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RESEARCH ARTICLE

# Infection prevention and control and water, sanitation, and hygiene status of healthcare facilities in the Greater Kampala Metropolitan region during the COVID-19 pandemic in Uganda

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## Abstract

Infection Prevention and Control (IPC) and Water Sanitation and Hygiene (WASH) are critical in preventing the spread of healthcare Associated Infections, including COVID-19. However, there was limited evidence on the status of IPC/WASH in healthcare facilities (HCFs) in Uganda amidst the COVID-19 pandemic which complicated IPC/WASH planning for the COVID-19 response. This study assessed IPC/WASH status for HCFs in the Greater Kampala Metropolitan Area (GKMA), during the COVID-19 pandemic, so as to inform programming and policy. A mixed methods cross-sectional study was conducted in 75 HCFs following the first wave of COVID-19 in Uganda. The *mWater* tool was used to collect quantitative data which were then analyzed into STATA version 16. A key informants' guide was used to collect qualitative data, which was analyzed thematically and themes and quotes used to support the quantitative findings. Overall, 86.7% (65/75) of HCFs had an IPC committee and 72.3% (47/65) of these were functional. Besides, 90.7% (68/75) of the HCFs had an IPC focal person, and 49.3% (37/75) had a clear annual IPC activity plan. Unfortunately, only 32.3% (21/65) of the functional IPC committees received budgetary support for their activities. In terms of WASH infrastructure, 96.0% (72/75), 10.7% (8/75), 60.0% (45/75), and 22.7% (17/75) had access to a basic water service, a basic sanitation service, a basic hand hygiene service and a basic environmental cleaning respectively. Our study reveals that while most HCFs have IPC committees and focal persons, functional support remains limited, with half having a clear annual plan and less than a third receiving budgetary support. Nearly all HCFs have basic water services, but there are significant gaps in sanitation and environmental cleanliness domains. These findings highlight the urgent need for improved support and investment in IPC/WASH supplies and infrastructure to enhance infection control and public health outcomes in Uganda.

**Data availability statement:** All relevant data is provided in S1 Dataset.

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**Competing interests:** The authors declare that they have no competing interests.

## Introduction

The emergence of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which causes Coronavirus disease (COVID-19), remains a serious global health emergency [1,2]. By June 29, 2022, more than 543 million confirmed cases and at least 6 million deaths from COVID-19 were reported globally [2]. In the same period, the World Health Organization (WHO) African region had documented more than 9 million confirmed cases and 172,492 COVID-19 deaths [1]. In Uganda the Ministry of Health had registered 165,607 confirmed COVID-19 cases, 3,613 deaths, 100,021 recoveries [1,3]. Additionally, a total of 21,490,654 vaccine doses had been administered in the country [1,3].

SARS-COV-2 Infections among healthcare providers (HCPs) were prevalent as these were at particularly high risk of exposure and infection [4,5]. HCPs accounted for 14% of all global COVID-19 cases, and 5% of cases in Sub-Saharan Africa [6]. Whereas global statistics on COVID-19 among HCPs remain scarce, a prospective study conducted in the United States and the United Kingdom reported a prevalence as high as 2,747 cases per 100,000 front-line HCPs [4]. Although the infection rate of SARS-COV-2 is lower among the HCPs compared to the general population, insufficient IPC and WASH services in HCFs poses a risk of accelerating transmission of COVID-19 in the general population [7]. HCPs are exposed to SARS-COV-2 through inhalation of aerosols exhaled by infected patients, and by touching their mouth, nose, and eyes after handling SARS-CoV-2 contaminated surfaces [8]. Factors such as inconsistent adherence to Infection Prevention and Control (IPC) measures, longer work hours and working in a risky department further elevate the risk of HCPs to SARS-COV-2 infection [6,9].

IPC is an evidence-based and practical approach that prevents harm caused by infection to HCPs and patients [6,10]. According to Wasswa et al. [11], the five basic standard precaution measures critical in IPC improvements in HCFs include hand hygiene, adequate protective wear, proper sterilization, proper sharps disposal, and safe waste management. The provision of WASH services in HCFs focuses on water services, sanitation services, hand hygiene services, waste management services, and environmental cleanliness services [12,13]. WASH is a prerequisite to IPC and is known to contribute towards reducing the number of SARS-COV-2 infections [13,14]. Although IPC and WASH are key in reducing and containing the spread of SARS-COV-2, Uganda like other low- and middle-income (LMICs) countries struggles to achieve the minimum WHO recommended standards [15]. The WHO recommends having well-formulated IPC committees that can: provide leadership for WASH and IPC; develop action plans, raise funds and provide accountability, and ensure proper operation and maintenance of facilities. The activities of the IPC committees should be coordinated by an IPC focal person [10,12]. However, there is limited data on the status of IPC in HCFs in the greater Kampala metropolitan area (GKMA) where most SARS-COV-2 cases had been registered in Uganda. Nonetheless, an IPC study conducted in Northern Uganda had indicated only 74.7% of the HCPs washed their hands during at least one of the five critical moments, two-thirds wore gloves when appropriate, and 90.6% disposed of sharps in suitable containers [11].

