Evaluation of Water, Sanitation, and Hygiene in Healthcare Facilities, Kamwenge District, Uganda 2017

Preliminary Report: Baseline Data Collection

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1.0 EXECUTIVE SUMMARY

A lack of safe water, toilets, and handwashing infrastructure in healthcare facilities (HCF) poses significant health risks to patients, healthcare workers, and nearby communities, especially in low income countries. In recognition of these challenges the Joint Monitoring Program (JMP) for the Millennium Development Goal initiative has included 100% coverage of WASH infrastructure for HCF in low-income countries by 2030 for the post-2015 Sustainable Development Goals (SDGs).

Water for People has partnered with The Centers for Disease Control and Prevention (CDC) to address the problem of inadequate water and hygiene in health facilities in Kamwenge District, Uganda. Based on baseline assessments of 62 HCFs, CDC has provided guidance for inexpensive, rapidly implementable interventions with 4 elements -- handwashing and drinking water stations, health worker training, patient teaching, and waste management -- that are aimed at addressing the neglected crisis of WASH in HCFs.

Findings

- Among 62 HCFs, 87% had access to an improved main water source, but consistent access to water was limited, and only 31% reported water was always available in patient care areas. Of samples collected from 43 HCF water sources, 16 (37%) yielded *E.coli.*
- At least one handwashing (HW) station was reported in 92% of HCFs, but HW coverage in patient care areas was 49%, with the lowest coverage found at smaller HCFs.
- A minority of HCFs provide water to patients and staff and district-wide drinking water station coverage was 18%.
- Waste was appropriately separated in 53% of HCFs, and was primarily eliminated in unimproved disposal sites.
- A minority of latrines had available HW stations within 5 meters.

Conclusions

Results of this assessment suggest a number of acute deficiencies in HCFs that can be addressed by Water For People in collaboration with the Ministry of Health and the local district government. Access to adequate water supplies for service delivery, handwashing facilities and drinking water are lacking. Overall, medical waste management was deficient including on-site disposal.

Recommendations

1. Provide full coverage of handwashing stations
2. Provide full coverage of drinking water stations
3. Improve waste management, including full coverage of separate receptacles for sharps, infectious, and non-infectious wastes, and barriers to protect local populations from waste
4. Provide ongoing education to health workers

Follow up

Four to six months following implementation, follow up surveys of HCF characteristics, WASH knowledge, attitudes, and practices and repeat source and drinking water testing will be completed using a revised tool adapted from the baseline questionnaire.

2.0 INTRODUCTION

2.1 Background

In sub-Saharan Africa, only 58% of healthcare facilities (HCFs) have access to an improved water source (1). This figure does not take into consideration quality, quantity, or reliability of the source, thus access is considered to be much less than 58%.

A nationally representative evaluation of HCFs in Uganda directed by the World Health Organization (WHO) in 2008 showed that overall, clean water coverage was 66%, while adequate sanitation was found in 59% of facilities, and handwashing supplies needed to meet the basic daily requirements for clinical care were found in 44% of HCFs (1). Additionally, an infection control study from Mulago Hospital in Kampala showed 79% of hospital wards lacked a functioning sink for handwashing, including 75% of obstetric wards and 86% of medical wards (2). It is likely that rural HCFs have even less WASH infrastructure.

A lack of safe water, toilets, and handwashing facilities poses significant health risks to patients, health workers, and nearby communities. Drainage of wastewater and health care waste management in HCFs are other issues that pose substantial risks. Poor WASH and environmental conditions can cause a range of infections due to contaminated water, food, hands, medical equipment, and other fomites; unsafe blood transfusions; and poor ventilation (3,4). Without water, HCF workers are unable to wash their hands before caring for patients, administer oral medications, or perform surgeries and other procedures safely, thereby increasing the risk of health facility-acquired infections (HAI). HAI have been estimated at two to twenty times higher than in developed countries, affecting between 2% and 15% of patients in hospitals, and 6% to 46% in surgical wards; the cumulative incidence of surgical site infections is estimated to range from 2.5% to 30.9% (5-7). The Ebola epidemic in West Africa highlighted the lethal consequences of the lack of handwashing stations as a basic first line of defense for health workers (8).

In recognition of these challenges, the Joint Monitoring Program (JMP) for the Millennium Development Goal initiative has included 100% coverage of WASH infrastructure for HCF in low-income countries by 2030 for Sustainable Development Goal (SDG) number 6. This issue is gaining momentum in the international community. The Director General of WHO described improving WASH in HCFs as an urgent priority, and WHO and UNICEF launched a global initiative in 2014 to promote 100% coverage of WASH in HCFs by 2030. However, even with this ambitious goal, millions of patients will be at risk of HAI in the intervening years.

Water For People (WFP) implements an Everyone Forever model with the goal of having reliable access to safe water and sanitation for every community, HCF, and school. WFP is presently working in Kamwenge District in South Western Uganda to provide rainwater tanks and/or a piped water connection to HCFs, but these interventions have not been able to fully mitigate the lack of WASH infrastructure in the district. It is against this background that Water For People has partnered with Centers for Disease Control and Prevention to undertake a baseline assessment to inform its Everyone Forever implementation strategy.

