


## Research Paper

# Level of JMP ladders for water, sanitation, and hygiene (WASH) services among healthcare facilities of Bishoftu Town, Ethiopia: An implication of healthcare-associated infection prevention status

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## ABSTRACT

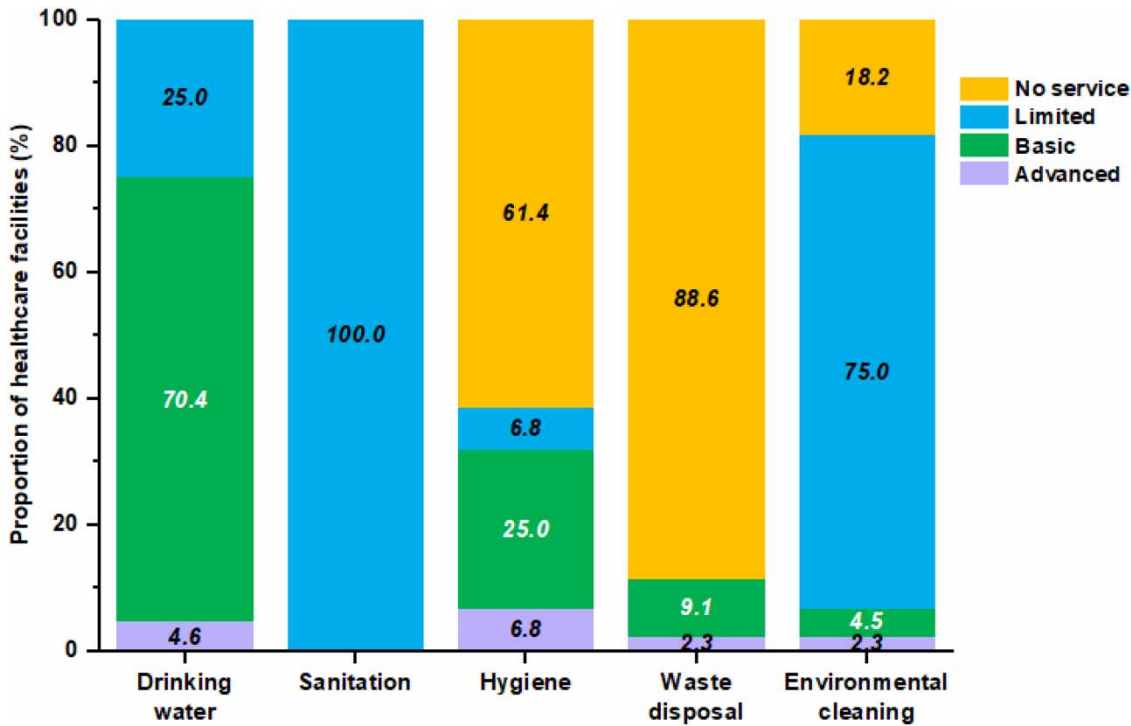
This study aimed to assess the level of JMP ladders for WASH services. A cross-sectional study was conducted. Forty-four healthcare facilities were enrolled. From each healthcare facility, water samples were collected directly from water storage facilities. In addition to the interview, an observational checklist was used. Descriptive statistics and a chi-square test were conducted to analyze the data. The coverage of advanced and basic drinking water services in healthcare facilities was 4.6 and 70.4%, respectively. However, the healthcare facilities' access to advanced and basic sanitation services was nil. Similarly, 61.4 and 88.6% of the healthcare facilities had no hygiene and waste disposal services, respectively. While 2.6, 4.5, and 75% of healthcare facilities had advanced, basic, and limited environmental cleaning services, 18.2% lacked environmental cleaning services. Water samples of 15.9, 11.4, and 6.8% of the healthcare facilities were found positive for total coliforms, fecal coliforms, and *E. coli*, respectively. The WASH services of the healthcare facilities were very low and not on track to achieve the Sustainable Development Goal target. Healthcare facilities could be sources of healthcare-associated infections. Hence, the government and other concerned bodies should take urgent action to improve WASH services.

