PLOS WATER

RESEARCH ARTICLE

Analysis of management systems for sustainability of infection prevention and control, and water sanitation and hygiene in healthcare facilities in the Greater Kampala Area, Uganda

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Citation: Isunju JB, Ssekamatte T, Wanyenze R, Mselle JS, Wafula ST, Kansiime WK, et al. (2022) Analysis of management systems for sustainability of infection prevention and control, and water sanitation and hygiene in healthcare facilities in the Greater Kampala Area, Uganda. PLOS Water 1(5): e0000021. https://doi.org/10.1371/journal.pwat.0000021

Editor: Eugene Appiah-Effah, Kwame Nkrumah University of Science and Technology, GHANA

Received: October 25, 2021

Accepted: April 27, 2022

Published: May 19, 2022

Peer Review History: PLOS recognizes the benefits of transparency in the peer review process; therefore, we enable the publication of all of the content of peer review and author responses alongside final, published articles. The editorial history of this article is available here: https://doi.org/10.1371/journal.pwat.0000021

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Data Availability Statement: Data has been uploaded as supporting information

Abstract

Sustaining Water, Sanitation, and Hygiene (WASH), and Infection Prevention and Control (IPC) services in healthcare facilities (HCFs) remain a challenge in the developing world. This is largely attributable to ineffective management systems such as leadership, training, monitoring, financing and accountability, and operation and maintenance (O&M) for WASH and IPC. This study analysed management systems for the sustainability of WASH and IPC in HCFs in the Greater Kampala Metropolitan Area (GKMA), Uganda. A descriptive cross-sectional study was conducted in 59 HCFs. Data were obtained from HCF in-charges using the WASHCon tool. Indicators of sustainability across HCF level and ownership were compared using Chi-square tests, performed in Stata 14 statistical software. A p-value of less than 0.05 was considered significant. Less than half, 42.4% (25/59) of the HCFs had trained their staff on WASH issues, and 44.1% (26/59) had WASH and IPC guidelines. Nearly all, 91.2% (31/34) of the HCFs that needed new sinks, taps, or pipes could not afford them due to insufficient funds. The perceptions of in-charges that it was their responsibility: to ensure that staff receive training on WASH and IPC ($p = 0.014$); to oversee the O&M of WASH and IPC infrastructure ($p = 0.005$); and to sustain WASH and IPC infrastructure and behaviours ($p = 0.014$) varied by ownership of the HCF. Availability of written guidelines on WASH and IPC varied by level and ownership ($p = 0.010$). In this study, sub-optimal management systems for WASH and IPC were noted, and leadership, training and monitoring, financing, and accountability varied across level and ownership of the HCFs. Nonetheless, simple acts such as recognising the best performing staff in WASH and IPC can boost the morale of the staff. Also, there is a need for budget increments and functionalisation of the WASH and IPC committees in order to sustain recommended practices.

Funding: This work was supported by the WaterAid (MaKSPH-WAU to JBI; RKM). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

Introduction

Availability of infection prevention and control (IPC) and water, sanitation and hygiene (WASH) services remains a public health challenge in healthcare facilities (HCFs) [1, 2]. Globally, 32% of HCFs do not have hand hygiene facilities at points of care, 15% have limited water service, and a tenth (10%) of HCFs, which serve over 800 million people have unimproved toilets or no toilets [3]. Sub-Saharan Africa (SSA) is disproportionately disadvantaged. More than half, 54% of HCFs in SSA lack access to a basic water supply, and nearly three-quarters (71%) lack access to a basic sanitation service [3]. Though characterised with limited evidence [3], the WASH status in HCFs in Uganda is not any different. More than half (56%) and nearly a third (25%) of HCFs in Uganda lack access to a safe water supply and basic sanitation respectively [3]. Only 12.1% of HCFs in the greater Kampala metropolitan area (GKMA), which is the focus of the current study, have a basic WASH service, as defined by the Joint Monitoring Programme (JMP) [1]. Nearly half, 48.3% of the HCFs have limited water service, 84.5% have a limited sanitation service, 50.0% have a limited environmental cleanliness service, 56.9% have a limited hand hygiene service, and 51.7% have a limited waste management service [2]. Discrepancies in WASH service levels are more prominent in lower-level HCFs compared to hospitals [2, 3].

Just like WASH, IPC, defined by the World Health Organisation (WHO) as a practical, evidence-based approach for preventing patients and health workers from being harmed by avoidable infections, remains a public health challenge worldwide [4, 5]. Improved WASH services are a prerequisite for IPC. Consequently, limited IPC measures and poor WASH services, in particular, are associated with an increase in healthcare-associated infections (HCAIs) including sepsis, pneumonia and COVID-19 [2, 6, 7], and the proliferation of multi-drug resistant pathogens. Improved WASH services are fundamental to health security, preparedness and response efforts, and remain a top priority for women receiving maternal care [3, 4]. Strong and effective IPC programmes are known to improve the quality of care, patient dignity and safety and to protect healthcare providers. Owing to the benefits of improved IPC and WASH in HCFs, a number of interventions have been implemented by governments and implementing partners [8]. Despite the implementation of these interventions, many HCFs especially in low- and middle-income countries struggle to sustain IPC and WASH services in HCFs when external support is withdrawn [9, 10].

