Infection Prevention in Practice 6 (2024) 100397

Available online at www.sciencedirect.com

Infection Prevention in Practice

journal homepage: www.elsevier.com/locate/ipip

Water, sanitation, hygiene, and waste management in primary healthcare facilities in war-torn Tigray, Ethiopia: implications for infection prevention and control

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ARTICLE INFO

Article history:
Received 25 June 2024
Accepted 4 September 2024
Available online 23 September 2024

Keywords:
Ethiopia
IPC
JMP service ladders
Tigray
WASH
Waste management

SUMMARY

Background: Water, sanitation and hygiene (WASH) and infection prevention and control (IPC) are compromised during emergencies and in the post-conflict period. The IPC-WASH status of primary healthcare facilities in Tigray, Ethiopia, is not known. The aim of the study was to assess the IPC-WASH status of facilities in war-torn Tigray, Ethiopia.

Methods: As part of a cross-sectional study, data were collected from January to February 2024 in 32 randomly selected primary healthcare facilities using an electronic Open Data Kit (ODK) based on a questionnaire. A descriptive analysis was conducted to describe the IPC-WASH services. The analyzed data were compared with the Joint Monitoring Program (JMP) service ladders and presented in texts, figures and tables.

Results: Nearly seven out of ten primary healthcare facilities had improved water sources, nine out of ten had latrines with limited sanitation facilities, and four out of ten had handwashing facilities. Eight out of ten facilities had no access to personal protective equipment, and most facilities surveyed had very limited waste management services, IPC capacity building and IPC committee. According to JMP service ladders, almost one in four primary healthcare facilities had basic water supply, one in ten had basic sanitation, basic hygiene and basic waste disposal.

Conclusions: The overall result of the study shows that access to IPC-WASH is low in primary healthcare facilities in war-torn Tigray, Ethiopia. Collaborative efforts to improve access to basic IPC-WASH facilities and IPC capacity building are essential to improve the quality of care.

Introduction

Healthcare settings are working environments with a high prevalence of infectious disease pathogens. Patients, staff, carers and neighbours of the healthcare setting face unacceptable risks of infection if environmental health is inadequate [1]. Healthcare workers face a range of potential occupational risks associated with infections, unsafe patient handling, hazardous

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https://doi.org/10.1016/j.infpip.2024.100397

chemicals, radiation, heat and noise, psychosocial hazards, violence and harassment, injuries, inadequate provision of safe water, sanitation and hygiene (WASH) [1—4].

The IPC-WASH in healthcare setting is important in achieving the Sustainable Development Goals (SDG 3 and SDG 6) [5]. However, the progress to achieve the SDGs is lagging behind in most low- and middle-income countries with poor infection prevention and control (IPC) services [6—8]. Studies from Ethiopia, Nigeria, Ghana and Kenya indicate that the status of WASH in healthcare facilities was found to be low in reference to the SDG standards [9—13] and need further improvements. Strengthening infection prevention and control (IPC) and WASH are essential to combat healthcare associated infections (HAI) by maintaining safe health service operations and mitigating the risks of infectious disease transmission during the delivery of essential health services [4,14].

During emergencies and post emergencies, existing systems for safe patient management and care delivery may become overwhelmed, resulting in reduced capacity, infrastructure, and essential staffing to respond [15,16]. Without sufficient resources to initiate and expand IPC and WASH capacities during emergencies, healthcare systems stretched to their limit can be locations of increased transmission risks, including infections associated with healthcare [15].

In Ethiopia's Tigray region, a full-blown war erupted in November 2020 resulting in collapsing of the health system [17]. Following this, Tigray has seen the worst human suffering [18]. According to the Health Resources and Services Availability Monitoring System (HeRAMS) assessment result, of the 754 facilities assessed: 51% of had no water services, 46% had no sanitation services, 74% lack waste segregation, and 65% had no hand hygiene services [19]. Inadequate hospital infrastructure, resource and workforce shortages, education of staff, inadequate in-service IPC training and supervision and large visitor numbers were the identified barriers to IPC in healthcare facilities of conflict affected setting. Furthermore, high patient numbers, supply chain disruptions, high infection rates and attacks on healthcare infrastructures, all as a direct result of conflict, exacerbated existing challenges and imposed an additional burden on hospitals and their IPC programmes [16]. Other studies in conflict affected areas indicated that the IPC was found to be inadequate [20]. Shortages of hand washing soap, interruptions of piped water supply, work overload, lack of IPC training and absence of support from hospital management were among the identified determinant factors [21].