**Key words:** healthcare, healthcare-associated infection, JMP ladders, WASH

## HIGHLIGHTS

- 4.6 and 70.4% of the healthcare facilities used advanced and basic water services, respectively.
- The healthcare facilities' access to advanced and basic sanitation services was nil.
- The majority of the healthcare facilities had no hygiene and waste disposal services.
- 18.2% of the healthcare facilities lacked environmental cleaning services.
- Bacteria and chemical contaminants contaminated many water samples.

## GRAPHICAL ABSTRACT



## ABBREVIATIONS

WASH Water, Sanitation, and Hygiene  
 WHO World Health Organization  
 JMP Joint Monitoring Programme of WHO and UNICEF

## INTRODUCTION

The United Nations approved the 17 Sustainable Development Goals in 2015 in order to address global challenges and achieve a better and more sustainable future for everybody by 2030 (Assembly 2015).

Among these goals, the Sustainable Development Goal 6 stipulates that everyone should have access to clean water, sanitation, and hygiene (Brookes & Carey 2015), because safe water, sanitation, and hygiene are the most fundamental human needs for health and well-being (Hutton & Chase 2017). However, unless progress is quadrupled, billions of people will lack access to these basic services by 2030 (World Health Organization 2021).

Despite the World Health Organization (WHO) and United Nations Children's Fund/UNICEF Joint Monitoring Program (JMP) establishing the JMP ladders for WASH services as advanced, basic, limited, and no service, these services in healthcare facilities remain a significant public health challenge. The 2020 JMP progress report indicated that 50, 63, 70, and 33% of healthcare facilities globally had no basic water, sanitation, waste management services, and hand hygiene facilities at the point of care, respectively (World Health Organization 2020a). This report also stated that due to the lack of basic water services, 1.8 billion people, including healthcare workers and patients, were exposed to a greater risk of infections. Furthermore, in Sub-Saharan African countries, 77% of the healthcare facilities had no basic sanitation services (World Health Organization 2019). In Ethiopia, however, no single study revealed the whole figure of the new JMP ladders for WASH services in Ethiopian healthcare settings.

Adequate water, sanitation, and hygiene (WASH) are vital components of basic health services (Chand *et al.* 2020). Besides, appropriate waste disposal and environmental cleaning services are essential for quality health services (Anicetus *et al.* 2022). The provision of these services in healthcare facilities assists in preventing infections and the spread of disease, protecting staff and patients, and supporting the dignity of vulnerable populations, including pregnant women and the

disabled (Sadhu *et al.* 2022). However, many healthcare facilities in low- and middle-income countries lack basic WASH services compromising the ability to provide safe care and presenting severe health risks to those who seek different treatments (Cronk & Bartram 2018). Worldwide, hundreds of millions of patients are affected by healthcare-associated infections each year, leading to significant morbidity, mortality, and financial losses (Haque *et al.* 2020). Of every 100 hospitalized patients at any given time, seven in developed and 10 in developing countries acquire at least one healthcare-associated infection (World Health Organization 2015a). Sepsis and other severe infections are major killers estimated to cause 430,000 deaths annually (World Health Organization 2015b). However, more than half of all cases of healthcare-associated sepsis are thought to be preventable through safe WASH services and appropriate infection prevention measures (Taylor 2022). Achieving and maintaining WASH services in healthcare facilities is critical for improving universal health coverage and achieving the Sustainable Development Goal targets (World Health Organization 2020b). Improving WASH conditions can help establish trust in health services and encourage mothers' timely care-seeking during prenatal and postnatal care (Guo *et al.* 2017). Additionally, those services assist mothers in seeking institutional delivery, which is an essential element in reducing maternal mortality rather than home delivery (Russo *et al.* 2012). The lack of access to WASH services in healthcare facilities may discourage women from giving birth or cause delays in care-seeking (Bouزيد *et al.* 2018). In Ethiopia, 31% of healthcare facilities used unimproved sanitation facilities (Guo *et al.* 2017). A study done in Ethiopia revealed that only 50% of the healthcare facilities had basic hygiene services (Berihun *et al.* 2022). Despite WASH services assisting in reducing the transmission of healthcare-associated infections and increasing trust and uptake of healthcare services, there is limited evidence on the JMP ladders for WASH services. So, filling data gaps and setting baselines about WASH services are essential and inspired us to conduct this study. The investigation's findings will also point decision-makers in the right direction for putting into practice successful WASH initiatives, such as creating national standards and accountability systems, enhancing infrastructure and maintenance, involving communities, conducting operational research and sharing learning, setting goals and defining a roadmap for improving WASH services and lowering the risk of healthcare-associated infections.