The concept of sustainable IPC and WASH in HCFs remains novel. Nonetheless, there is a consensus that sustainable interventions should be able to deliver their intended benefits over an extended period of time after external support from donor agencies is terminated [11, 12]. In order to be sustainable, key stakeholders such as the HCF management should have the ability to mobilise and allocate resources with the aim of improving IPC and WASH in HCFs [13, 14]. Sustainability of WASH services, including in HCFs is built on five domains which include technical, institutional, social, environmental and financial sustainability [15]. This definition of sustainability was applied to both IPC and WASH services in this paper. Therefore, technological sustainability of IPC and WASH services is reached when the technology or hardware needed for the services to continue to function is maintained, repaired and replaced by local people [12, 15]. Institutional sustainability means that IPC and WASH systems, institutions, policies and procedures at the HCF are functional and meet the demand of users of WASH services [15]. Social sustainability entails appropriate social conditions, systems and prerequisites that are required to ensure that the current and future IPC and WASH needs in HCFs are met [15–17]. In order for IPC and WASH services in HCFs to be financially sustainable, there should be continuity in the delivery of IPC and WASH products and services. This can only be achieved if such products and services are locally financed, and do not depend on

external subsidies [12, 15]. Considering these aspects of sustainability reduces wastage of funds and missed opportunities to improve the population's health and wellbeing [18–20].

In order for IPC and WASH services to be sustainable, HCFs have to put in place robust management systems [21]. Such systems must have IPC and WASH policies, guidelines and standards, good leadership, dedicated budgets, supervision and monitoring systems, accountability mechanisms, and strong capacity-building [22]. Once in place, an effective management system increases ownership and the ability to identify deficiencies, provides an avenue for understanding the complexity, interactions, and interdependencies of the different stakeholders engaged in the sustainable provision of WASH and IPC in a HCF [23]. Furthermore, the existence of effective WASH and IPC management systems in healthcare settings is vital for safeguarding not only the safety of health workers but also that of clients seeking healthcare services [24]. Thus, effective management is a critical requirement for efficiency and sustainability of IPC and WASH services. Conversely, a lack of effective management systems derails operations and maintenance (O&M) of services [25] including IPC and WASH, thereby increasing the risk of transmission of HCAIs [26]. Limited access to trained personnel, equipment, and supplies, in addition to lack of proper planning, have generally resulted in a lack or breakdown of WASH and IPC services in HCFs. For instance, evidence from the United Nations Children's Fund (UNICEF) scoping study in Eastern and Southern Africa indicated that 13 of the 19 countries lacked national O&M plans for WASH in HCFs [27].

It has been noted that many WASH interventions in HCFs often focus on improving infrastructure such as building sanitation and hygiene facilities and providing access to safe water supplies but this approach is largely supply-driven and often prone to a lack of ownership and responsibility for O&M [28]. It is further noted that WASH sustainability may not be achieved by strengthening individual factors but requires a multifaceted approach to strengthen the whole system of factors that impact sustainability [24, 29]. Evidence shows that effective management systems can improve O&M [24, 30–33], however, there is little evidence on the existence of management systems for WASH and IPC in healthcare settings in LMICS including Uganda. In this study, management systems for the sustainability of WASH and IPC in HCFs were analysed in the GKMA, Uganda. The study was premised on the sustainability model by Brikké [34]. This model has previously been used to understand the opportunities and barriers to effective O&M of public toilets in Kampala [25].

Materials and methods

Study setting and design

This study was cross-sectional in design and was conducted in selected HCFs within the GKMA (Fig 1). The GKMA includes Kampala, Mukono, and Wakiso districts, whose HCFs serve approximately 15% of Uganda's population. The study was restricted to only public and private not-for-profit (PNFP) HCFs which offer maternal, new-born, and child health (MNCH) services to the majority of the population. The HCFs in Uganda follow the pattern of the administrative units within the districts, with health centres (HCs) of increasing capacity designated as level II HC, level III HC, level IV HC, general hospitals, and regional referral hospitals. Details of Uganda's health care system have been described in our earlier publication [2]. Briefly, HC IIs are based at Parish level and serve a population of up to 5,000 people; HC IIIs are based at Subcounty level and serve a population of up to 20,000; HC IVs are based at County level and serve a population of up to 100,000; General Hospitals are based at District level and serve a population of up to 500,000; and Regional Referral Hospitals are based at Regional level and serve a population of up to 2,000,000 people [35].