Globally, there is limited published literature on IPC-WASH in healthcare facilities in war and post war situations as per the joint monitoring program (JMP) services ladders. Furthermore, the situation is unknown in war affected regions such as Tigray, Ethiopia. The present study aimed at assessing the facility level IPC-WASH in public primary healthcare facilities (primary hospital and health centers) in Tigray, Ethiopia after the signing of the African Union-mediated Pretoria agreement or "*Agreement for Lasting Peace through a Permanent Cessation of Hostilities*" *between the Government of the Federal Democratic Republic of Ethiopia and the Tigray People's Liberation Front* [22]. The findings might help guide evidence-based interventions in the study area and future planning in other areas with similar challenges.

Method

Study design and setting

The study was conducted in the Tigray region of Ethiopia. The region has seven zones and 93 districts. The study was conducted in 32 primary healthcare facilities (9 primary hospitals, and 23 health centers) from 24 randomly selected districts out of the 78 accessible districts. A facility-based cross-sectional study design was conducted in six zones of Tigray, Ethiopia. However, the western zone and some parts of the southern, eastern and northwestern zones were excluded for security reasons (Figure 1). Data was collected from January 14, 2024, to February 16, 2024.

Sample size and sampling technique

All primary hospitals in the districts (n=9) were included and 2—3 health centers were considered from each district (n=23). A total sample size of 32 primary healthcare facilities were included in this study. The health facility medical director or IPC focal person was the respondent in this study.

Questionnaire development and data collection

A semi-structured questionnaire was developed and used to collect data from the study health facilities and ask questions on selected key indicators of water supply, sanitation, hygiene and infection prevention and control. Data were collected using an electronic open data kit (ODK) tool by bachelor's degree holder healthcare workers. Supervisors at district and zonal level were assigned to follow and monitor the overall data collection activities.

Data quality control

A pre-test of the questionnaire was conducted outside the study site to verify that respondents understood the questions correctly. The use of open data kit (ODK) for data collection enabled us to follow the quality of collected data centrally by the data manager of the research team. Data collectors were trained on the purpose of the study, method of data collection, ethical principles, and other practical issues. The questionnaire was reviewed for completeness by field supervisors on each day of data collection. All the mentioned data quality control activities aimed to enhance the validity of the data.

Data analysis

The dataset was cleaned, coded, and analysed using SPSS version 25 software. Prior to data analysis, an assessment was conducted to look for missing values and outliers, and addressed using appropriate measures. A descriptive statistical measure such as proportions for categorical variables was

