

Water, sanitation, and hygiene (WASH) in healthcare facilities of 14 low- and middle-income countries: to what extent is WASH implemented and what are the 'drivers' of improvement in their service levels?

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ABSTRACT

Prevention and control of healthcare-associated infections through the provision of water, sanitation, and hygiene (WASH) in healthcare facilities (HCF) is inadequate in low- and middle-income countries (LMICs), resulting in high patient morbidity and mortality, additional costs, and increased risk of antibiotic resistance. There is little evidence describing factors leading to improved WASH conditions in LMICs. We aim to identify the extent to which WASH is implemented in HCFs in LMICs and understand the 'drivers' of improvement in their service levels. WASH service levels in 14 LMICs were descriptively analysed, and potential drivers of service-level differences were explored using univariable and multivariable mixed-model logistic regression analyses. Descriptive analysis showed a lack of adequate water quality, sanitation, hand, and environmental hygiene, and waste disposal. We found that the presence of infection prevention and control protocols (IPCPs), having an IPC/WASH focal person at the facility, and conducting WASH training for staff were associated with higher levels of WASH services. This study demonstrates a lack of basic WASH services in HCF in LMICs. We show that there are potential interventions, such as implementing IPCPs, identifying WASH leaders in HCF, and conducting training that may lead to service improvements.

Key words: capacity building, LMIC, service levels, WASH

HIGHLIGHTS

- Infection prevention and control protocols, a facility WASH focal person, and WASH training for staff could improve WASH service levels at facilities.
- Managerial interventions could be just as vital as hardware interventions in improving WASH service levels at facilities.
- The SDG WASH in healthcare facility targets are not met in most LMICs.
- Research into the policy context for local capacity building is required.

INTRODUCTION

An estimated 10–25% of neonatal and maternal deaths are estimated to be related to healthcare-associated infection (HAI), of which the majority are recorded in low- and middle-income countries (LMICs) (Zaidi *et al.* 2005; Allegranzi *et al.* 2011; Kassebaum *et al.* 2014; Say *et al.* 2014). The availability of water, sanitation, and hygiene (WASH) services and effective associated practices are important components of healthcare infection prevention and control (IPC) and thus must be addressed in any successful intervention to improve patient outcome in healthcare facilities (HCFs) (Kruk *et al.* 2016). Basic measures to ensure patient safety and to prevent transmission of HAI, such as clean drinking water, waste management, hand hygiene, personal protective equipment, and clean and safe sanitation facilities, all of which are components of 'WASH in HCF', are frequently missing (Zaidi *et al.* 2005; Buxton *et al.* 2019). This could be due to a lack of physical infrastructure, staff capacity, funding gaps, competing interests, and limited data collection and evaluation measures (Zaidi *et al.* 2005; Bouzid *et al.* 2018; Buxton *et al.* 2019). The 2020 WHO report 'Progress report on water, sanitation and hygiene in health care facilities' highlights the major gaps in WASH services globally: 25% of all HCFs have

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no basic water service, 10% have no sanitation services, and over 30% do not have the facilities for hand hygiene at the point of care (World Health Organization 2020). These numbers are even higher in least-developed countries: 50% without basic water service level and 60% with no sanitation facilities (World Health Organization 2020). In the midst of the COVID-19 pandemic, this lack of service availability can have even more serious consequences.

Ensuring adequate WASH in HCF is important to reduce patient deaths, reduce antibiotic resistance, improve resilience to outbreak scenarios (through better IPC), improve trust in the medical profession, set examples for good hand hygiene behaviour which may be carried into households and communities, and improve staff morale and efficiency, and hence contribute to a reduction in healthcare costs (World Health Organization 2018). The need to ensure adequate WASH in HCF to reduce preventable deaths has been recognised by the Sustainable Development Goals (SDGs) set out in 2015 by the United Nations (UN). Especially SDG 6.1 calling for the provision of safe and sustainable WASH for all and SDG 3.8 emphasising the need for providing access to quality healthcare place WASH high up on the global policy agenda (UN 2016; United Nations 2018).