2.2 The Intervention

Phase 1

To address the problem of inadequate water and hygiene in health facilities, the Waterborne Diseases Prevention Branch at the Centers for Disease Control and Prevention (CDC) has implemented a series of

simple, inexpensive HCF interventions with various partner organizations over the past 14 years in Kenya, Zambia, and Mali. These interventions have 3 elements:

- handwashing and drinking water stations constructed out of local materials (metal stand, plastic bucket with lid and tap, plastic basin to catch wash water, and a "starter supply" of chlorine for water treatment and soap for handwashing)(Fig 1),
- health worker training on water, sanitation, and hygiene, and
- patient teaching on water, sanitation, and hygiene using the water stations as a platform (Fig 2).

More recently, promotion of waste management using 3 receptacles, one each for sharps, infectious waste, and non-infectious waste, in all patient care and laboratory areas; promotion of waste containment (eg, fenced off or in a closed room); and proper waste disposal (eg, incineration) have become part of this intervention. Evaluations of initial pilot programs in these countries have documented use and maintenance of the water stations by health workers and adoption of water treatment and handwashing behaviors by patients (9-11). A recent follow up evaluation in Kenya showed that these simple interventions have been sustained for at least 12 years after placement (12).

Figure 1. Water stations

This approach to handwashing and drinking water is inexpensive (approximately $300 to $500 per HCF, inclusive of training and transport of supplies) and can be rapidly implemented. This intervention also has the advantage of providing a simple, easy to understand, and critically important foundation for basic health care. Establishing this foundation is a basic first step that can be followed by other interventions (such as autoclaves, incinerators, laundry service, etc). CDC has developed an implementation curriculum for this short to medium term response that can be adapted to any setting. The aim of the phase 1 approach is to address the neglected crisis of WASH in health care facilities and help avert morbidity and mortality from HAI while implementation of the more expensive and time-consuming WASH infrastructure (phase 2) continues. For water-scarce countries in which a reliable, continuous water supply will not be feasible, these simple water stations will likely become part of a more permanent solution.

Fig 2. Health worker training community members

Phase 2

Although phase 2 is beyond the scope of this report, it refers to longer term, more permanent infrastructure such as water supply (piped water supply, boreholes, rainwater collection, etc), latrines, and incineration technology, all of which involve engineering. Planning of phase 2 interventions can be initiated simultaneously with implementation of phase 1.

2.3 Justification for the Intervention

The Ebola epidemic in West-African illuminated the silent crisis of inadequate WASH in HCFs faced by health workers and their patients in the developing world. WASH infrastructure is the foundation of public health and handwashing with soap is the first and most fundamental barrier to the transmission of communicable diseases. HCFs that lack this infrastructure are unable to guarantee that clinic visits will not create health risks for both the patient and the provider. The need for access to handwashing facilities, safe drinking water, and improved sanitation is acute in many health facilities in Uganda. The purpose of this evaluation was to demonstrate the extent of the need for WASH infrastructure and guide remediation efforts. A successful outcome could justify further expansion of the program.

3.0 BASELINE HEALTH CARE FACILITY ASSESSMENT

3.1 Objectives

General Objective
We conducted a baseline health facility assessment in Kamwenge District to determine deficiencies in WASH and waste management infrastructure and provide guidance to phase 1 implementation.

Specific Objectives
We enumerated baseline characteristics of 62 HCFs in Western Uganda; assessed knowledge, attitudes and practices (KAP) regarding water, sanitation, and hygiene among current HCF staff; and, in this report, provide Water For People with phase 1 implementation guidance based on baseline data.

4.0 EVALUATION DESIGN AND METHODOLOGY

Phase 1. We conducted a baseline assessment of HCF characteristics and WASH knowledge, attitudes, and practices of HCF staff, and tested source and stored water for free chlorine residual and *Escherichia coli (E.coli)*.

Following baseline data collection, project partners will install portable handwashing and drinking water stations in all patient care areas; handwashing stations in all laboratories and within 5 meters of latrines; drinking water stations in all waiting areas of participating HCFs; and 3 color-coded waste receptacles (for sharps, infectious waste, and non-infectious waste) in all patient care areas and laboratories. Health workers will receive training in use and maintenance of the water stations and waste receptacles and encouraged to use the water stations to teach their patients about WASH topics.

Four to six months after implementation, follow-up surveys of HCF characteristics, and WASH knowledge, attitudes and practices of HCF staff, will be completed using a revised tool adapted from the baseline questionnaire, the Uganda Ministry of Health WASH tool, and the Water and Sanitation Health Facility Improvement Tool (WASH FIT). Source and stored water will be tested for *E. coli* and chlorine residuals during the follow-up assessment.

Phase 2. Water For People will implement water supply, sanitation, and waste disposal interventions following completion, or concurrent with phase 1, and a second follow-up evaluation will be conducted 12 months later.

5.0. EVALUATION SITES AND POPULATION

5.1. Evaluation Sites

The initial phase targeted 62 rural HCFs in Kamwenge District that serve a population of 421,000 people.

4.2. Evaluation Population

The KAP survey included health workers employed at the 62 project HCFs. We included all health workers providing services at the designated HCFs on the day of the visit who were willing to provide informed consent for responding to a short survey. We excluded health workers who did not provide clinical service or who were unwilling to provide informed consent.