The WASH standards in HCFs in the GKMA are generally unsatisfactory [13]. Before the COVID-19 pandemic, 48.3% of the HCFs in the GKMA had a limited water service, 84.5% had limited sanitation service, 50.0% had limited environmental cleanliness service, 56.9% had limited hand hygiene service, and 51.7% had limited waste management service [13]. Additionally, 75.9% reported instances of discontinuity in water supply—only 58.3% had a piped water supply to the wards, 45.0% had an unpleasant smell at the toilet, and only 20% had a toilet facility that met the needs of people with limited mobility [13]. Critical gaps include, 38.3% of the HCFs lacking critical hand hygiene supplies, 20.0% having uncontained solid wastes,

33.3% lacking protected areas for storing healthcare waste, and 11.7% failing to segregate healthcare waste despite availability of waste bins [13].

The onset of the COVID-19 pandemic warranted significant improvements in WASH and IPC to prevent the spread of the virus [16]. However, evidence on the advancement of IPC and WASH in HCFs in the GKMA during the COVID-19 pandemic remains limited [3]. This lack of data hinders the ability of WASH organizations to support interventions efficiently. Moreover, the previous study in the GKMA [13] did not adequately document the status of the IPC committees and the WASH service levels based on the JMP service ladders, which are critical for guiding COVID-19 prevention. This study, therefore, aimed at establishing the status of the IPC committees and WASH service levels in HCFs in the GKMA, a region with the highest burden of COVID-19 in Uganda.

## Methods

### Study setting

Public and private not-for-profit (PNFP) health centers (HC) of level III, IV and hospitals in Kampala, Wakiso and Mukono districts were included in this study between October and November 2020. The region comprises of Kampala district with 1,458 HCFs (26 public, 61 PNFP, 1,371 Private for-Profit (PFP), of which 48 are HC IIIs, 13 are HC IVs and 22 are hospitals [17]. Wakiso district has 589 HCFs, which include 165 HC IIIs, 19 HCIVs and 15 hospitals, while Mukono district has 16 HC IIIs, 3 HC IVs and 3 hospitals [17]. In Uganda, the healthcare system is organized into a four-tier system with hospitals and HCs of levels IV, III and II [13]. General hospitals (catchment population of 500,000 people) provide preventive, promotive, curative, maternity, and inpatient health services and surgery, blood transfusion, laboratory, and medical imaging services. HC IVs have a target population of 100,000 people and are responsible for preventive, outpatient health services, maternity, inpatient health services, emergency surgery and blood transfusion, and laboratory services. HC IVs provide all the services of HC IIIs except emergency surgery. The study was restricted to public HC IVs and IIIs because these offer cost- friendly Maternal, Newborn and Child Health services to the majority of the population in the GKMA [13]. This study focused on HCFs that had a high volume of patients, and those involved in the delivery of Maternal, Newborn and Child Health services and the outpatient department since they present a greater risk of exposing healthcare workers (HCWs) and patients to infections [18–20].

### Study design

A healthcare facility-based explanatory mixed methods study was conducted. In this sequential mixed methods design, quantitative data were first collected to establish the status of IPC/WASH in HCFs. This was then followed by a qualitative approach to gain a deeper understanding of the IPC/WASH status in HCFs. Quantitative data were provided by healthcare facility managers, also known as health facility in-charges. Qualitative data were obtained from IPC focal persons and other key stakeholders since they had adequate knowledge and experience in IPC/WASH programming in HCFs.

### Assessment framework

The WASHFIT framework guided the assessment of IPC/WASH conditions in HCFs and data was collected using the mWater survey tool. The WASH FIT is a risk-based, quality improvement framework/tool that has been used in more than 40 countries to guide HCFs in improving WASH, environmental cleaning, healthcare waste management, and facility management [21–23]. It has a total of 96 indicators spread across the domains of water supply

(17), sanitation (13), healthcare waste management (20), hand hygiene (5), environmental cleaning (16), and administration and workforce (12). Other scholars have previously used the WASHFIT tool to monitor the IPC/WASH status, prioritize HCF needs, and guide programming [24].

## Sample size and sampling procedure

We intended to study the IPC/WASH status in a random sample of lower-level (HC IIIs, HC IVs, and general hospitals) public and PNFP HCFs. Unlike lower-level HCFs directly administered and supervised by the District Directorates of Health Services, regional and national referral hospitals are directly supervised by a higher authority (the Ministry of Health) [25]. The types of HCFs at the different management levels and the corresponding health system management structure are as provided in Fig 1 [26] below.