Despite the importance of WASH in HCF, large gaps and a lack of commitment in WASH policy-making remain (Sinharoy *et al.* 2019). Providing WASH infrastructure can lead to short-term service-level improvements; however, without adequate capacity building and management support, this hardware may not be a sustainable option (Klug *et al.* 2017). There is little evidence describing factors and conditions leading to improved WASH conditions in LMICs. Through a joint commitment at the national and community/facility-based level, the steps are taken for the initial creation and sustainable maintenance of WASH infrastructure and behaviour at the facilities. An investigation of the ‘drivers’ of service-level improvements in HCF is clearly needed to establish which practices may be more successful than others. Additionally, a better understanding of the policy environments and contexts that impede progress is helpful. Recognising these existing and ongoing impediments is invaluable to the planning of any future WASH intervention.

AIMS AND OBJECTIVES

The aims of this paper are to describe and summarise WASH service levels in HCFs in rural areas of 14 LMICs and to demonstrate the extent to which WASH is currently implemented. We used a large dataset of WASH outcomes from selected HCF across LMICs, collected in 14 separate country-wide surveys by the non-governmental organisation World Vision (WV) and the Water Institute at the University of North Carolina (UNC). We establish which software interventions were associated with higher WASH service levels at these HCFs. This was achieved by:

- conducting a descriptive analysis and summarising data from HCFs in 14 LMICs to establish WASH service levels and compare countries and
- carrying out a secondary analysis of the data using logistic regressions to assess WASH service levels.

METHODS

The dataset for this analysis was obtained through the publicly available Dataverse of the Water Institute at UNC (University of North Carolina at Chapel Hill 2020). The data were collected from rural HCFs in 14 LMICs between January 2017 and May 2018. The methods for this study have been described in full elsewhere (Guo & Bartram 2019; The Water Institute at UNC 2020; Cronk *et al.* 2021). Briefly, HCFs were selected within the sampling frame of a larger cluster-randomized population-based household study design. Within each country sampling frame, HCFs were identified from HCF master lists, which were obtained from each country. HCFs that provided outpatient care were randomly selected with the goal of identifying 200 HCFs per country. If the total number of HCFs identified was less than 200, all HCFs were selected. At selected HCFs, enumerators went to each facility and attempted to interview the head doctor, head nurse, or a nurse who had worked at the facility for a minimum of 2 years. The respondent could decline to respond to any question and to stop the survey at any time. The HCF survey included questions and observations of HCF characteristics, water (source type, distance to source, availability, water storage, and treatment), sanitation (type, functionality, condition, and use), hygiene (hand hygiene), waste management (sharps and infectious waste segregation, treatment, and disposal), and administration and training (policies, budget, and trainings on WASH and IPC).

During the interview, respondents were also asked to serve the interviewer some water for drinking, of which 100 ml was tested for faecal coliform bacteria using the Compartment Bag Test, which forms the estimate for water quality at each facility (the full methods on the water quality testing are provided in Guo & Bartram 2019).

The dataset was exported into Stata IC 16.1 for descriptive analysis by country and indicator, binary logistic regressions for all 14 countries, explorative binary analysis by country, and mixed-effects logistic models. Continuous and categorical variables were recoded to a binary form: yes or no, and variables coded as ‘don’t know’ or ‘decline to state’ were coded as missing. Hygiene and water-service levels were recoded to a binary form: basic or higher and less than basic.

The dataset used for this analysis includes six managerial variables, which could be effective at providing long-term and sustainable functionality of any infrastructural intervention conducted at an HCF: IPC protocol (IPCP) being present, a designated WASH/IPC focal person (FP) being present, WASH training (WT) being offered to staff at the facility, the facility having a community-composed WASH oversight committee, an operation and management protocol which includes the procurement of WASH supplies, and sufficient budget allocated to WASH at the facility. We investigated the association between three of these managerial (independent) variables and WASH service-level outcomes (dependent variables) using univariable and multivariable regression models. The dependent variables selected for the univariable and multivariable regression models were chosen *a priori* based on the list of essential indicators listed in the WHO ‘Water and Sanitation for Healthcare Facility Improvement Tool’ (WASH-FIT) or on the plausibility of relationship: water service level, water treatment, *Escherichia coli* water contamination, open defecation, sanitation facility access on premises, and hand hygiene service level. Three managerial variables were selected as independent variables for the multivariable analysis: IPCP present at the facility surveyed, presence of a designated IPC/WASH FP at the facility, and WT offered to staff at the facility. Univariable logistic regressions were run with each of these managerial variables and each of the selected variables to identify possible associations, and the effect of the three managerial independent variables on the dependent variables (WASH service-level outcomes) was then investigated using multivariable models, the results of which were reported. Results are presented as changes in odds ratios (OR) to a more desirable service level, for example, changes in the likelihood of no open defecation being present at the facility. *p*-values of <0.05 indicate strong evidence for a true association of the variables in question at the 95% confidence level.