6.0. DATA COLLECTION

6.1. Baseline HCF assessments

We obtained information from the 'in charge' on basic demographics of each HCF, including data on number of health workers, average number of patients seen per day, average number of patients hospitalized per day, average number of deliveries per month, number of patient care areas (in- and outpatient), and access to water, sanitation, and hygiene facilities. We made observations of water source(s), water treatment, water storage (if applicable), handwashing stations, availability of soap, drinking water stations, latrines, and waste management facilities. Additionally, photographs were taken of relevant parts of each HCFs. We also tested source and stored water for free and total chlorine residuals and *E. coli*.

6.2. Health Worker Survey

At baseline, we interviewed all health workers employed at each HCF on demographic characteristics; job category, time employed as a health worker; knowledge, attitudes, and practices regarding water sources, treatment, and storage, hygiene, and sanitation; and patient education practices, including

teaching topics. While we attempted to interview all current HWs on duty during the day of interview, we were limited by time at some larger health centers.

7.0. DATA MANAGEMENT AND METHODS

Data were collected using smart phones with Akvo Field Level Operations Watch (FLOW) software by 10 trained enumerators. Data were entered and stored in a proprietary database and analyzed with SAS 9.4 software (Cary, NC). HCF data on basic demographics are presented descriptively and stratified by HCF designation. We refer to private clinics as 'clinics' for this analysis. Data on handwashing stations and safe drinking water at baseline are presented descriptively as are water-testing data. Health worker survey data are similarly presented descriptively.

We defined a functional handwashing station as having soap and water in the same location. Functional handwashing station coverage in HCFs reflects the minimum standard to prevent HAI and there should be at least one per patient care area (inpatient and outpatient), per WHO guidelines (4). All laboratories should also have functional HW stations.

We defined a functional drinking water station as a container with observable water. An improved drinking water station is defined as having a cover and tap/spigot for hygienic dispensing. Drinking water should be treated with chlorine, filtered, or otherwise proven to have no detectable *E. coli*. There should be one drinking water station per inpatient and outpatient care area and in outpatient waiting areas.

We defined adequate waste management as separation of sharps, non-infectious waste, and infectious waste into covered waste receptacles in each patient care area and laboratory.

Improved waste disposal is defined as placement in a covered and lined pit at least 30 meters from groundwater sources or in an incinerator. Waste disposal sites should be located in a site that is not accessible to persons not employed by the HCF.

We defined a latrine as functional if it was not full/overflowing, could be flushed (if it was a flush toilet), and had a door that closes. Hygienic latrines were defined as free of visible human waste.

8.0. RESULTS

8.1. HCF characteristics

While we initially targeted 52 HCFs in Kamwenge District, during data collection we observed that 3 had closed and found 14 that were not on the list of district HCFs. We visited a total of 63 HCFs, and have data on 62 HCFs for this report; 32 (52%) were classified as private and 30 (48%) were public HCFs (Table 1). Overall, 23 (37%) HCFs visited were designated as health center II (HC II), 14 (23%) as HC III, 2 (3%) as HC IV, and 23 (37%) as clinics. The median number of professional staff in HCFs ranged from 4 in private clinics to 53 in HC IVs. All HCFs provided outpatient care, and 68% provided inpatient care. Additionally, 36 (58%) health centers provide labor and delivery services, and 40 (65%) reported having a laboratory, including all HC III and HC IV. Of 62 HCFs, 49 (79%) reported access to electricity, although only 13 (56%) HC II reported having electricity compared with 13 (93%) HC III and 2 (100%) HC IV. Sixty-nine percent of HCFs with power used at least some solar energy. The median number of patient beds was 2 for HC II, 14 for HC III, and 67 for HC IV. The median number per month for admissions ranged from 0 to 500, for deliveries from 5.5 to 127.5, and for consultations from 30 to 1618.

8.2. Facility exterior and cleaning supplies

The exterior was adequately fenced in 14 (23%) HCFs, including 2 (100%) HC IV and 5 (36%) HC III (Table 2). On observation, 34 (55%) HCF exteriors were free of solid waste, and 53 (85%) had no visible standing water. Protective gear for cleaning the facility was available in 42 (68%) HCFs, and chlorine cleaning supplies were observed in 28 (76%) (Table 2).

8.3. Guidelines available

Of 62 health facilities, 4 (6%) had district or Ministry of Health guidelines for WASH, 15 (24%) for waste disposal, and 11 (18%) for infection prevention and control (IPC).

8.4. Staff responsible for IPC

Thirty-seven (60%) HCFs held trainings for new staff members in IPC and 34 (55%) assigned IPC responsibility to an individual, including a nurse in 40% of HCFs and the in-charge or clinic director in 21%.

8.5. Water availability at HCFs

The main water sources in 54 (87%) of 62 HCFs were improved, including boreholes in 14 (23%), rainwater collection in 13 (21%), a piped water connection in 12 (19%), and a public standpipe in 6 (10%) (Table 3). The main water source was located off the premises of 30 (48%) HCFs; the median roundtrip time to collect water was 30 minutes (range 0-90 minutes). Of 62 HCFs, 40 (65%) reported regular interruptions in water supply, 38 (58%) reported that water availability was affected by seasonality or other constraints, 16 (44%) reported that water was unavailable from the main water source for more than three months a year, and 30 (48%) reported that they needed to ration water. Water was stored in 24 (60%) HCFs, with jerry cans reported by 22 (92%); 19 (79%) reported storing enough water for 1-3 days of typical use. Of 62 HCFs, 19 (31%) reported that water was always available in patient care areas. The person with responsibility for replenishing water was defined in 45 (73%) HCFs.

