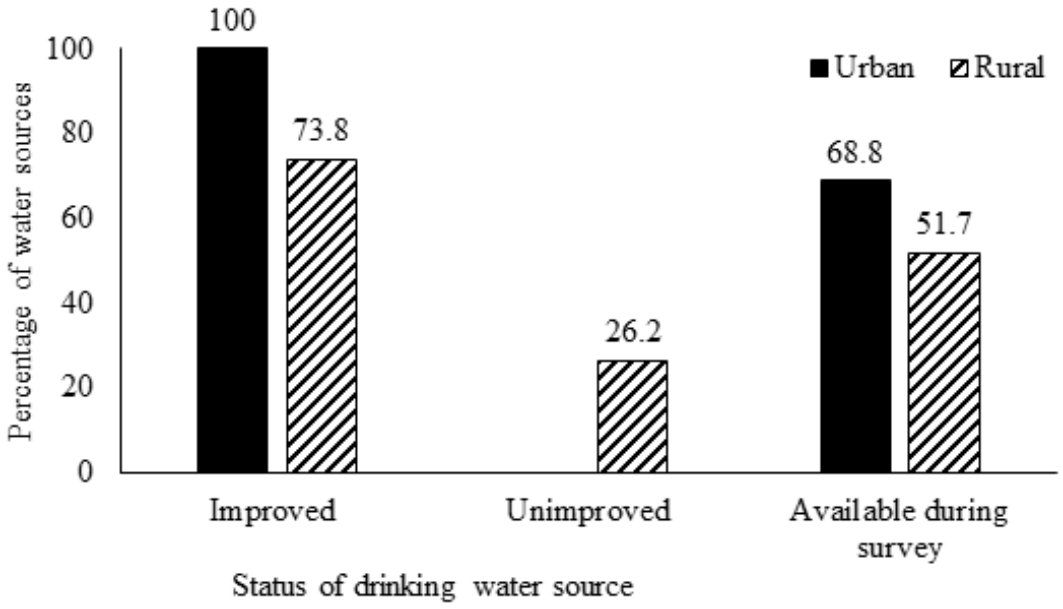

Figure 1: proportion of PPSs water source options, south Gondar zone, Northern Ethiopia, 2020

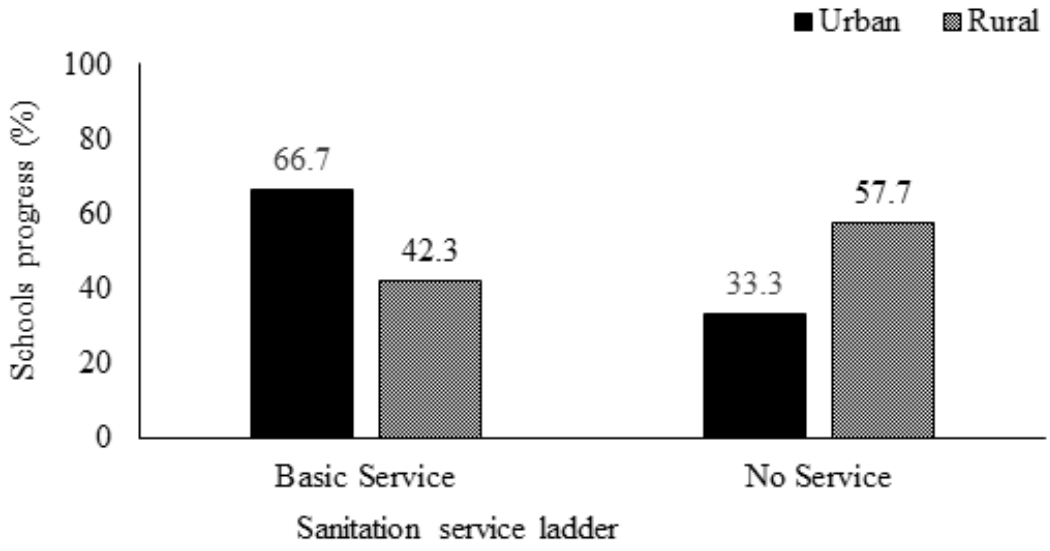

Figure 2: proportion of the water service ladder of PPSs, south Gondar zone, northern Ethiopia, 2020