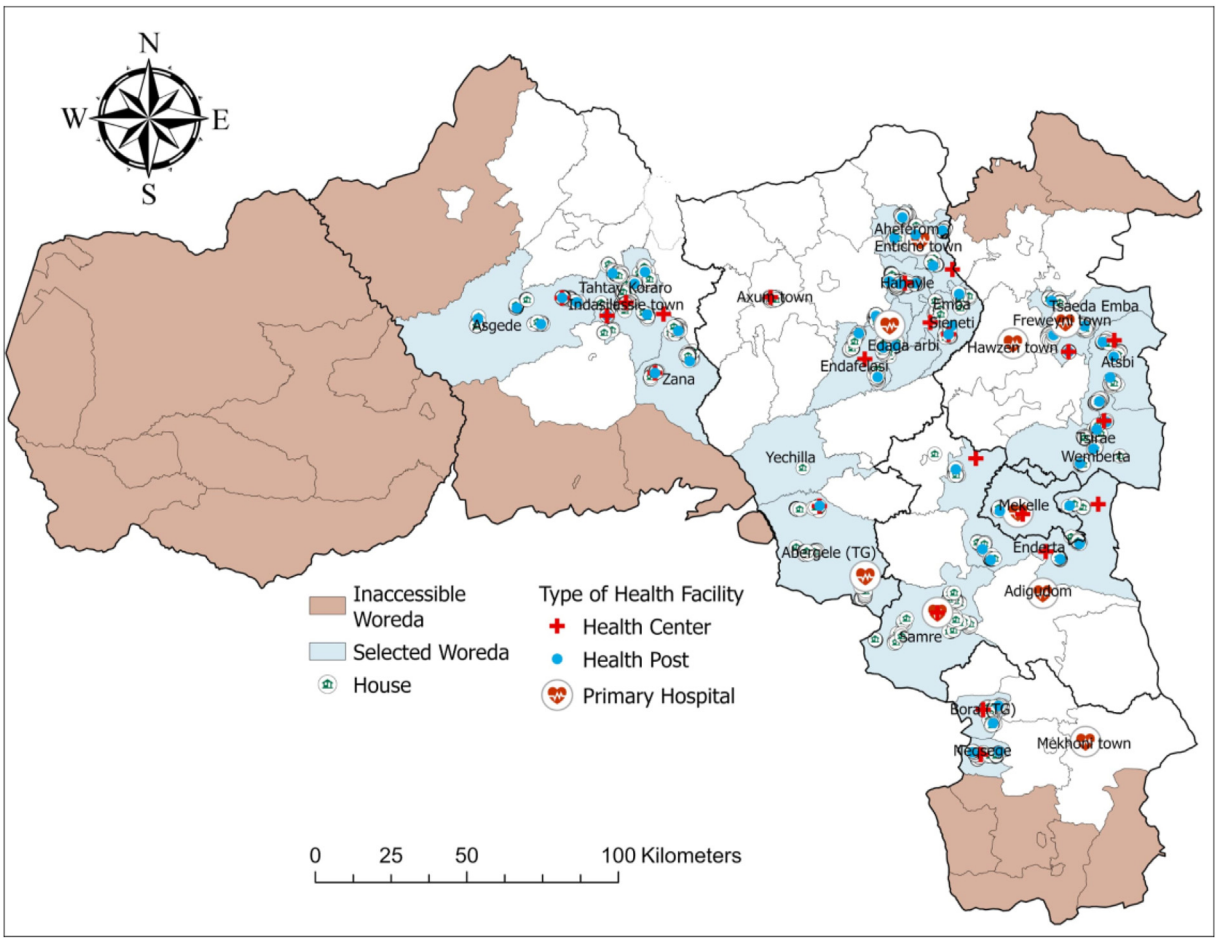

Figure 1. Map of the study area.

calculated to describe the general characteristics of study facilities regarding the proportion for WASH and IPC services. Analyzed data were compared with respect to national and international standards (i.e. the JMP IPC-WASH service ladders) and presented through text, figure, and tables.

Ethics approval and consent to participate

Ethical approval was obtained from Tigray Health Research Institute Institutional Review Board (Ref. No. THRI/4031/0503/16). An additional letter of support was obtained from the Tigray Health Bureau to facilitate the study. Written informed consent was obtained from study participants before the actual data collection. Confidentiality of the respondents was maintained, and their names were not included in the data. All methods were performed in accordance with the ethical principles of the Declaration of Helsinki.

Operational definitions [7]

(Table I).

Results

Water supply services

Of the thirty-two primary healthcare facilities assessed, 21 (65.6%) had improved water sources, and more than half (53.1%) indicated that water was not present at the day of data collection. Basic water supply service was available in less than one-third (28.1%) of the healthcare facilities with difference in the type of primary health facilities (Table II).

Sanitation services

Nine out of ten primary healthcare facilities have latrine access. However, a higher proportion (84.4%) had limited sanitation services. Placenta pit and incinerator were present in most of the primary healthcare facilities. Over one in ten (12.5%) of the healthcare facilities had basic waste management in place (Table III).