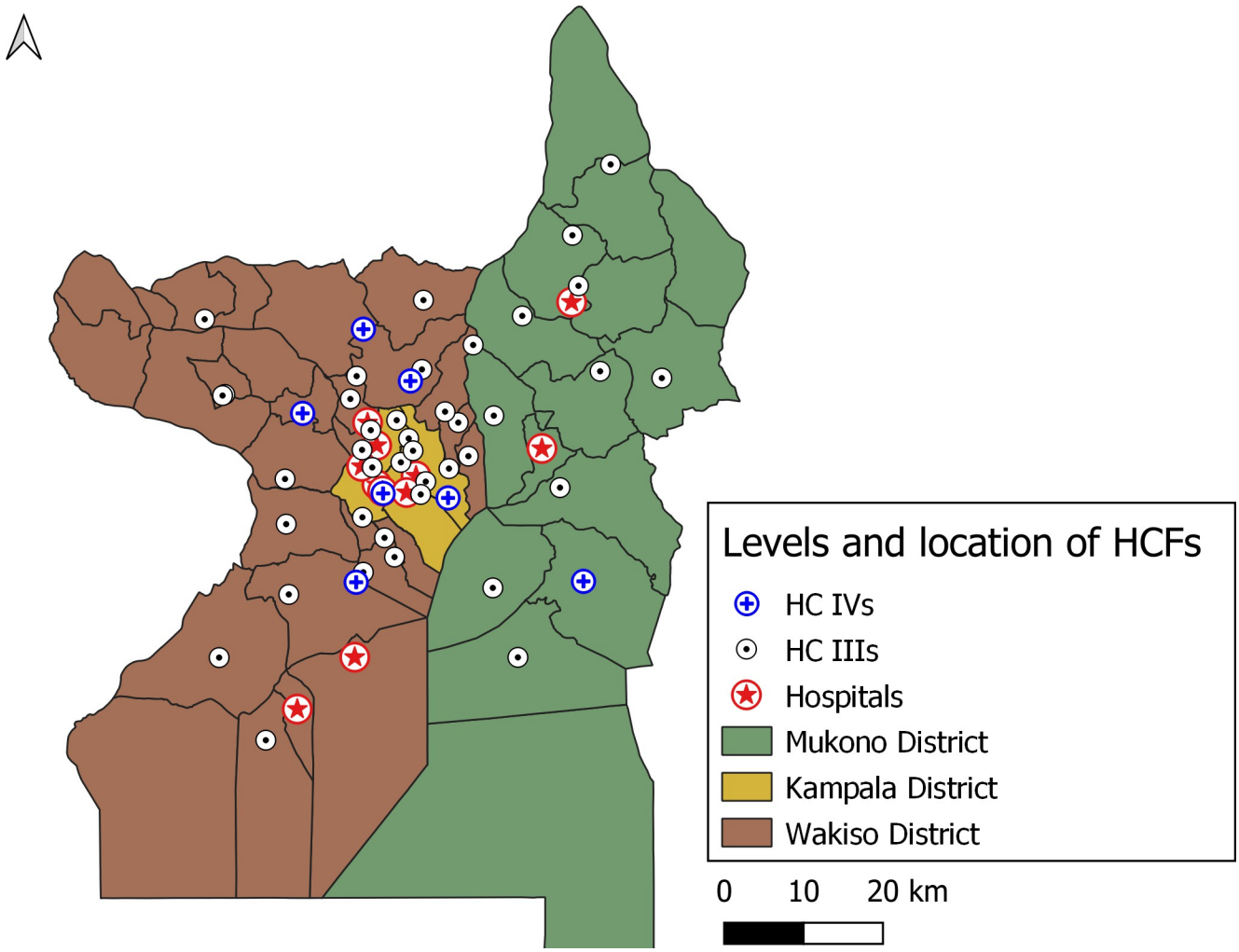

Fig 1. Map of the Greater Kampala Metropolitan Area showing the distribution of healthcare facilities included in the study.

https://doi.org/10.1371/journal.pwat.0000021.g001

Sample size and sampling

We sampled 60 HCFs out of a total of 110 public and PNFP (Health centre IIIs, IVs and hospitals) healthcare facilities in the GKMA [36]. However, one healthcare facility was excluded at analysis due to data gaps. With respect to ownership, all public and PNFP hospitals and high-volume HC IVs were purposively selected. These were selected because they cover large catchment areas, and offer maternity and delivery services for which WASH is a critical prerequisite for infection prevention and control.

Data collection and study variables

Data were collected using the WASH Conditions (WASHCon) in Healthcare Facilities Tool on a Commcare mobile application (Dimagi, Massachusetts, US). The tool, developed by researchers from the Center for Global Safe Water, Sanitation, and Hygiene at Emory University (CGSW), has been used to evaluate WASH conditions in more than 400 HCFs in LMICs [37]. The WASHCon tool has been employed in previous studies in Uganda and other countries [2, 33] with high validity. Details on how the WASHCon tool is used, and how the

WASHCon scores are calculated and interpreted were described in our previous publication [2]. Using the tool, structured interviews were conducted with the in-charges of the selected HCFs. In Uganda, an in-change at HC II is an enrolled nurse, at HC III is a clinical officer while at HC IV, general and regional referral hospitals is a medical officer.

Data were segregated according to ownership (public vs PNFP) and level (hospital, HC IV, and HC III) and also on the various indicators adapted within the management domains for sustainability of WASH. The four indicator domains adapted included 1) leadership for IPC and WASH, 2) training, 3) monitoring, financing, and accountability for IPC and WASH, and 4) O&M for IPC and WASH, which has been emphasized by the USAID maternal and child survival program [38].