ETHICAL APPROVAL

The initial data collection was approved by the University of North Carolina Chapel Hill Institutional Review Boards as well as from agencies within each of the 14 countries participating in the study. The cleaned, de-identified data were used for this study.

RESULTS

In total, 2,002 HCF across the 14 countries consented to be surveyed: Ethiopia (*n* = 172), Kenya (*n* = 162), Rwanda (*n* = 81), Tanzania (*n* = 149), Uganda (*n* = 77), Malawi (*n* = 136), Mozambique (*n* = 133), Zambia (*n* = 163), Zimbabwe (*n* = 119), Ghana (*n* = 175), Mali (*n* = 118), Niger (*n* = 172), India (*n* = 209), and Honduras (*n* = 136). The most common type of facility was the ‘health centre’. The terminology ‘health centre’ may be used slightly differently in each country, but no clearer definitions are given in the dataset or in the primary analysis. A summary table of the results and more detailed tables are found in the Supplementary material.

Almost all health facilities (85%) surveyed had improved water sources for use at the facility, most commonly a borehole with a pump or handpump, but the number of these sources being on the premises was smaller (64%). 87% of the facilities surveyed could produce water from the source at the time of interview. 64% of facilities reported treating their water in some way before use (most commonly using chlorine liquid, powder, or tablets). 60% reported the water being extracted in a safe way, such as with a spigot, or poured directly into another vessel.

Of the HCFs surveyed, 90% reported having access to their own sanitation facilities, with numbers ranging from 68% of facilities in Niger to 100% of facilities in Rwanda and Uganda. 20% of facilities stated that open defecation was present on their premises (highest in Mali – 88% of facilities stating open defecation present). 22% of facilities were observed to have functional hand hygiene stations near the sanitation facilities.

Across all 14 countries, 84% of facilities had no waste management service and 7% provided a basic service level. 44% of infectious waste and 47% of sharps waste were observed to be treated and disposed of correctly.

In 57% of the surveyed facilities, a functional hand hygiene station existed for at least one point of care, and hand hygiene promotion materials were clearly visible and understandable at key places in 34% of facilities. Floors and counters appeared clean in 84 and 89% of facilities, respectively. Mattresses, pillows, and linens were cleaned between each patient in 55% of facilities, ranging from 23% in Niger to 92% in Zimbabwe.

Overall, 53% of surveyed HCFs reported having a designated IPC/WASH FP at the facility. The numbers varied between countries: with 15% of the facilities in Niger and 85% of facilities in Rwanda having an IPC/WASH FP. Overall, 67% of facilities reported having an IPC policy. There was variation between countries ranging from 27% in Niger and 96% in Zimbabwe. 14% of the facilities stated that a budget for the facility with sufficient IPC/WASH funding existed, and only 46% of facilities had a protocol for the organisation and management of the facility and the procurement of WASH supplies in place. 50% of the facilities stated that no WT was provided to their employees. Among HCFs that provided training, 50% conducted at least one WT session in the last year, most attended by nurses. 39% of facilities had an active WASH committee, which was reported to have met at least once in the preceding 6 months. 54% of facilities stated that the biggest challenge to making improvements in the WASH sector was a lack of funds and having no sufficient budget for WASH.

SECONDARY ANALYSIS OF THE 'DRIVERS' OF WASH SERVICE LEVELS

We conducted univariable and multivariable logistic regressions to analyse the association of three managerial variables (independent variables):

- IPCP present at the facility,
- IPC/WASH FP present at the facility, and
- WT offered to staff at the facility

against six WASH service-level outcomes (dependent variables). While potential collinearity among the independent variables was noted (correlation coefficients for the three managerial variables were calculated using Stata IC: IPCP and FP = 0.398, IPCP and WT = 0.286, and FP and WT = 0.315), no variables were excluded from the analysis. The choice of the following dependent variables was based to some extent on the essential indicators listed in the WASH-FIT and on the plausibility of association:

- water service level at the facility is classified as 'basic' according to the JMP service ladder (reference value: water service level is below 'basic'),
- water is treated in some way before use at the facility (reference value: water is not treated before use),
- water is classed as 'low risk' for *E. coli* contamination (<1 *E. coli* per 100 ml) in accordance with the WHO guidelines (reference value: >1 *E. coli* per 100 ml in the water tested at the facility),
- facility being open defecation-free (reference value: visible or reported open defecation at the facility),
- the facility having access to their own sanitation facility (reference value: no access to facility-own sanitation facilities), and
- at least 'basic' hand hygiene service level based on the JMP service ladder (reference value: hand hygiene service level is below basic).