8.6. Source water testing results

Samples collected from water supplying 43 (69%) HCFs included 37 (86%) from improved sources. Sixteen (37%) of 43 source water samples yielded *E.coli*, 12 (32%) from improved sources, and 4 (66%) from unimproved sources. Eight (19%) of 43 water samples, including 5 from improved sources had turbidity levels >5 NTU.

8.7. Handwashing stations in HCFs

Respondents from 60 HCFs reported the number of handwashing stations on premises; at least one handwashing (HW) station was reported in 55 (92%) HCFs, 47 (78%) had 1-4, and 8 (13%) HCFs had ≥5 (Table 4). On the day of the HCF visits, enumerators observed 113 (74%) of 153 handwashing stations reported to be present, of which 62 (55%) had both water and soap present; only 9 (15%) had proper hand drying supplies available. Of 113 observed HW stations, 100 (88%) had water available, and 64 (57%) had soap. The most common type of HW station observed was a covered container with a tap (54%). Sinks were noted at 22% of observed HW stations.

District-wide HW station coverage was 49%, with 89 functional HW stations observed in 181patient care areas. Median HW station coverage was 33% for HC II, 63% for HC III, and 90% for HC IV. Crude district handwashing coverage, defined as any handwashing station, regardless of the presence of soap or water, per total patient care areas, was 85%, with 153 HW stations observed in 181 patient care areas.

Respondents from 40 (65%) HCFs reported a laboratory on premises. Of 18 HW stations observed, 14 (78%) were functional.

8.8. Drinking water for patients and staff

Drinking water was reported to be available to staff/patients at 32 (51%) HCFs; 23 (38%) HCFs were observed to have water available on interview day. Of 32 HCFs providing drinking water, 30 (94%) reported that they treated the water; 14 (47%) reported boiling and 16 (53%) reported chlorination (WaterGuard or Aquasafe).

8.9. Drinking water stations in HCFs

Of 58 HCFs, 28 (48%) reported at least one functional drinking water (DW) station on premises. Of 22 drinking water stations observed, 3 (14%) were considered improved.

District wide DW station coverage which reflects the number of functional DW stations per patient area was 18% (27 functional DW stations/148 patient areas); the median coverage was 0.0 (range 0, 1) for HC II, 0.1 (range 0, 1) for HC III, and 0 (range 0,0) for HC IV.

8.10. Drinking water testing results

A convenience sample of drinking water from 15 (50%) HCFs that reported always treating their water was tested for free chlorine residual (FCR) and presence of E. *coli*. Of 10 samples from HCFs that reported chlorination, three (30%) had FCR ≥0.2mg/l and no presence of *E. coli*. All five samples from HCFs reporting boiling were negative for FCR and one sample was positive for *E. coli* (Figure 1).

8.11. Oral rehydration solution (ORS) availability and preparation

ORS was available in 61 (98%) HCFs surveyed, and 45 (75%) reported always treating water used to make the ORS solution; 12 (52%) of 23 HC IIs reported treating the water used to mix ORS (Table 3). Stock outs of ORS were reported by 21 (34%) HCFs.

8.12. Glove supply and staff practice

Respondents from 41 (66%) HCFs reported that gloves were always used to examine individual patients; 1 HCF reported almost never using gloves. Respondents from 26 (43%) HCFs reported that glove stock outs occurred and 15 (25%) acknowledged that health workers do not always change gloves between patients.

8.13. Sharps and medical waste management

Respondents from 33 (53%) of 62 HCFs reported separating sharps, infectious waste, and non-infectious waste; 56 (90%) reported that they separated sharps from other waste and 38 (61%) respondents reported separating infectious waste. Fifty-three (85%) HCFs reported disposing of sharps onsite, including 47 (89%) that reported burning; 16 (34%) had fuel for burning on interview day (Table 2). Enumerators observed waste disposal containers in 99 (66%) of 150 patient care areas visited.

Eight (15%) of 62 HCFs used an improved site for sharps disposal (either an incinerator or lined pit for burning). Sharps disposal sites were enclosed and secure in 10 (20%) of 51 HCFs, and inaccessible to the public in 13 (25%) of 51 HCFs.

8.14. Non-sharps infectious waste/ noninfectious waste

Respondents from 59 (95%) of 62 HCFs reported disposing of infectious waste on premises, including 58 (98%) which used burning; 8 (14%) used an improved disposal site (5 reported an incinerator, 3 a lined pit).

Noninfectious waste was disposed of and burned onsite in all HCFs but only 6 (10%) HCFs used an improved disposal system (Table 2).