Quality assurance and control

Prior to data collection, research assistants were trained on the subject content, use of the WASH-Con tool, appropriate interview skills, and research ethics. The data collection tools were pretested in a health centre III in Kampala, a lower level HCF to ensure the appropriateness of the tool but this facility was not considered in actual data collection. The interviews were conducted by trained research assistants with at least a bachelor's degree in Health Sciences.

Data management and analysis

Data obtained using the WASHCon Commcare app were uploaded onto an online server housed at Makerere University School of Public Health and the CSGW, and were synchronized daily by each enumerator to the server. The investigators had access to preliminary results through a pre-programmed dashboard. Data were downloaded and cleaned, and data analysis was conducted using Stata 14 (StataCorp, Texas). We conducted absolute and relative frequencies to summarize categorical data on HCFs characteristics and indicators for the domains on management systems for WASH and IPC sustainability. C to oversee the O&M of WASH and IPC infrastructure ($p = 0.005$); and (c) to sustain WASH and IPC infrastructure and behaviours hi-square tests were run to assess the whether these indicators statistically differed by level of health care facility type and ownership. A p-value of less than 0.05 was considered significant.

Ethical considerations

This study obtained ethical approval from Makerere University School of Public Health Higher Degrees and Ethics Committee (HDREC) (Protocol No. 659), and Emory Institution Review Board (IRB) 00078907. We also obtained administrative clearance from local governments in Kampala, Wakiso, and Mukono district and also from the in-charges of participating HCFs. Written informed consent was obtained from all participating HCF in-charges. All respondents were informed that participation was completely voluntary and that they could decide to withdraw from the study at any time without any consequences. Data collection tools were designed to ensure confidentiality through the use of unique IDs instead of names. All information gathered were treated with confidentiality by the research team and would only be used for reporting or publication purposes.

Results

Health facility characteristics

The survey included a total of 59 HCFs. Among these, 69.5% (41/59) were HC IIIs; 11.9% (7/59) were HC IVs; and 18.6% (11/59) were general hospitals. Of the 59 HCFs, 62.7% (37/59)

Table 1. Characteristics of study healthcare facilities.

Variable	Category	Frequency	Percentage
District	Kampala	16	27.2
	Mukono	12	20.3
	Wakiso	31	52.5
Level of Healthcare Facility	General Hospital	11	18.6
	Health Centre IV	7	11.9
	Health Centre III	41	69.5
Ownership of HCF	Public	37	37.3
	Private not for profit	22	62.7

https://doi.org/10.1371/journal.pwat.0000021.t001

were public, while 37.3% (22/59) were Private Not for Profit (PNFP). Of the 59 HCFs, 27.2% (16/59) were located in Kampala city, 20.3% (12/59) were located in Mukono district, and 52.5% (31/59) were located in Wakiso district (Table 1).

Indicators for management systems of WASH and IPC sustainability in HCFs

Training in WASH and IPC in HCFs. As part of orientation, 62.7% (37/59) of the HCFs trained new healthcare personnel on IPC, and 57.6% (34/59) trained new cleaners and maintenance personnel on IPC. Less than half, 42.4% (25/59) of the HCFs trained staff on WASH issues in HCFs; 35.6% (21/59) of the HCFs had trained staff in the last 24 months responsible for cleaning the delivery room. More than half, 57.6% (34/59) of HCFs had had their staff trained on healthcare waste management. A majority, 89.8% (57/59) of the HCF managers believed that it was their responsibility to ensure that staff are trained on WASH and IPC. A statistically higher proportion of in-charges in public compared to those in PNFPs HCFs thought it was their responsibility to ensure that staff are trained on WASH and IPC ($p = 0.014$) (Table 2).

Leadership for WASH and IPC in HCFs. More than half, 61.0% (36/59) had a dedicated infection control focal person or committee. More than three quarters, 86.4% (51/59) of the HCFs appraised staff on their performance. About half, 45.8% (27/59) recognized and rewarded high-performing staff. A majority, 81.4% (48/59) of the HCFs had frequent communication between the manager and maintenance staff on WASH and IPC issues. Less than half, 44.1% (26/59) of the HCFs had written guidelines pertaining to WASH and IPC for the HCF; 40.7% (24/59) of the HCFs had cleaning protocols. Availability of written guidelines on water, sanitation, and hygiene statistically varied by level and ownership of the HCF ($p = 0.01$). A statistically higher proportion of HCF managers in public compared to PNFP healthcare facilities believed it was their ultimate responsibility to sustain IPC and WASH infrastructure, conditions, and behaviours ($p = 0.014$). A statistically higher proportion of HCF managers in public compared to PNFP facilities thought overseeing the operation and maintenance of WASH and IPC infrastructure was their responsibility ($p = 0.005$) (Table 3).

Monitoring, financing, and accountability mechanisms for WASH and IPC in HCFs. A majority, 66.1% (39/58) of the HCFs had an annual budget for funding WASH and IPC activities. The main sources of funding were: HCF revenue for 32.2% (19/59), Primary Healthcare (PHC) funds from government for 61% (36/59), and other sources (including donations) for 6.8% (4/59). More than half, 67.8% (40/59) of the HCFs had a mechanism to track the supply of IPC-related materials and a focal person who was responsible for monitoring the daily availability and functioning of WASH and IPC infrastructure for the HCF. Having a

Table 2. Training in WASH and IPC in HCFs in the GKMA.