## METHODS

### Study area

Bishoftu town is located at a distance of 44 km from the capital city of Addis Ababa (Girmay *et al.* 2022a). The area of the town is estimated to be 18,278 hectares and has an estimated population of 171,227 (Girmay *et al.* 2023). It is located at the Global Positioning System (GPS) coordinates of 8°44'4.74" North and 39°0'30.726" East (Girmay *et al.* 2022b). According to the Bishoftu Town health bureau data, the town has 64 healthcare facilities. In the town, a five-year project titled 'Hygiene and Environmental Health Services' is currently underway. The project's purpose is to create a learning city model in terms of urban water, sanitation, and hygiene services. The Ministry of Health Ethiopia chose the study area based on a variety of criteria. The main grounds for selecting the learning model city were its closeness to Addis Ababa, suitability for increased government and expert monitoring, and significant tourist population. In addition, having substantial investments, a landfill, and past experience with WASH were all requirements.

### Design and sample size

A health facility-based cross-sectional study was conducted among healthcare facilities in Bishoftu Town from January to February 2022. For this study, the sample size was calculated using a single population proportion formula with 95% CI, 5% marginal error ( $r$ ), and a 10% proportion of healthcare facilities ( $P$ ) that had no sanitation services (World Health Organization 2020a). Then, 138 samples were calculated. Yet, since the sampling was from a finite population of size 64 ( $N < 10,000$ ) total healthcare facilities in Bishoftu Town, the authors used the population correction formula. Then, the final sample size was = 44. Adding 10% for the non-response rate, the sample size ( $n$ ) for this study was = 48 healthcare facilities.

### Sampling and data collection procedures

A listing of the 64 healthcare facilities was obtained from the Bishoftu town healthcare office. Then, 48 (75%) healthcare facilities were selected using a lottery method. Water samples were taken from each healthcare facility's water storage. Heat-sterilized bottles of 250 mL capacity for bacteriological and 1,000 mL plastic bottles for chemical parameters were used to collect the water samples. Sampling and preservation techniques were adopted following the guidelines laid down by the WHO guidelines for drinking water quality (World Health Organization 2011). The bottles arrived at the laboratory within 6 h and were refrigerated at 4 °C until the analysis time. A structured questionnaire having JMP core questions for

healthcare facilities (World Health Organization 2018) was used to collect the data. Ten trained Bachelor of Science holder health professionals collected data using Open Data Kit (ODK) software. Healthcare directors were interviewed to assess water, sanitation, and hygiene services.

### Data quality control

To assess WASH services, an English questionnaire was created and then translated to Amharic and back to English to ensure consistency of questions. In addition, the primary investigator evaluated and reviewed the entire completed questionnaire to confirm the accuracy and consistency of the information. All relevant processes were followed by competent laboratory personnel, ensuring the validity of laboratory results. The apparatus and chemicals used in the test were calibrated, and the expiry date was checked.