Hand hygiene and personal protective equipment

Of the total (32) primary healthcare facilities assessed, 12 (37.5%) had hand washing facilities during the time of observation. Only 3 (9.4%) primary health facilities had basic hand washing services. In addition, more than half (78.1%) of the

Table I
Joint Monitoring Programme (JMP) service ladder for WASH services in healthcare facilities

Service level	Water	Sanitation	Hygiene	Waste management
Basic service	Water is available from an improved source on the premises	Improved sanitation facilities are usable, with at least one toilet dedicated for staff, at least one sex-separated toilet with menstrual hygiene facilities, and at least one toilet accessible for people with limited mobility.	Functional hand hygiene facilities (with water and soap and/or alcohol-based hand rub) are available at points of care, and within five metres of toilets.	Waste is safely segregated into at least three bins, and sharps and infectious waste are treated and disposed of safely.
Limited service	An improved water source is available within 500 metres of the premises, but not all requirements for a basic service are met.	At least one improved sanitation facility is available, but not all requirements for a basic service are met.	Functional hand hygiene facilities are available either at points of care or toilets but not both.	There is limited separation and/or treatment and disposal of sharps and infectious waste, but not all requirements for a basic service are met.
No service	Water is taken from unprotected dug wells or springs, or surface water sources; or an improved source that is more than 500 metres from the premises; or there is no water source.	Toilet facilities are unimproved (e.g. pit latrines without a slab or platform, hanging latrines, bucket latrines) or there are no toilets.	No functional hand hygiene facilities are available either at points of care or toilets.	There are no separate bins for sharps or infectious waste, and sharps and/or infectious waste are not treated/ disposed of

Table II
Source of water supply and water availability among primary healthcare facilities in Tigray, Ethiopia in 2024 (n=32)

Variables		Type of primary healthcare facility		
		Health center	Primary hospital	Total
		n (percent)	n (percent)	n (percent)
Source of water	Improved	14 (60.9)	7 (77.8)	21 (65.6)
	Unimproved	9 (39.1)	2 (22.2)	11 (34.4)
Water availability	Yes	10 (43.5)	4 (44.4)	14 (43.8)
	No	13 (56.5)	5 (55.6)	18 (56.2)
Water supply services	Basic	6 (26.1)	3 (33.3)	9 (28.1)
	Limited	8 (34.8)	4 (44.4)	12 (37.5)
	Unimproved	9 (39.1)	2 (22.2)	11 (34.4)

inspected primary healthcare facilities lacks access to personal protective equipment (Table IV).

WASH services as per the JMP service ladders

The majority of primary healthcare facilities had limited access to a water supply, sanitation and waste management services. However, the majority of primary healthcare services were characterized by no hygiene services (Figure 2). The status of the WASH service ladders are found to be low as (compared the global standard reports of JMP) sub Saharan Africa (Figure 3).

Infection prevention practices in primary healthcare facilities of Tigray, Ethiopia

Autoclaves and chemical disinfectants were available in 81.2% and 75.0% of the assessed primary healthcare facilities respectively. Infection prevention and control committees were non-existent in almost half (46.9%) of the primary healthcare facilities. Furthermore, one in three (37.5%) of the primary healthcare facilities did not receive training IPC (Table V).

Table III
Sanitation services of primary healthcare facilities in Tigray, Ethiopia in 2024 (n=32)