Indicator	Overall (%) N = 59	Level of HCF			p-value	Ownership		p-value
		Hospital (N = 11)	HC IV (N = 7)	HC III (N = 41)		Public (N = 37)	PNFP (N = 22)	
Manager/ in charge thinks spending time learning about WASH and IPC is a good use of his/her time	96.6	11 (100)	7 (100)	39 (95.1)	0.635	35 (94.6)	22 (100)	0.267
Manager/ in charge thinks it is his/her responsibility to ensure that staff at the hospital are educated about WASH and IPC	89.8	10 (90.9)	7 (100)	36 (87.8)	0.609	36 (97.3)	17 (77.3)	**0.014***
New healthcare personnel receive WASH and IPC training as part of their orientation program	62.7	9 (81.8)	4 (57.1)	24 (58.5)	0.347	24 (64.9)	13 (59.1)	0.657
At least a cleaner or maintenance personnel received WASH and IPC training as part of their orientation	66.1	10 (90.9)	3 (42.9)	26 (63.4)	0.089	24 (64.9)	15 (68.2)	0.795
Staff responsible for cleaning the delivery room received training in the last 24 months	35.6	6 (54.5)	3 (42.9)	12 (29.3)	0.273	11 (29.7)	10 (45.5)	0.223)
New cleaners and maintenance personnel receive WASH and IPC training as part of their orientation	57.6	8 (72.7)	3 (42.9)	23 (56.1)	0.429	23 (62.2)	11 (50.0)	0.361
All healthcare staff (including cleaners) received training on sorting, storage, and elimination of healthcare waste (e.g., used needles, bandages, tubes) in the last 24 months	57.6	8 (72.7)	3 (42.9)	23 (56.1)	0.429	22 (59.5)	12 (54.5)	0.712
Staff have been trained on WASH and IPC issues in healthcare facilities	42.4	8 (72.7)	2 (28.6)	15 (36.6)	0.072	16 (43.2)	9 (40.9)	0.861

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https://doi.org/10.1371/journal.pwat.0000021.t002

mechanism to track the supply of IPC/WASH-related materials and supplies available statistically varied by ownership of the healthcare facility (p = 0.024). In many of the HCFs, 67.8% (40/59) regular audits were conducted in each ward to assess the availability of hand sanitizers, soap, single-use towels, and other hand hygiene resources (Table 4).

Availability and O&M of WASH and IPC facilities in HCFs. Few HCFs, 6.8% (4/59) of the HCFs had their water quality monitored and tested. More than half, 57.6% (34/59) of the HCFs needed new sinks, taps, or pipes but could not afford them. Nearly all, 91.2% (31/34) of the HCFs that needed new sinks, taps or pipes could not afford them due to insufficient funds, while 7.8% (3/34) of HFCs could not access spare parts. About 52.5% (31/59) had a designated person to complete tasks related to the maintenance and repair of their water source. Availability of WASH and IPC facilities and their O&M did not significantly differed by level and ownership status of HCFs (Table 5). About 37.3% (22/59) of the HCFs had an inadequate number of cleaners and maintenance staff, 67.8% (40/59) had a Focal person responsible for managing the daily availability and functioning of the WASH infrastructure at the HCF. In addition, only 20.3% (12/59) of HCFs had a staff member responsible for O&M of the incinerator.

Discussion

This study analysed management systems for WASH and IPC sustainability in HCFs in the GKMA, Uganda. It was guided by the sustainability model by Brikke [39], considering aspects of 1) leadership for WASH and IPC, 2) training, 3) monitoring, financing and accountability, and 4) O&M for WASH and IPC. Specifically, the study assessed training and staffing needs, job description, staff appraisal and recognition, guidelines as well as aspects of O&M which are discussed below.

About 37.3%, and 42.4% of the HCFs did not train new healthcare personnel and cleaners respectively. This could be attributed to inadequate funding, negative attitude of some HCF in-charges, and a lack of policies on training of staff. The failure to train clinical and support staff limits knowledge acquisition, attitudinal and perception change, yet these influence the

Table 3. Leadership for WASH and IPC in HCFs.