8.15. Latrines

All HCFs had latrines on site. Separate facilities for patients and staff was reported for 34 (55%) HCFs. Of a total of 222 observed latrines, 197 (88%) were functional, defined as a latrine that is not full, can be flushed if it is a flush toilet, has a door that closes; 138 (62%) were hygienic, defined as free of urine/feces/blood, trash, unpleasant associated smells, or flies. Handwashing stations were available within 5 meters of 66 (30%) patient latrines. Latrines were separated by gender in 18 (30%) HCFs.

8.16. Knowledge, Attitudes, and practices of healthcare workers

At least one health worker was interviewed from every HCF visited. Of 180 interviews, 162 (90%) were with staff with direct patient care responsibilities. Among 162 health care providers, the median age was 28 (12-65); 93 (57%) were female and 81 (55%) were nurses. Of 162 health care providers interviewed, 92 (57%) had received training on handwashing, 53 (32%) on sanitation, and 103 (64%) on infection control. Eighty-eight (54%) respondents reported that health workers should wash their hands before examining a patient.

Of 162 health care providers, 67 (51%) said they always or almost always taught patients about handwashing, and 146 (90%) reported teaching patients about treating their drinking water. Forty-five (28%) correctly reported the recommended time for handwashing (Table 5).

9.0. PRELIMINARY CONCLUSIONS

Results of this assessment suggest a number of acute deficiencies in HCFs that should be addressed by Water For People in collaboration with the Ministry of Health. We will briefly summarize them and then will focus on recommendations for Phase 1 (short-to-medium term) interventions that can improve basic conditions rapidly.

Over half of HCFs are private and serve as an alternate source of health care in the district. All HCFs, regardless of designation, should provide a minimum level of WASH, including handwashing stations, safe water for drinking, and receptacles for proper waste management. Water For People will need to decide, perhaps in conjunction with the Ministry of Health, whether it is appropriate for private HCFs to be incorporated into this program of free distribution of supplies.

Results of this evaluation showed that access to adequate water supplies for service delivery were lacking. While a majority of HCFs used water from improved water sources, in many HCFs the source was often not reliable and off premises. Water testing demonstrated that many of the water sources exhibited fecal contamination, which highlighted the need for water treatment. Although most respondents reported boiling or chlorinating water, the actual practice lagged behind the reports.

Access to handwashing facilities was inadequate in most HCFs in Kamwenge District. As noted above, handwashing stations should be in all inpatient and outpatient care areas, laboratories, and within 5 meters of all latrines. HCF-specific report cards provide each HCF with an assessment of their deficiencies and guidance to Water For People for procurement of handwashing stations and supplies. The actual number of needed HW stations and supplies may be somewhat different from the reports because of limitations in our ability to conduct observations of all patient care areas and laboratories. For this reason, Water For People should be prepared to augment the amount of needed supplies reported in the scorecard.

Of HW stations that were observed, nearly half lacked soap, which reveals insufficient prioritization of this essential health care commodity by local HCFs. Many health centers did have improved water containers and stands. In these cases, the focus should be on ensuring that they are functional and that there is a sufficient quantity to provide them to all patient care areas, laboratories, and latrine areas.

Water For People should advocate that the Ministry of Health and/or the district government ensure adequate supplies of soap and clean towels for hand drying.

Access to drinking water was also deficient in most facilities in Kamwenge District, and few water samples exhibited evidence of treatment. As noted above, drinking water should be provided in all outpatient waiting areas where patients may wait for hours to be seen, all inpatient wards where patients tend to be less mobile, and outpatient departments where oral medicines, including directly observed therapy for tuberculosis, are dispensed. The number of needed drinking water stations indicated in the reports may not be accurate because of limitations in our ability to observe all locations that should have drinking water, so Water For People should be prepared to augment the quantity recommended.

While almost all HCFs had stocks of ORS available, over a third acknowledged stock outs, and 25% reported not treating water prior to mixing ORS. Laboratory studies have demonstrated that ORS is an excellent culture medium for pathogenic bacteria (13), highlighting the need to ensure treatment of water used to mix ORS.

Overall medical waste management was also deficient, particularly on-site disposal. About half of HCFs said they had receptacles for the 3 types of waste, while 2/3 of patient care areas observed had waste receptacles. More than half of the HCFs did not contain and or dispose of waste on-site adequately.

Ministry of Health or district government WASH, medical waste disposal and IPC guidelines were not observed in many Kamwenge District HCFs and only about half of HCFs had a staff person responsible for IPC.

Access to protective gear, examination gloves, and chlorine supplies were lacking in many HCFs. In particular, stock outs of gloves and inconsistent patterns of use were common. Water For People should advocate with the District to provide these essential supplies.

9.1. Limitations

Because of logistical constraints, this evaluation had several important limitations. First, because of problems with data collection software and procedures, the number of inpatient and outpatient care areas were inadequately captured in the 62 HCFs. Consequently, coverage ratios of HW and drinking water stations are likely inaccurate. We will correct this problem during implementation, at which time, alterations in the number of water stations and receptacles to be procured can be adjusted. The problem was most acute in large health facilities because of limited time to do the assessments. Second, because of time and funding limitations, we were unable to do structured observations of handwashing, which prevented the direct measurement of the impact of location of water stations on health worker behavior. Finally, water quality testing was performed on a convenience sample of source and stored water at HCFs. Because each health facility is unique, testing all sources and more stored water samples would have been desirable, permitting a measurement of changes in water quality. All water sources and a larger sample of stored water sample should be tested at the first follow-up evaluation.