Variables		Type of primary healthcare facility		
		Health center	Primary hospital	Total
		n (percent)	n (percent)	n (percent)
Availability of latrines	Yes	21 (91.3)	8 (88.9)	29 (90.6)
	No	2 (8.7)	1 (11.1)	3 (9.4)
Sanitation services	Basic	1 (4.3)	1 (11.1)	2 (6.2)
	Limited	20 (87.0)	7 (77.8)	27 (84.4)
	No service	2 (8.7)	1 (11.1)	3 (9.4)
Sex separated latrine (n=29)	Yes	10 (47.6)	3 (37.5)	13 (44.8)
	No	11 (52.4)	5 (62.5)	16 (55.2)
Latrine cleanliness (n=29)	Yes	12 (57.1)	3 (37.5)	15 (51.7)
	No	9 (42.9)	5 (62.5)	14 (48.3)
Larine suitable for disabled (n=29)	Yes	1 (4.8)	1 (12.5)	2 (6.9)
	No	20 (95.2)	7 (87.5)	27 (93.1)
Waste segregation	Yes	13 (56.5)	6 (66.7)	19 (59.4)
	No	10 (43.5)	3 (33.3)	13 (40.6)
Availability of incinerator	Yes	21 (91.3)	8 (88.9)	29 (90.6)
	No	2 (8.7)	1 (11.1)	3 (9.4)
Waste management services	Basic	3 (13.0)	1 (11.1)	4 (12.5)
	Limited	14 (60.9)	6 (66.7)	20 (62.5)
	No service	6 (26.1)	2 (22.2)	8 (25.0)
Availability of ash pit (n=29)	Yes	12 (57.1)	7 (87.5)	19 (65.5)
	No	9 (42.9)	1 (12.5)	10 (34.5)
Availability of liquid waste management	Yes	14 (60.9)	6 (66.7)	20 (62.5)
	No	9 (39.1)	3 (33.3)	12 (37.5)
Availability of placenta pit	Yes	22 (95.7)	9 (100)	31 (96.9)
	No	1 (4.3)	0	1 (3.1)

Table IV
Hand washing facility and availability of personal protective equipment in primary healthcare facilities of Tigray, Ethiopia in 2024 (n=32)

Variables		Type of health facility		
		Health center	Primary hospital	Total
		n (percent)	n (percent)	n (percent)
Hand washing facility	Yes	7 (30.4)	5 (55.6)	12 (37.5)
	No	16 (69.6)	4 (44.4)	21 (62.5)
Hand washing services	Basic	1 (4.3)	2 (22.2)	3 (9.4)
	Limited	6 (26.1)	3 (33.3)	9 (28.1)
	No service	16 (69.6)	4 (44.4)	20 (62.5)
Access to PPE	Yes	12 (52.2)	2 (22.2)	14 (43.8)
	No	11 (47.8)	7 (77.8)	18 (56.2)
Availability of PPE	Yes	6 (26.0)	1 (11.1)	7 (21.9)
	No	17 (73.8)	8 (88.9)	25 (78.1)

All PPE= Gloves, face masks, aprons, eye goggle, and boots.

Discussion

This study describes a facility level water, sanitation, hygiene and IPC assessment from 32 primary healthcare facilities in war torn Tigray, Ethiopia. The overall finding indicates very low access to basic water, sanitation and hygiene, which has a negative impact on IPC activities.

The service ladder for water supply indicates that one in four had basic water services and one in three of the primary healthcare facilities had unimproved water services. However, nearly 40% of the primary healthcare facilities had limited water services. Our results suggest that access to water services is below that reported by the joint monitoring program report for sub Saharan Africa and world (Figure 3) [6,7] and studies from Ethiopia, Nigeria, Ghana and Serbia [9–11,23]. The difference could be explained by the impact of the war on water infrastructure in healthcare facilities and communities of Tigray, Ethiopia [19,24] and low income compared to Ghana,