Indicator	Overall (%) N = 59	Level of HCF			p-value	Ownership		p-value
		Hospital (N = 11)	HC IV (N = 7)	HC III (N = 41)		Public (N = 37)	PNFP (N = 22)	
Staff are regularly appraised on their performance	86.4	10 (90.9)	7 (100)	34 (82.9)	0.424	31 (83.8)	20 (90.9)	0.439
HCF Manager is ultimately responsible for the sustainability of IPC and WASH infrastructure, conditions, and behaviours.	89.8	9 (81.8)	7 (100)	37 (90.2)	0.455	36 (97.3)	17 (77.3)	**0.014***
HCF Manager thinks overseeing the operation and maintenance of WASH and IPC infrastructure is his/her responsibility.	88.1	9 (81.8)	7 (100)	36 (87.8)	0.505	36 (97.3)	16 (72.7)	**0.005***
Cleaning protocols available	40.7	6 (54.5)	3 (42.9)	15 (36.6)	0.556	16 (43.2)	8 (36.4)	0.603
HCF Manager frequently communicates with the IPC and WASH maintenance staff	81.4	11 (100)	6 (85.7)	31 (75.6)	0.174	29 (78.4)	19 (86.4)	0.446
IPC/WASH written policies and protocols available within the facility relating to cleaning the delivery room	39.0	4 (36.4)	3 (42.9)	16 (39.0)	0.971	16 (43.2)	7 (31.8)	0.324
Dedicated infection prevention and control focal person or committee available	61.0	9 (81.8)	2 (28.6)	25 (61.0)	0.078	24 (64.9)	12 (54.5)	0.432
Up-to-date diagram of the facility management structure visible and legible	45.8	8 (72.7)	4 (57.1)	15 (36.6)	0.083	16 (43.2)	11 (50.0)	0.614
Adequate cleaners and maintenance staff available	62.7	6 (54.5)	4 (57.1)	27 (65.9)	0.748	25 (67.6)	12 (54.5)	0.317
HCF has written guidelines on water, sanitation, and hygiene for the HCF available	44.1	7 (63.6)	6 (85.7)	13 (31.7)	**0.010***	15 (40.5)	11 (50.0)	0.479
High-performing staff recognized and rewarded, while staff that do not perform well are dealt with accordingly	45.8	6 (54.5)	4 (57.1)	17 (41.5)	0.603	17 (45.9)	10 (45.5)	0.971
Job description written clearly and legibly for all staff, including cleaners	86.4	10 (90.9)	6 (85.7)	35 (85.4)	0.891	33 (89.2)	18 (81.8)	0.424

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https://doi.org/10.1371/journal.pwat.0000021.t003

uptake of appropriate WASH and IPC behaviours [40]. In this study, a higher proportion of in-charges in public compared to PNFP HCFs thought it was their responsibility to ensure that staff are trained on WASH and IPC. Similarly, a higher proportion of in-charges in public

Table 4. Monitoring, financing, and accountability mechanisms for WASH and IPC in HCFs.

Indicators	Overall (%) N = 59	Level of HCF				Ownership		
		Hospital (N = 11)	HC IV (N = 7)	HC III (N = 41)	p-value	Public (N = 37)	PNFP (N = 22)	p-value
Manager makes sure that there is sufficient funding for WASH and IPC supplies	76.3	9 (81.8)	6 (85.7)	30 (73.2)	0.687	29 (78.4)	16 (72.7)	0.622
Regular ward audits done to assess availability of WASH and IPC supplies	67.8	9 (81.8)	4 (57.1)	27 (65.9)	0.490	27 (73.0)	13 (59.1)	0.270
Annual budget for the HCF that includes funding for WASH infrastructure available	66.1	8 (72.7)	5 (71.4)	26 (63.4)	0.804	25 (67.6)	14 (63.6)	0.758
Mechanism to track the supply of IPC/WASH-related materials and supplies available	67.8	7 (63.6)	4 (57.1)	21 (70.9)	0.736	29 (78.4)	11 (50.0)	**0.024***
HCF has a focal person responsible for monitoring the daily availability and functioning of WASH infrastructure for the HCF	67.8	9 (81.8)	4 (57.1)	27 (65.9)	0.490	26 (70.3)	14 (63.6)	0.598
HCF has a focal person responsible for monitoring WASH and IPC supplies	69.5	9 (81.8)	3 (42.9)	29 (70.7)	0.206	27 (73.0)	14 (63.6)	0.451

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https://doi.org/10.1371/journal.pwat.0000021.t004

Table 5. Availability and O&M of WASH and IPC facilities in HCFs.

Indicator	Overall (%) N = 59	Level of HCF				Ownership		
		Hospital (N = 11)	HC IV (N = 7)	HC III (N = 41)	p-value	Public (N = 37)	PNFP (N = 22)	p-value
New sinks, taps, or pipes needed but could not afford them	57.6	7 (63.6)	5 (71.4)	22 (53.7)	0.615	24 (64.9)	10 (45.5)	0.145
Assigned or contracted someone to complete tasks related to the maintenance and repair of water source and/or distribution system	52.5	8 (72.7)	4 (57.1)	19 (46.3)	0.288	16 (43.2)	15 (68.2)	0.064
Implemented activities related to ensuring the daily availability and functioning of WASH infrastructure (sinks, toilets, etc.)	69.5	9 (81.8)	7 (100)	25 (61)	0.072	26 (70.3)	15 (68.2)	0.866
Water regularly tested and monitored for quality	6.8	0(0.0)	0(0.0)	4 (9.8)	0.390	3 (8.1)	1 (4.5)	0.599

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https://doi.org/10.1371/journal.pwat.0000021.t005

compared to PNFP HCFs thought it was their responsibility to oversee the O&M of WASH and IPC infrastructure, and to sustain appropriate behaviours. This could be because healthcare providers in public HCFs often have more training opportunities which contribute to awareness of their responsibilities than their PNFP counterparts.