### Data analysis

Firstly, data were checked for correctness and transferred from Open Data Kit (ODK) into the Stata version 16 for analysis. Chi-square test was used to assess the association. According to the United States Food and Drug Administration, the enumeration of *Escherichia coli*, total coliform, and fecal coliform bacteria was performed using the membrane filtration method (Food and Drug Administration 2018). Furthermore, according to the United States Environmental Protection Authority (USEPA) guideline, an ion-selective electrode (ISE) was used to determine fluoride levels in drinking water (USEPA 1996). In addition, the level of nitrate concentration was determined by the ultraviolet spectrophotometer screening technique according to the American Public Health Association (1998) Standard methods for examining water and wastewater (APHA). The study location was in the rift valley and had a larger concentration of livestock feedlots. As a result, we prioritized testing the above chemicals.

### Ethical approval

The Ethiopian Public Health Institute scientific and ethical review board approved the study with the reference number EPHI-IRB-358-2021. Then, written consent was obtained from the heads. The confidentiality and anonymity of respondents were ensured throughout the study.

### Definitions

*Drinking water quality:* To determine the drinking water quality, the water analysis was conducted according to the WHO drinking water guideline (World Health Organization 2011).

JMP ladders for WASH services for healthcare facilities were defined according to <https://washdata.org/monitoring/health-care-facilities>.

## RESULTS

### Type of healthcare facilities and the number of customers

Forty-eight healthcare facilities medical directors were included in this study, with a response rate of 92%. The mean of employees in the health facilities was 27 (Table 1).

### Water quality, contamination risk levels, and availability of sanitation facilities

Most (93.2%) of the healthcare facilities had at least one type of functional toilet. Besides, 90.9% of the healthcare facilities had at least one kind of available toilet accessible for people with limited mobility (Supplementary Table S1).

### JPM ladders for WASH services of the healthcare facilities

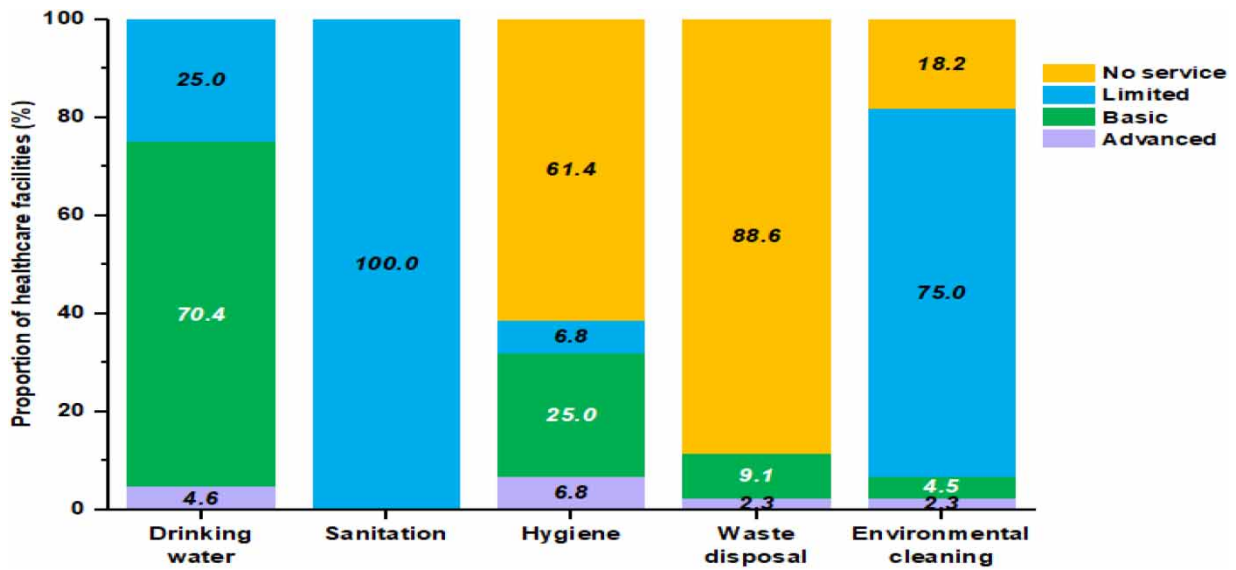
In this investigation, the coverage of advanced and basic drinking water services was 4.6 and 70.4%, respectively. Access to advanced and basic sanitation services of the healthcare facilities was nil. Furthermore, 6.8 and 25% of the healthcare facilities used advanced and basic hygiene services, respectively. However, 61.4, 88.6, and 18.2% of the healthcare facilities had no hygiene, waste disposal, and environmental cleaning services (Figure 1).