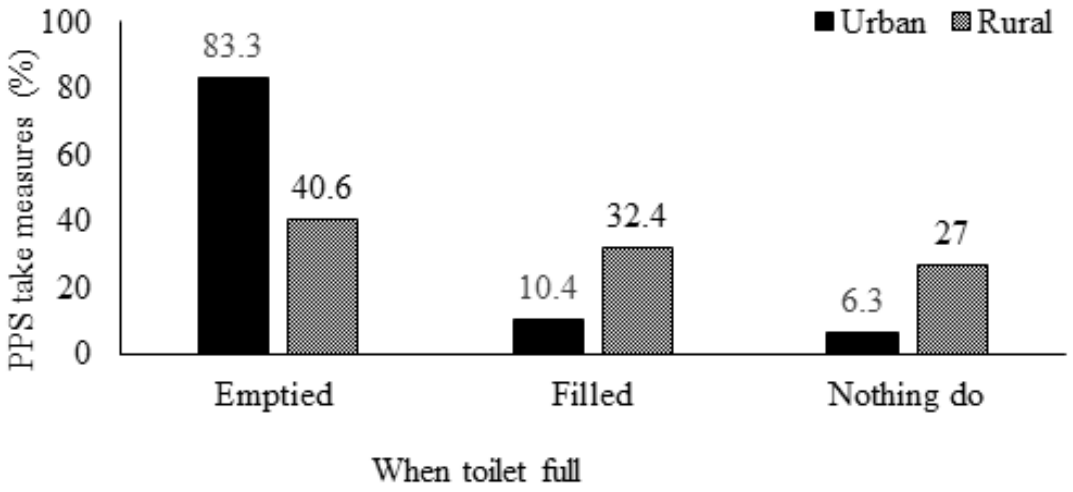

Figure 3: proportion of PPSs with toilet facility status, South Gondar Zone, Northern Ethiopia, 2020

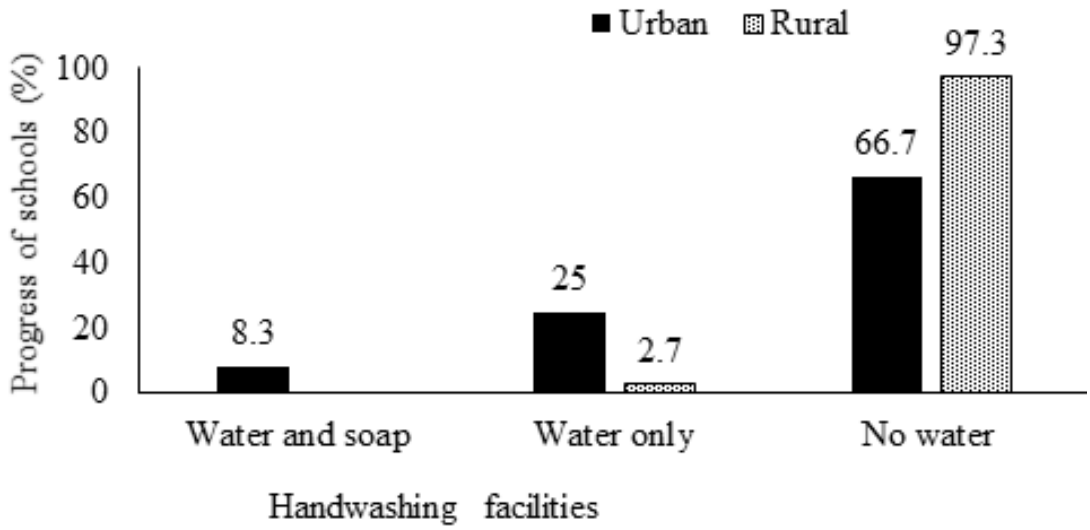

Figure 4: proportion of PPSs measures taken when the toilet is full, South Gondar zone, Northern Ethiopia, 2020

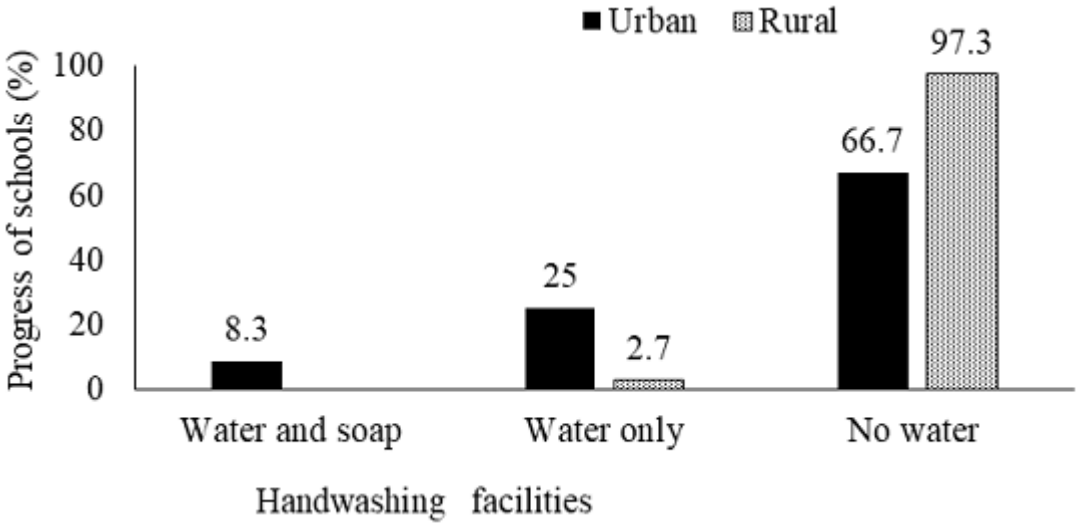

Figure 5: proportion of PPSs handwashing facilities, South Gondar Zone, Northern Ethiopia, 2020