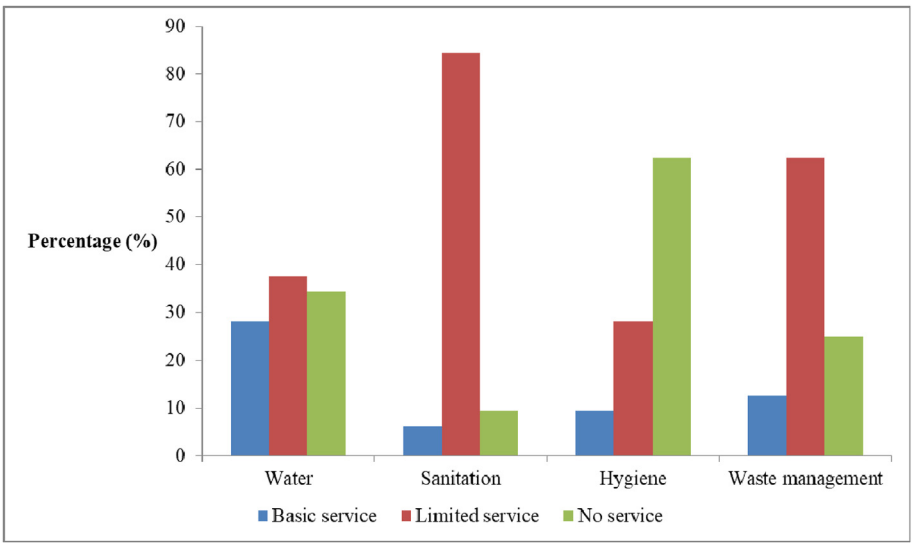

Figure 2. Water, Sanitation, Hygiene and Waste management services in primary healthcare facilities of Tigray, Ethiopia as per JMP service ladders (2024).

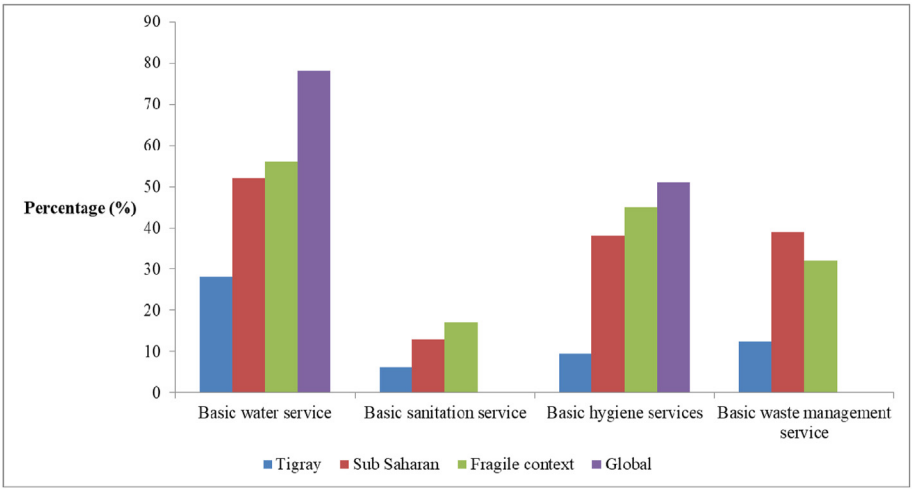

Figure 3. Comparison of basic water, sanitation, hygiene and waste management services in primary healthcare facilities of Tigray, Ethiopia with JMP service ladders (2024).

Table V
Infection prevention practices in primary healthcare facilities of Tigray, Ethiopia in 2024 (n=32)

Variables		Type of primary health facility		
		Health center	Primary hospital	Total
		n (percent)	n (percent)	n (percent)
Availability of autoclave	Yes	19 (82.6)	7 (77.8)	26 (81.2)
	No	4 (17.4)	2 (22.2)	6 (18.8)
Availability of chemical disinfectant	Yes	19 (82.6)	5 (55.6)	24 (75.0)
	No	4 (17.4)	4 (44.4)	8 (25.0)
Functional IPC committee	Yes	9 (39.1)	6 (66.7)	15 (46.9)
	No	14 (60.9)	3 (33.3)	17 (53.1)
IPC related training	Yes	14 (60.9)	6 (66.7)	20 (62.5)
	No	9 (39.1)	3 (33.3)	12 (37.5)

Nigeria and Serbia which will affect the distribution of water supply infrastructure.

One in ten of the primary healthcare facilities had unimproved sanitation service. Eight in ten had limited sanitation services. Only 6% of the assessed primary healthcare facilities had basic sanitation services. Basic access to sanitation services is low compared to studies from Ghana, Serbia and global reports from sub—Saharan Africa and the world (Figure 3) [6,7,11,23]. This low level of access for basic sanitation services indicates that the issue of sanitation services is still a neglected issue in low-income countries and war affected areas such as Tigray.