### Hand hygiene service

In this study, 63.6% of the healthcare facilities had functional handwashing facilities at one or more toilets. Also, 2.3% of the healthcare facilities had hand washing facilities without water and soap, while 54.5% of the point of care had no hand washing facilities (Supplementary file 2 Table S2).

**Table 1** | Type of healthcare facilities and number of stakeholders in Bishoftu Town, Ethiopia, 2023

Study variables	Frequency	Percent (%)		
Sex of the medical directors				
Male	27	61.4		
Female	17	38.6		
Type of health facility				
Health post and drug store	16	36.4		
Health center	4	9.1		
Primary hospital	2	4.5		
Maternal and child health specialty	1	2.3		
Medium clinic	13	29.5		
Primary clinic	7	15.9		
General hospital	1	2.3		
<b>Descriptive Statistics</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
Number of employees	5	654	26.8	98.9
Number of visiting inpatients	0	695	30.1	133
Number of visiting outpatients on the previous day	0	439	41.3	89.9



**Figure 1** | JMP ladders for WASH services in healthcare facilities of Bishoftu Town, Ethiopia.

### Healthcare waste management

In the study, 40.9% of the healthcare facilities stored waste in unprotected storage. Surprisingly, 86.4% of the healthcare facilities had no protocol for cleaning and cleaning schedule. In this study, 25% of staff with cleaning responsibilities did not take any training regarding healthcare waste management (Supplementary Table S3).

### Association between basic hygiene and selected study variables

The study’s findings revealed that having a cleaning protocol, a waste management guideline, and an infection prevention committee had no statistically significant association with basic hygiene services. However, trained staff about healthcare

waste management, having a specific budget for WASH services, having trained staff for maintenance and repair of WASH infrastructure, and community involvement in planning, monitoring, and evaluation had significant association with basic hygiene service (Table 2).

## DISCUSSION

The current study aimed to assess the level of JMP ladders for WASH services in healthcare facilities of Bishoftu Town, Ethiopia. The coverage of advanced drinking water services in healthcare facilities was low. Therefore, developing and putting into action effective strategies is a requirement for the government and decision-makers. Despite the coverage of basic water services in the assessed healthcare facilities being relatively high and seeming on track to achieve the Sustainable Development Goal of 2030, still, significant healthcare facilities had no basic water service. Besides, there was a significant water supply interruption, as 15.9% of the healthcare facilities had no water during the survey day. This could be the leading cause of healthcare-associated infections, although this finding was similar to a study done in Rwanda (Huttinger *et al.* 2017). This investigation revealed that 93.2% of the healthcare facilities had no sufficient water for all purposes (5–400 liters/person/day). Despite the Ethiopian healthcare facilities' WASH guidelines requiring a minimum of 5–400 liters of water per person per day (<https://www.washinhcf.org/resource/health-care-facilities-wash-guideline/>), this research showed that the majority of the healthcare facilities lacked the water they needed for their operations. Furthermore, 15.9, 11.4, and 6.8% of water samples of the healthcare facilities were positive for total coliforms, fecal coliforms, and *E. coli*, respectively. These findings suggest that the water supply of the healthcare facilities was fecally contaminated and can cause a serious potential health hazard. Behind the presence of indicator bacteria in the water supply, many pathogenic microorganisms that can cause public health problems are always ensured (Huttinger *et al.* 2017; Girmay *et al.* 2020, 2021). The findings revealed that 93.2, 4.6, and 2.3% of the health facilities' water samples had low, moderate, and very high contamination risk levels, respectively. The latter two results revealed that the water supply of the health facilities needs priority and urgent actions. Moreover, 2.3% of the water samples of the healthcare facilities were above the permissible level. According to the WHO drinking water guideline value, 2.3% of the water samples were polluted and posed a health concern. Exposure to above the permissible level of fluoride may harm human health. Skeletal fluorosis can be caused by drinking water with substantial amounts of fluorides. However, the disease occurs after long-term exposures that can cause denser bones, joint pain, and a limited range of joint movement. This idea is supported by Petersen & Ogawa (2016). In this study, the coverage of advanced and basic sanitation services among the healthcare facilities was nil. All (100%) of the healthcare facilities used limited sanitation services. This revealed a huge gap and a need for decisive action to upgrade the limited service to the advanced and basic sanitation services of the healthcare facilities. Also, the study indicated that a large number (61.4%) of