The presence of the managerial independent variables, IPCP, FP, and WT, was associated with higher service levels in most of the dependent variables at the 95% confidence interval (95% CI). The largest change in OR was observed for the dependent variable 'facility has access to its own sanitation facility' when an IPC/WASH FP was present at the facility (OR: 3.450) (see Table 1). The multivariable regression model indicated an association

Table 1 | Percentage of facilities with access to their own sanitation facilities and the change in OR and adjusted odds ratio (aOR) with their respective 95% CI and *p*-values in the presence of IPCP, FP, and WT

Independent variables	Access to own sanitation facility		OR (95% CI)	<i>p</i> -value	aOR (95% CI)	<i>p</i> -value
	Yes <i>n</i> (%)	No <i>n</i> (%)				
IPCP present at the facility	90	10	3.450 (2.541, 4.684)	<0.001	2.024 (1.406, 2.915)	<0.001
Designated IPC/WASH FP at the facility			3.446 (2.465, 4.817)	<0.001	1.708 (1.088, 2.683)	0.02
WT offered to staff at the facility			1.747 (1.279, 2.386)	<0.001	0.999 (0.705, 1.417)	0.997

between the presence of an IPC/WASH FP (OR: 1.708), as well as an IPCP (OR: 2.024), and an increased likelihood of the facility having access to their own sanitation facilities at the 95% CI.

Facilities were less likely to be open defecation-free when a designated IPC/WASH FP was present at the facility (OR: 0.384, see Table 2). The presence of an IPCP and WT being offered to staff at the facility resulted in an increased likelihood of the facility being open defecation-free (ICP: OR, 1.588; WT: OR, 1.226; see Table 2). When this relationship was analysed in a multivariable logistic regression model (see Table 2), which took all other dependent variables into account, facilities were still more likely to be open defecation-free in facilities with an IPCP (OR: 1.347, see Table 2). The multivariable model did not demonstrate an association between the presence of an IPC/WASH FP and a higher likelihood of the facility being open defecation-free (see Table 2).

While IPCP and WT were not associated with a low risk of *E. coli* contamination at the facility, the presence of an IPC/WASH FP was associated with a lower water contamination risk at facilities (OR: 1.299, see Table 3). In the multivariable analysis, however, this association could not be demonstrated (see Table 3).

In the univariable analysis, facilities were more likely to treat their water before use when IPCP (OR: 1.704) and FP (OR: 1.750) were present (see Table 4). Offering WT to staff was not associated with an increased likelihood of water being treated before use. The multivariable model indicated that a strong association between the presence of an IPC/WASH FP and water being treated before use remains (OR: 1.650, see Table 4).

Table 2 | Percentage of open defecation-free facilities and the change in OR and adjusted odds ratio (aOR) with their respective 95% CI and *p*-values in the presence of IPCP, FP, and WT

Independent variables	Facility is open defecation-free		OR (95% CI)	<i>p</i> -value	aOR (95% CI)	<i>p</i> -value
	Yes <i>n</i> (%)	No <i>n</i> (%)				
ICP present at the facility	80	20	1.588 (1.262, 1.998)	<0.001	1.347 (1.022, 1.775)	0.034
Designated IPC/WASH FP at the facility			0.384 (0.109, 1.729)	0.004	0.998 (0.751, 1.326)	0.988
WT offered to staff at the facility			1.226 (0.977, 1.538)	0.078		

Table 3 | Percentage of facilities with low *E. coli* contamination risk (<1 *E. coli* per 100 ml) and the change in OR and adjusted odds ratio (aOR) with their respective 95% CI and *p*-values in the presence of IPCP, FP, and WT

Independent variables	Facility has low <i>E. coli</i> contamination		OR (95% CI)	<i>p</i> -value	aOR (95% CI)	<i>p</i> -value
	Yes <i>n</i> (%)	No <i>n</i> (%)				
ICP present at the facility	62.5	37.5	1.088 (0.874, 1.355)	0.448		
Designated IPC/WASH FP at the facility			1.299 (1.063, 1.587)	0.010	1.218 (0.965, 1.538)	0.097
WT offered to staff at the facility			1.029 (0.842, 1.258)	0.778		