9.2. Summary of recommendations

Deficiencies noted above are not unique to Kamwenge District and are common across sub-Saharan Africa and other resource limited regions of the world. We recognize that access to safe water is a challenge in Kamwenge District due to interruptions in supply, seasonal variations in access, and off-premises location of water sources at many HCFs. The purpose of this assessment was to help Water

For People and the Ministry of Health correct the deficiencies. The HCF-specific scorecards will provide a roadmap for each HCF to improve WASH conditions. Phase 1 interventions will enable the HCF to achieve a rapid improvement of conditions even while planning is underway for phase 2.

9.3. Recommendation 1: Provide full coverage of handwashing stations

All HCFs should have at least one handwashing station in each patient care area, defined as any location where a health worker examines a patient. This includes outpatient clinics, dispensaries, pharmacies, and inpatient wards. All laboratories should also have a handwashing station present and all latrines should have handwashing stations within 5 meters.

It is important that handwashing stations be functional, with adequate supplies of soap and water, and, ideally, constructed with locally available materials. Stations should consist of a 20 to 60-liter container (volume determined by need) with a tap and lid, a wash-basin, stand, and soap. Towels for hand drying should also be provided, which were found to be lacking in most of the HCFs visited.

9.4. Recommendation 2: Provide drinking water stations

Drinking water should be provided in all outpatient waiting areas (where patients may wait for hours) as well as all inpatient wards where patients may have limited mobility, and outpatient departments where oral medicines are dispensed. Drinking water stations should consist of a 20-60L containers with a tap and lid, and a locally produced stand. The drinking water points should be easy for patients to identify.

HCFs should be guided to meet minimum water quality guidelines, which call for no detectable *E. coli* per 100ml sample. Water treatment options include chlorination, boiling, and filtration. HCFs currently report using chlorine products for disinfection, which is an easy, inexpensive method of water treatment that prevents recontamination, and is locally available (brand names: WaterGuard, Aqua Save). While smaller facilities report boiling as a main method of water treatment, this method is expensive, time consuming, does not prevent recontamination, and is not best suited for HCFs that experience heavy patient loads and small numbers of health workers. Chlorine procured for water treatment can also be used for IPC activities.

9.5. Recommendation 3: Improve waste management

This assessment has highlighted the need for improved waste disposal methods at most health care facilities. While definitive strategies are needed to improve waste disposal (such as incinerators or lined pits), simple, practical protection measures can be put in place quickly and effectively. Because waste disposal sites at few HCFs were securely enclosed and inaccessible to the public, we recommend that waste disposal sites at all HCFs be surrounded by protective fencing. By keeping people out, fencing would limit the risk of accidental exposure to sharps or infectious waste.

To decrease the risk of accidental needle sticks and exposure to contaminated waste, we recommend that all medical waste be separated into sharps, infectious, and non-infectious waste prior to disposal.

9.6. Recommendation 4: Ongoing Education

We recommend trainings during installation of drinking water and handwashing stations to empower health workers about the importance of improving WASH infrastructure and of maintaining and repairing water stations as needed. The process of implementing water treatment, hygiene, improved sanitation, and waste management technologies into HCFs provides an opportunity for HCF staff to set an important example to local populations and take advantage of ‘teachable moments’ to motivate their patients to incorporate improved WASH behaviors into their lives. Ongoing education of all health workers is an essential part of building lasting improvements in preventing HAIs.

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Table 1. HCF characteristics by HCF category, Kamwenge District, Uganda, 2017

	Total (N=62)	Clinic 23 (37%)	Health Center II 23 (37%)	Health Center III 14 (23%)	Health Center IV 2 (3%)
Designated as a Public Health Center	30 (48%)	0 (0%)	19 (82%)	9 (64%)	2 (100%)
Services provided					
Outpatient	62 (100%)	23 (100%)	23 (100%)	14 (100%)	2 (100%)
Adult in-patient	42 (68%)	21(91%)	5(22%)	14 (100%)	2 (100%)
Pediatric in-patient	31 (50%)	13 (56%)	3 (13%)	13 (93%)	2 (100%)
Labor and delivery	36 (58%)	12 (52%)	8(35%)	14 (100%)	2 (100%)
Laboratory	40 (65%)	17(74%)	7 (30%)	14 (100%)	2 (100%)
Median number of beds (range)	-	5 (0-12)	2(0-14)	13.5 (6-60)	67 (66-68)
Median number of healthcare workers	-	4 (1-10)	6 (2-14)	14.5 (5-40)	52.5 (35-70)
Median number of doctors		0(0-1)	0	0 (0-2)	3(2-4)
Median number of nurses	-	1 (0-4)	1 (0-3)	3 (1-10)	11 (7-14)
Median number of monthly admissions	-	15 (0-64)	0 (0-50)	30 (12-1400)	500 (450-550)
Median number of monthly deliveries	-	5.5 (0-35)	5.5 (0-50)	25 (4-300)	127.5 (75-180)
Median number of monthly consultations	-	30 (10-300)	600 (30-3000)	750 (60-1800)	1618 (1500-1736)

Table 2. HCF exterior characteristics, access to protective cleaning supplies waste elimination; sharps, infectious, and non-infectious waste