**Table 2** | Association between basic hygiene and selected study variables

Study variables	Basic hygiene service			X <sup>2</sup>	Df	p-value
	Yes (%)	No (%)				
Having a protocol for cleaning	Yes	3(21.4)	3(10)	1.1	1	0.30
	No	11(78.6)	27(90)			
Having waste management guidelines	Yes	5(35.7)	4(13.3)	2.9	1	0.09
	No	9(64.3)	26(86.7)			
Having an infection prevention committee	Yes	4(28.6)	3(10)	2.5	1	0.12
	No	10(71.4)	27(90)			
All staff with cleaning responsibilities received training in healthcare waste management	Yes	8(57.1)	25(83.3)	3.5	1	0.01
	No	6(42.9)	5(16.7)			
Having a specified budget for WASH	Yes	14(100)	21(70)	5.3	1	0.02
	No	0(0)	9(30)			
Having trained staff for maintenance and repair of WASH facilities	Yes	5(35.7)	3(10)	4.2	1	0.04
	No	9(64.3)	27(90)			
Community involvement in planning, monitoring, and evaluation	Yes	4(28.57)	1(3.3)	6.0	1	0.00
	No	10(71.4)	29(96.7)			



the health facilities had no functional hand washing facilities available either at the point of care or in the toilets. This critical point needs governmental and partner organizations' attention to reduce WASH and healthcare-associated health problems.

Similarly, 88.6% of the healthcare facilities had no waste disposal services. These findings showed that basic hygiene and waste disposal services in healthcare facilities were low and needed urgent action to prevent healthcare staff and patients' infections. Furthermore, a significant number (18.2%) of the healthcare facilities had no environmental cleaning services. The access rates to basic WASH services remain far from the WHO target of 100% coverage ([World Health Organization 2015b](#)). Menstrual hygiene management is important for women and girls ([Budhathoki et al. 2018](#)). However, the current study showed only 25% of the healthcare facilities had at least one functional toilet with menstrual hygiene facilities. This could increase the vulnerability to reproductive tract infections. This study revealed that healthcare facilities with trained workers in healthcare waste management had a direct relationship with having basic hygienic services. The cause could be due to a high level of involvement and a request to the relevant administrators to reduce the risk of infection by trained personnel. This is ascertained by a study done among healthcare workers ([Tilahun et al. 2023](#)). Moreover, this research found an association between budget, community involvement, and basic hygiene service. This proved that significant funding and community involvement are required to implement basic hygiene service. This idea is assisted by [World Health Organization \(2020c\)](#).

## CONCLUSION

The WASH services of the healthcare facilities were very low and not on track to achieve the Sustainable Development Goal target. Healthcare facilities could be sources of healthcare-associated infections. Many factors associated with basic hygiene services were identified. Therefore, the government and stakeholders should establish effective national standards and accountability mechanisms, improve infrastructure and maintenance, engage communities, set targets and define a roadmap to improve WASH services.

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## DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

## CONFLICT OF INTEREST

The authors declare there is no conflict.

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