Table 4 | Percentage of facilities treating their water in some way before use and the change in OR and adjusted odds ratio (aOR) with their respective 95% CI and *p*-values in the presence of IPCP, FP, and WT

Independent variables	Water treated in some way before use		OR (95% CI)	<i>p</i> -value	aOR (95% CI)	<i>p</i> -value
	Yes <i>n</i> (%)	No <i>n</i> (%)				
ICP present at the facility	64	36	1.704 (1.379, 2.106)	<0.001	1.242 (0.971, 1.588)	0.085
Designated IPC/WASH FP at the facility			1.750 (1.445, 2.119)	<0.001	1.650 (1.298, 2.098)	<0.001
WT offered to staff at the facility			1.198 (0.992, 1.447)	0.061		

The univariable model suggests that facilities in which IPCP, FP, and WT are present are more likely to have at least basic water and hand hygiene service levels (see Table 5). This association remained in the multivariable model for IPCP (OR: 1.390) and FP (OR: 1.486), but the multivariable analysis showed that offering WT to staff was not associated with at least basic water service level (see Table 5).

Univariable analysis indicated an association between facilities with an IPCP (OR: 2.489), an FP (OR: 2.211), and WT (OR: 2.160) being more likely to have at least basic hand hygiene service levels (see Table 6). The multivariable analysis indicated that the presence of an IPCP (OR: 1.594) as well as offering WT to staff (OR: 1.665) resulted in a higher likelihood of facilities having at least basic hand hygiene service levels (see Table 6).

Summary

These multivariable analyses indicate that the presence of an IPCP as well as a designated IPC/WASH FP was associated with the most service-level improvements. With an IPCP present at the facility, facilities were more likely to have access to their own sanitation facilities, be open defecation-free, and have at least basic water and hand hygiene service level in this multivariable analysis. The multivariable analysis also demonstrated that the presence of an IPC/WASH FP led to increased likelihood of facilities having access to their own sanitation facilities, treating water before use, and having at least basic water service level. Offering WT to facility staff only showed an increased likelihood of hand hygiene service levels being at least basic at the facilities. The presence of IPCP, FP, and WT did not lead to any increase in the likelihood of facilities having low *E. coli* contamination risk at the multivariable level; however, the univariable analysis showed that the presence of an FP was associated with a lower risk for *E. coli* contamination.

DISCUSSION

The data in this study demonstrate that WASH service levels across all 14 LMICs studied are far from being close to universal access to basic services. Approximately half the facilities (52.4%) had basic water services, and 24.8% had no service. The country with the highest level of basic water services was Mali (82.2%), and the country with the lowest level was Ethiopia (22.1%).

The logistic regression models were developed to examine the potential association between managerial practices such as installing a WASH committee, IPC/WASH FP, or conducting WT at the HCF and an improvement

Table 5 | Percentage of facilities with at least basic water service level and the change in OR and adjusted odds ratio (aOR) with their respective 95% CI and *p*-values in the presence of IPCP, FP, and WT

Independent variables	At least basic water service level		OR (95% CI)	<i>p</i> -value	aOR (95% CI)	<i>p</i> -value
	Yes <i>n</i> (%)	No <i>n</i> (%)				
IPCP present at the facility	52.4	47.6	1.826 (1.505, 2.214)	<0.001	1.390 (1.106, 1.747)	0.005
Designated IPC/WASH FP at the facility			1.930 (1.613, 2.310)	<0.001	1.486 (1.182, 1.867)	<0.001
WT offered to staff at the facility			1.201 (1.011, 1.445)	0.038	0.898 (0.735, 1.097)	0.294

Table 6 | Percentage of facilities with at least basic hand hygiene service level and the change in OR and adjusted odds ratio (aOR) with their respective 95% CI and *p*-values in the presence of IPCP, FP, and WT

Independent variables	At least basic hand hygiene service level		OR (95% CI)	<i>p</i> -value	aOR (95% CI)	<i>p</i> -value
	Yes <i>n</i> (%)	No <i>n</i> (%)				
IPCP present at the facility	16.2	83.8	2.489 (1.830, 3.386)	<0.001	1.594 (1.118, 2.271)	0.01
Designated IPC/WASH FP at the facility			2.211 (1.711, 2.854)	<0.001	1.326 (0.973, 1.806)	0.074
WT offered to staff at the facility			2.160 (1.683, 2.772)	<0.001	1.665 (1.270, 2.183)	<0.001

in WASH service levels. The regression results demonstrated several associations between these managerial aspects being present at facilities and increased numbers in facilities with:

- water being treated before use,
- hand hygiene service level being least basic,
- facility having access to its own sanitation facilities,
- water service level being at least basic, and
- no open defecation being present at the facility.