One in ten of the primary healthcare facilities had basic waste management services and one in four had no services at all. Three in five (62.5%) of the primary healthcare facilities had limited waste management services. A previous facility assessment report also indicated that poor waste segregation practices in war affected Tigray, Ethiopia [19]. Our results are lower than those reported from Serbia [23], which may indicate better waste management in Serbia. In addition, the present finding is also lower than those reported in the joint monitoring program 2022 report for fragile context and sub Saharan Africa report, where one in three of healthcare facilities and three of five hospitals were found to have basic waste management [7].

We describe low availability of hand washing facilities, mainly due to low supplies of IPC materials and limited/damaged IPC infrastructures. The present result is very low compared to the findings from Serbia where nine in ten healthcare facilities reported basic hand hygiene [23]. WE hypothesise that the low water service and lack of hand washing infrastructure may affect the overall hand washing practices in our study. However, the present finding is similar with other studies done in 14 low- and middle-income countries showing inadequate hand hygiene services [6]. Only one in five of the healthcare facilities had reported the availability of personal protective equipment (PPE) in our study. This low availability of PPE will hamper good quality IPC practice and place healthcare workers at risk. However, access and utilization of PPE is a critical part of the IPC program in healthcare. Studies indicate that shortages of PPE and hand washing agents were the barriers for IPC compliance [25] leading to healthcare associated infection [26].

In summary, the low access for basic WASH services, lack of access for PPE, lack of disinfectants (one in four of the primary healthcare facilities), absence of IPC committees in half of the primary healthcare facilities) will expose visitors, patients and healthcare workers to infectious agents in primary healthcare settings and also compromise the quality of care in Tigray, Ethiopia.

Studies indicate that presence of IPC protocols, having an IPC/WASH focal person at the facility, and conducting WASH training for staff were associated with higher levels of WASH services and ensure quality of care to reduce healthcare acquired infections [6]. Studies have also showed that inadequate and ineffective hospital IPC infrastructure, lack of guidelines in local language, lack of awareness and support from managers, resource and trained workforce shortages, access to and trust in PPE, work place culture, paucity and inconsistencies in surveillance, lack of basic sanitation, financial constraints, inadequate in-service IPC training and supervision and large visitor numbers are barriers to IPC in healthcare settings [13,16,27—29]. The present findings call for evidence-based IPC capacity building and provision of IPC supplies with regular monitoring and evaluation of IPC practices in the conflict affected region of Tigray, Ethiopia and other similar situations.

Furthermore, it is important to consider the importance of wastewater surveillance in war torn regions to ensure better sanitation, hygiene, and waste management is implemented in healthcare facilities as indicated by various studies [30,31].

The study strength and limitations. The cross-sectional nature of the design is observational and is not generalisable to other regions/healthcare systems. The exclusion of primary healthcare facilities from western and some parts of the southern, eastern and northwestern zones of Tigray might also affect the nature of the presented results. However, the study assessed the post war IPC-WASH services in primary healthcare facilities according to JMP service ladders. This enables readers to have a better understanding of the findings with internationally recognized JMP service ladders giving a better insight of IPC-WASH at various primary healthcare facilities of war torn Tigray, Ethiopia.

Conclusion

The overall findings of the study showed low access to basic water, sanitation, hygiene and waste management which will compromise the IPC activities in primary healthcare facilities of war-torn Tigray, Ethiopia. In addition, there was absence of an IPC committee in half of the healthcare facilities, lack of access to PPE and absence of IPC capacity buildings. To prevent and control healthcare acquired infection, collaborative efforts aimed at increasing access for basic WASH facilities, PPE and IPC material supply, establishing IPC committees and provision of IPC capacity building is essential in post war regions of Tigray and other areas with similar situations.

Acknowledgements

We would like to thank the Tigray Health Bureau, study participants, data collectors, supervisors, district health office, and local administrators for their cooperation during the study.

Conflict of interest

The authors declare no conflict of interest.

Funding statement

This research received funding for data collection from Tigray Health Bureau, Ethiopia.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.infpip.2024.100397.

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