	Total	Clinic	Health Center II	Health Center III	Health Center IV
Exterior well fenced	14(23%)	3 (13%)	4 (23%)	5(36%)	2 (100%)
Exterior free of solid waste	34 (55%)	11(48%)	11(48%)	10(71%)	2(100%)
Exterior free of stagnant water	53 (85%)	19 (82%)	18(78%)	14(100%)	2(100%)
Protective gear available for cleaning facility	42(68%)	12(52%)	17(74%)	11(79%)	2(100%)
Chlorine supplies present (n=37)	28(76%)	6(55%)	14(88%)	7(78%)	1(100%)
Bucket present (n=37)	35(95%)	11(100 %)	14(88%)	9(100%)	1(100%)
Mop present (n=37)	34(92%)	8(72%)	16(100%)	9(100%)	1(100%)
Appropriate separation of waste	33(53%)	9 (39%)	12 (52%)	10 (71%)	2 (100%)
Sharps disposed of on site	53(85%)	18(78%)	21(91%)	13(93%)	1(50%)
Incineration	5(11)%	0	2 (10%)	3(23%)	0
Burned in a pit	35(75%)	8(61%)	17(85%)	9(69%)	1(100%)
Burned on flat ground	6(13%)	4(31%)	1(5%)	1(8%)	0
Sharps buried onsite	6(11%)	5(28%)	1(5%)	0	0
Use of lined pit for burning sharps disposal (n=34)	3(8%)	2(25%)	0	1(13%)	0
Availability of fuel for burning on interview day	16(34%)	2(15%)	6(30%)	7(54%)	1(100%)

Sharps waste disposal area is enclosed and secured (n=51)	10(20%)	2(12%)	2(10%)	6(46%)	0
Sharps waste disposal area inaccessible to the public area (n=51)	13(25%)	1(6%)	3(15%)	8(62%)	1(100%)
Infectious non-sharps disposed of on site	59 (95%)	21(91%)	23(100%)	13(93%)	2(100%)
Incineration	5(9%)	0	2(9%)	3(23%)	0
Burned in a pit	45(78%)	16(76%)	18(82%)	9(69%)	2(100%)
Burned on flat ground	8(14%)	5(24%)	2(9%)	1(8%)	0
Use of lined pit for burning infectious non-sharps disposal (n=44)	3 (7%)	1(6%)	0	1(13%)	1(50%)
General non-infectious waste disposed of on site	62(100%)				
Incineration	5(8%)	0	2(9%)	3(21%)	0
Burned in a pit	49(79%)	18(78%)	19(83%)	10(71%)	2(100%)
Burned on flat ground	8(13%)	5(22%)	2(9%)	1(7%)	0

Table 3. Water sources, available, storage, and treatment by type of HCF, Kamwenge District, Uganda, 2017

	Total	**Clinic**	**Health Center II**	**Health Center III**	**Health Center IV**
Improved water source	54 (87%)	18 (71%)	21 (91%)	13 (93%)	2 (100%)
Borehole	14 (23%)	5 (22%)	6 (26%)	3 (21%)	0
Rain water	13 (21%)	2 (9%)	6 (26%)	5 (36%)	0
Health facility private connection (piped)	12 (19%)	6 (26%)	4 (17%)	2 (14%)	0
Public tap stand	6 (10%)	3 (13%)	3 (13%)	0	0
Protected spring	5 (8%)	1 (4%)	1 (4%)	2 (14%)	1 (50%)
Covered dug well (shallow well)	4 (5%)	1 (4%)	1 (4%)	1 (7%)	1 (50%)
Unimproved water source	8 (13%)	5 (22%)	2 (9%)	1(7%)	-
Surface	3 (5%)	1 (4%)	1 (4%)	1 (7%)	0
Uncovered dug well	4 (8%)	4 (17%)	0	0	0
Tanker truck	1 (2%)	0	1 (4%)	0	0
Main water source located on premises	32 (52%)	11 (48%)	12 (52%)	9 (64%)	0 (0%)
Regular interruptions in water supply	40 (65%)	15 (65%)	14(61%)	10 (71%)	1 (50%)
Water availability affected by seasonality or other constraints	36 (58%)	11 (48%)	14 (61%)	10 (71%)	1 (50%)
Water unavailable from the main source for ≥3 months of the year (n=36)	16 (44%)	4 (36%)	5 (36%)	7 (70%)	0 (0%)
HCF stores water, (n=40)	24 (60%)	9 (60%)	10 (71%)	5 (50%)	0 (0%)
Water quantity sufficient for daily needs	48 (77%)	20 (87%)	16 (70%)	10 (71%)	2 (100%)
Water always available in patient care areas	19 (31%)	6 (26%)	7 (30%)	5 (35%)	1 (50%)
Drinking water availability for patients/staff	32 (51%)	17(74%)	8 (34%)	6(43%)	1(50%)
Drinking water available on interview day	23 (38%)	9(41%)	7(30%)	7(50%)	0(0%)