The presence of an IPCP showed to have the largest effect on the above-mentioned variables, followed by FP. WT only led to an improvement of service levels in the multivariable models by $p < 0.05$ for ‘hand hygiene service level is at least basic’. This may give some guidance as to which type of managerial interventions could be implemented. These results are based on the data from all 14 countries, and there may be substantial variation between the countries. The difficulties with enacting true and long-lasting improvements in WASH service levels in these 14 countries could stem from a lack of national WASH in HCF minimum service-level standards and strong national efforts to improve these service levels. With the presence of many stakeholders, state and non-state actors, and lack of communication between ministries, as well as competing national interests, investment in WASH in HCF could be rendered inefficient and inadequate. 39% of the questioned HCFs had active WASH committees in place. Implementing a WASH committee in the HCF, which consists of members of the community, may lead to greater national recognition of WASH in HCF as an important issue through the active participation of the voting public, but also have further-reaching effects of WASH behaviour change in communities and other institutions. Community and committee-based interventions are a form of capacity building and empowerment, which can ultimately lead to more sustainable improvement (Pérez-Foguet *et al.* 2017; Dey *et al.* 2019; Zarychta 2020).

Like previous studies on effective WASH in HCF, this study has highlighted that making use of human resources at facilities to work together in WASH or IPC committees or acting as an IPC/WASH FP, with clear policies and goals set out, could lead to improved WASH service levels at HCF. Similar conclusions were also drawn in Maina *et al.* (2019)’s paper on extending the WASH-FIT model to the WASH-FAST model, in which the researchers found that when some key WASH-related tasks in their study hospitals in Kenya were delegated to WASH committees, these had a substantial influence on the monitoring of WASH and resource allocation. The combined ‘hardware and software’ approach through the integration and efficient collaboration with the local population in WASH interventions is also frequently and effectively utilised in non-institutional settings in the communities, such as household/community sanitation initiatives or water hardware management and rehabilitation (Klug *et al.* 2017; Valcourt *et al.* 2020).

The secondary data analysis suggested that WT offered to staff was not associated with many improvements in WASH service levels, except for hand hygiene. The presence of an IPC/WASH FP or an IPCP was seemingly more frequently associated with better WASH service levels. In their paper on implementing environmental health policy in Malawi, McCord *et al.* (2019) concluded that training of Malawi’s environmental health officers, who play a vital role in implementing environmental health policy in hospitals as well as acting as the important link between the communities and the district- and national-level policymakers, receives far too infrequent and often incomplete training to fulfil their role (McCord *et al.* 2019). Similar gaps in the training of all staff, not just those responsible for the implementation of environmental health practices, in the hospitals included in this report could have led to the results seen in the logistic regression models.

This paper has taken a new approach in investigating the impact that three managerial interventions could have on improving WASH service levels in HCF. The results of this analysis are promising and indicate that managerial interventions, especially installing an IPC/WASH FP as well as having a comprehensive IPCP, and potentially also offering comprehensive WT to staff, could have substantial implications in improving institutional WASH service levels.

A strong, centrally governed driving force, behind which stakeholders can rally, may lead to adequate financial investment in WASH in HCF, heightened donor interest and participation, community mobilisation, rapid policy diffusion, and ultimately set the stage for sustainable improvement in service levels and provision. When strong national guidelines exist, and targets have been set by national governments, a facilitative environment for local leaders, stakeholders, and interested community members is created from which they can act locally and effectively.

There are some limitations to this report. The main limitation is that the data used were collected in 2017 and can only, therefore, provide evidence of WASH service levels in selected facilities at that exact time. Furthermore, as this was a static dataset, there was no opportunity to amend questions or ask for further information. Further limitations are present in the data analysis, the variables selected for logistic regressions being chosen based on some literature search, but mainly on plausibility and through discussion with World Vision. When constructing the logistic regressions, collinearity and effect modification between the variables were noted as a potential limitation, but no variables were excluded from the analysis for this reason.

DATA AVAILABILITY STATEMENT

All relevant data are available from an online repository or repositories (<https://dataverse.unc.edu/file.xhtml?fileId=7507741&datasetVersionId=31170>).

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