More than a third of the HCFs in our study had inadequate numbers of cleaners and maintenance staff. The inadequate number of cleaners and maintenance staff compromises the quality and frequency of cleaning, which affects overall WASH and IPC status. The inadequate number of cleaners and maintenance staff that characterised the study HCFs could be attributed to limited funding for WASH and IPC in LMICs, including Uganda [22, 41–44]. Abu, Elliott [41] reported that, due to limited WASH and IPC funding in Kenya, all the cleaning responsibilities at HCFs were left to one individual. Our findings therefore imply that HCFs may not be in position to hire or recruit cleaners and other maintenance staff. Yet, clinical staff, due to the workload that characterises HCFs in Uganda, are not in position to assume such roles. Healthcare providers often prioritise childbirth, patient and new-born care as opposed to engaging in availing and maintenance of WASH and IPC equipment [45]. This in turn compromises the implementation of suitable WASH and IPC measures in HCFs, and compliance with IPC guidelines and standards [45]. It is worth noting that a lack of dedicated personnel in charge of cleaning and maintenance of WASH and IPC equipment or facilities affects sustainability of related interventions. It limits the distribution of IPC supplies such as bin liners, sharps' boxes, soap and detergents, hand sanitisers, and personal protective equipment. The understaffing not only stops at the HCF level. It is also evident at the district health management level, most especially in the health inspectorate department, which makes the supervision of the cleaners and maintenance staff difficult.

In spite of the low staffing levels noted above, a significant proportion of the HCFs had clear and legible job descriptions for the hospital staff including cleaners. Recruitment of staff, including cleaners for HCFs is usually formal, most especially in public HCFs. Cleaners in HCFs are hired based on prescribed terms of references, and operate under contracts. However, the cleaners who may not have contracts belong to a contracting company. Nonetheless, clear job descriptions have been shown to improve role-specific work performance resulting in a positive response from hospital leadership through recognition of the staff [46], while poor job description has been shown to lead to job dissatisfaction among HCFs [47].

Our study revealed that majority of the HCFs appraised staff performance. However, less than half (45.8%) recognized and rewarded their staff. This study revealed that a high proportion (86.4%) of HCFs appraised their staff to understand their performance, provide feedback, and to understand any challenges that may be affecting performance of particular tasks.

Performance appraisals help to link the individual's job role and responsibilities and aligns it to the HCF goal, such as infection prevention and control. While majority of the HCFs appraised staff, they did not recognise or reward the well performing individuals. Recognition of well performing individuals can help sustain good performance and motivate staff who may be performing poorly. Evidence from Nigeria indicates that cleaners feel proud in being applauded as the cleanest workers in the HCFs IPC [45]. The recognition of best-performers can act as an internal motivator, which in turn sustains WASH and IPC interventions [45]. Our study findings therefore, re-emphasize the need for performance appraisals of all technical and support staff, including the cleaners, and recognition of best performing staff in HCFs.

Less than half of the HCFs had written guidelines pertaining to WASH and IPC in the HCF. Existence of WASH and IPC guidelines provides a framework for strategic planning and implementation of WASH and IPC services, provides guidance on the minimum standards, and can be used as a tool for monitoring the performance of WASH and IPC in HCFs [48, 49]. In addition, standards can also be used to establish compliance to prescribe WASH and IPC measures in HCFs. Despite the significance of these guidelines, only a few HCFs had them. Yet, the Ugandan Ministry of Health developed the National IPC Guidelines in 2013 to foster IPC in HCFs [50]. It was expected that majority of the HCFs would be having these guidelines but this was not the case, especially in PNFP HCFs. The low proportion of HCFs with WASH and IPC guidelines can be explained by the limited investment in WASH and IPC interventions, especially, development and dissemination of related policies, guidelines and standards. It is only until recently that Uganda is developing national guidelines for WASH in HCFs. These guidelines have been long overdue, suggestive of low prioritisation and investment in WASH and IPC in HCFs. Our findings however differ from a study in Nigeria where 83.3% of the HCFs had IPC protocols, 66.6% had waste management protocols, 83.3% had sharps disposal protocols and all HCFs had sterilization protocols in place [45]. The discrepancy between the findings of the current study and those of Buxton, Flynn [45] may be due to the fact that the two studies were conducted in different countries, with varying contextual enabling environment including policy adoption, implementation rates and enforcement of compliance to WASH and IPC in HCFs guidelines. Whereas our study enrolled 59 HCFs, Buxton, Flynn [45] enrolled only 6 HCFs. Nonetheless, our study highlights the need to ensure the availability of WASH and IPC guidelines along with strengthening of IPC committees in all HCFs in order to ensure compliance, accountability, and sustainability of gains.

Allocation of funds is key for the sustainable provision of WASH and IPC services within HCFs. The study revealed that more than half of the HCFs had an annual budget that included funding for WASH and IPC infrastructure. Whereas our study did not ascertain how much money was allocated to WASH and IPC activities, another study conducted in two districts in Uganda by the Civil Society Budget Advocacy Group [51] revealed inadequacy in funds allocated for the provision of WASH infrastructure within HCFs. As a result, HCFs were unable to provide sufficient WASH services. In addition, our study revealed that, more than half (57.6%) of the HCFs, irrespective of whether they had an annual budget for WASH and IPC or not, were unable to afford new sinks, taps, and pipes when they needed to. This finding indicates that the amount of funds allocated to WASH and IPC is insufficient to sustain improvements in HCFs. Therefore, there is a need to increase funds allocated to WASH hardware and software activities in HCFs. This can consequently, improve O&M of WASH and IPC facilities and equipment in HCFs.