Water treatment reported (n=32)	30 (94%)	17(100%)	6(75%)	6(100%)	1(100%)
Boiling	*14 (47%)*	12 (86%)	2 (30%)	0	0
Chlorination	*16 (53%)*	5 (29%)	4 (67%)	6 (100%)	1 (100%)
Availability of ORS	61 (98%)	22(96%)	23(100%)	14(100%)	2(100%)
Treatment of water used to mix ORS	45(75%)	21 (95%)	12 (52%)	10(71%)	2(100%)
Occurrence of stock outs of ORS*	*21(34%)*	11(50%)	7 (30%)	2 (14%)	1 (50%)

*61/62 HCFs responded to inquiry of stock outs

Table 4. Handwashing stations by Health center designation

	Total	**Clinic**	**Health Center II**	**Health Center III**	**Health Center IV**
Number of Handwashing (HW) stations, median	-	1 (1-4)	1(1-5)	4 (1-18)	5(4-6)
Facilities with zero HW stations	5 (8%)	5 (22%)	0	0	0
Facilities with 1-2 HW stations	31 (12%)	13 (57%)	17 (74%)	1 (7%)	0
Facilities with 3-4 HW stations	16 (27%)	5 (22%)	4 (17%)	6 (42%)	1 (50%)
Facilities with ≥5 HW stations	8 (13%)	0	1 (4%)	6 (42%)	1 (50%)

Figure1. Flow diagram of drinking water (DW) testing results

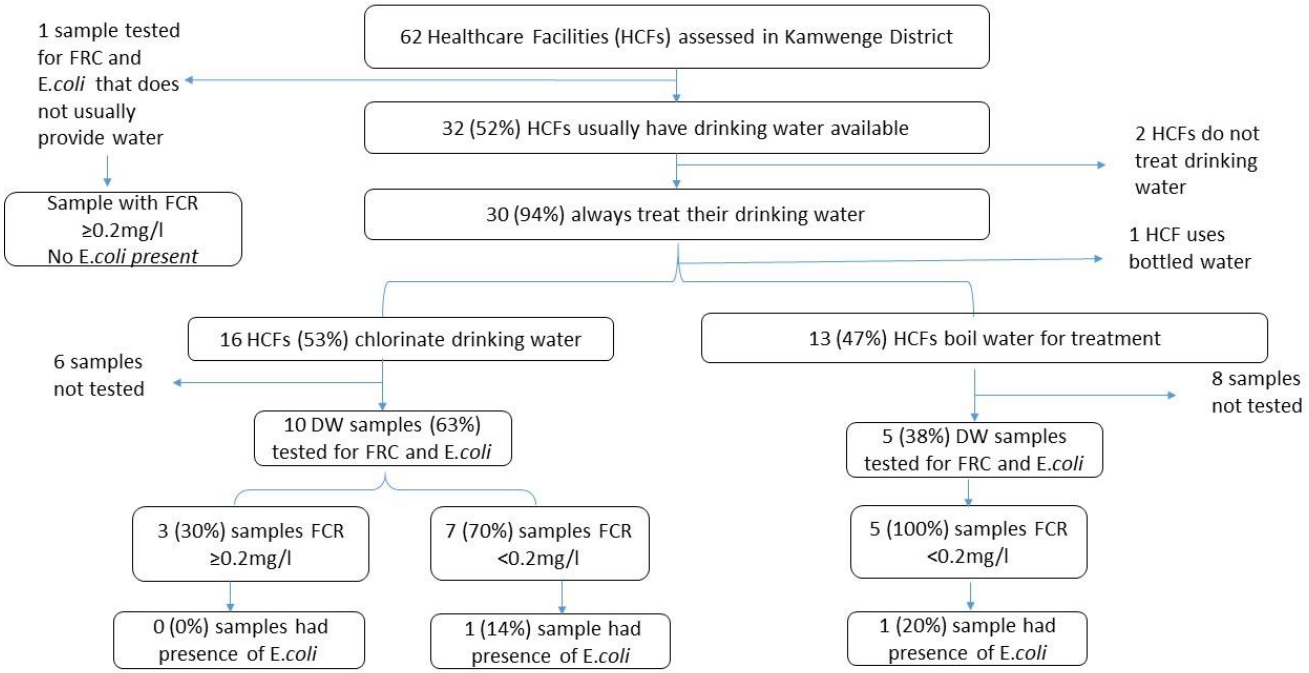

Table 5. Knowledge, Attitudes, and Practices of Health workers

	Health workers (N=162)
Age, years, median (range)	28 (12-65)
Female, %	93 (57%)
Health center level where interviewee works	
HCII	50 (31%)
HCIII	64 (40%)
HC IV	8 (5%)
Clinic	40 (25%)
Position at health center	
Doctor	0 (0%)
Clinical officer	22 (14%)
Nurse	81 (55%)
Midwife	18 (11%)
Laboratory tech	23 (14%)
Medical Assistant	2 (1%)
Community Health Worker	10 (6%)
Received training on handwashing	92 (57%)
Received training on water treatment	53 (32%)
Received training on safe water storage	50 (31%)
Received training on sanitation	89 (55%)
Received training on infection control	103 (64%)
Teach patients about hand washing	132 (82%)
Always/Almost always	67 (51%)
Teach patients about treating drinking water	146 (90%)
Reported that health workers should wash hands before examining a patient	88 (54%)
Correctly reported recommended time for handwashing	45 (28%)