A number of factors contribute towards the inadequate distribution of funds for WASH and IPC. Type of ownership is one of those factors; whether the HCF is PNFP or public. In Uganda, provision of WASH and IPC supplies to HCFs is often done centrally, by the National Medical Stores (NMS), which is also reported to have logistical challenges [52, 53]. However,

each HCF, depending on the level, receives PHC funds to support operation and maintenance costs, including those related to WASH and IPC. The PHC funds are directly remitted to the HCFs' bank account, whose signatory is the HCF in charge [54]. PHC funds can be used by HCFs to locally procure WASH and IPC supplies in case of stockouts, and to afford spare parts in case of breakdown of WASH and IPC equipment.

Tracking mechanisms for the supply of WASH-related IPC materials were reported in over half of the HCFs. These mechanisms are crucial during the planning and budgeting of WASH-related services to ensure adequate and continuous supply within the HCFs. These are managed by HCF accountants who are responsible for procuring these materials and paying utility bills. Similar findings by Huttinger, Dreibelbis [55] indicated that within HCFs in Rwanda, requisition forms are used as a mechanism to track the supply of WASH-related materials. In this study, a higher proportion of public compared to PNFP HCFs (78.4% and 50.0% respectively) had a mechanism to track the supply of IPC/WASH-related materials and supplies. This may be attributed to the sub-optimal management systems that characterise PNFPs HCFs. There is evidence that some PNFP HCFs operate without proper management systems but rather submit to the dogmatic authority of the founding directors. Unlike the public, PNFP HCFs are marred with *p*olitics and in-fighting among boards of trustees/governors, in-charges and administrators, which makes the implementation of tracking mechanisms difficult [56]. Monitoring and evaluation for accountability is critical in ensuring value for money and transparency. Accountability can take two directions, i.e., upward and downward accountability. Upward accountability focuses on whether policies, programs or activities, were implemented as planned and whether contractors or those in charge took due diligence, while downward accountability focuses on transparency to the primary stakeholders and clients [57].

For effective and sustainable use of WASH services and infrastructure within HCFs, HCFs must identify focal persons in charge of IPC materials and O&M of the infrastructure. Over half of the HCFs had focal persons for monitoring the availability and functionality of WASH infrastructure but these were only common in public facilities and hospitals compared to PNFP and lower HCFs. This management weakness calls for promotion of IPC and WASH in lower-level HCFs and also in PNFP facilities. A similar cross-sectional study in Rwanda showed that many HCFs had environmental health officers acting as focal persons to supervise the maintenance workers and hygienist to ensure clean facilities and better management of water use [55]. In our study however, only 6.8% of the HCFs had a designated person responsible for testing and monitoring water quality within the facility. This suggests that water quality testing is not a prioritized activity which is a concern because water contamination can occur and go undetected leading to potential disease outbreaks. This therefore highlights the need for more investments to ensure sustainability in water quality provision among HCFs to ensure the reduction of HCAIs.

Strengths and limitations

This study is one of the few studies that have examined management systems for sustainability of WASH and IPC in HCFs. The analysis is based on a large sample size making the results more generalisable. Nonetheless, our study had a few limitations which can be addressed by future studies. Aside from the PHC funds disbursed by the Ugandan Ministry of Finance, Planning and Economic Development to both public and PNFP HCFs, this study did not explicitly explore other funding mechanisms for WASH and IPC. In addition, this being a quantitative study, we could not obtain an in-depth understanding of the factors that affect the sustainability of WASH and IPC. Furthermore, this study did not ascertain the

implementation of audit findings, and sustainability of WASH and IPC in private HCFs. Therefore, future studies could explore funding mechanisms for WASH and IPC in all HCFs, implementation of audit findings, and the gaps that affect sustainability in private HCFs.

Conclusion

Sustainability of WASH and IPC in HCFs in the GKMA is constrained by a number of factors, including lack of budgets for O&M of WASH infrastructure. Besides the inadequacies on the supply side, the gaps in management systems for WASH and IPC further worsen the situation. Nonetheless, simple acts of motivation such as recognising best performing staff in WASH and IPC can boost the morale of the staff and contribute to sustaining recommended practices. In addition, there is a need to provide IPC guidelines, offices, and to operationalize IPC committees in each HCF in the GKMA. The WASH and IPC focal persons need to improve monitoring and accountability which are essential for ensuring the sustainability of the gains in WASH and IPC.

Supporting information

S1 Data.
(XLSX)

Acknowledgments

Appreciation goes out to the study participants of this study and the data collection team for their assistance during data collection. We thank the managers of the healthcare facilities for granting us access to the healthcare facilities. We would like to thank the Uganda Ministry of Health, KCCA, Wakiso, and Mukono District Health Office for their guidance during the selection of study facilities.

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