At the time of the study, the GKMA (Kampala, Wakiso, and Mukono) had 99 public and PNFP HCFs. With 50, Wakiso had the highest number of HCFs, followed by Kampala (28) and Mukono (21). Considering the total number of HCFs, we used the Kish-Leslie formula

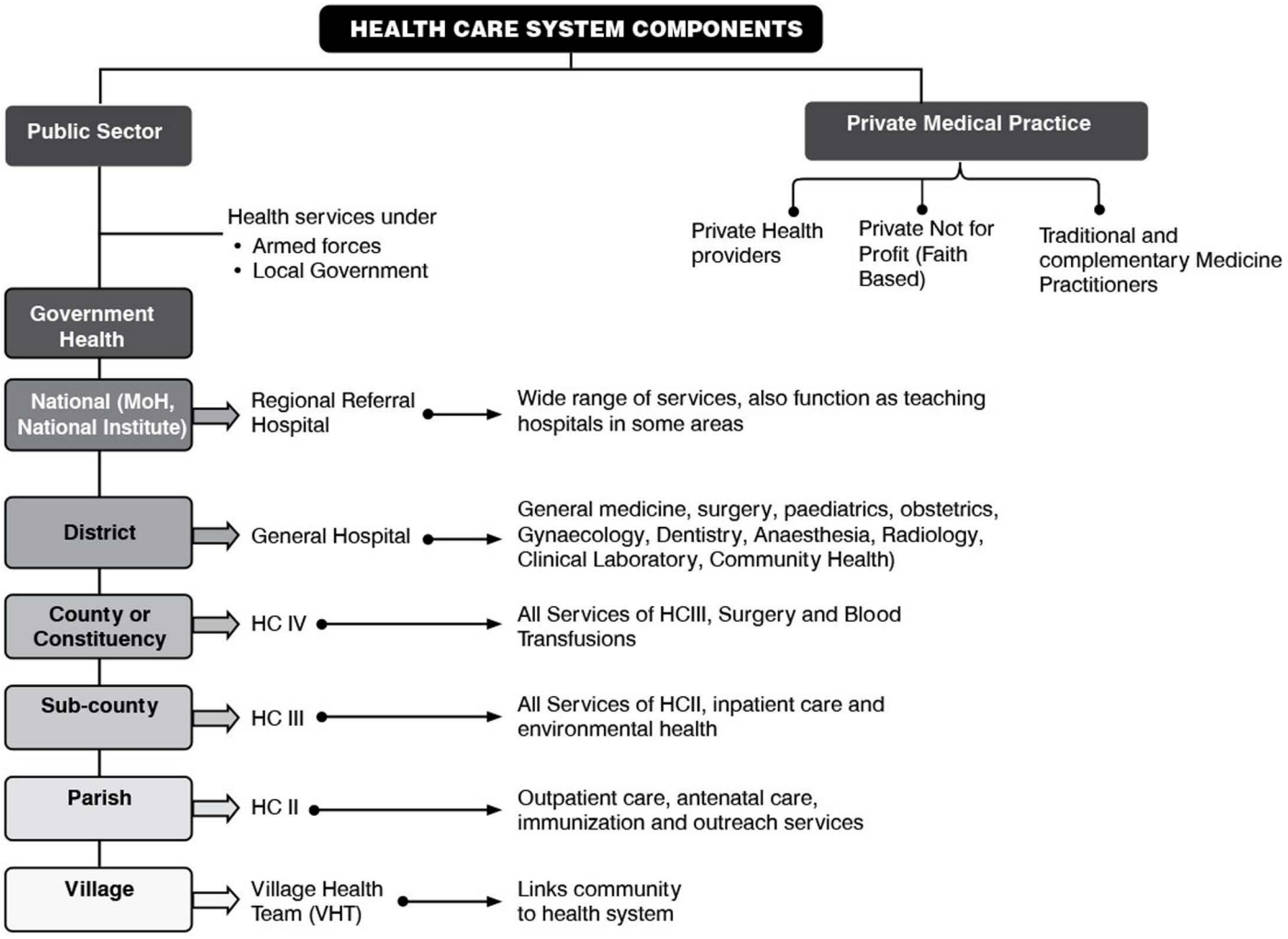


**Fig 1. Levels of HCFs in Uganda and the corresponding health system management structure.**

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for cross-sectional studies to estimate the required random sample [27]. We assumed an estimated conservative proportion of HCFs with an optimal WASH status of 50% at a 95% confidence level, an error rate of 0.05, and a two-sided Z score of 1.96, corresponding to the 95% confidence interval (CI). This yielded a sample size of 384.

$$X = \left[ \frac{\left[ \left( z^2 * p * (1-p) \right) \right]}{\left[ (ME)^2 \right]} \right]$$

$$X = \left[ \frac{\left[ \left( 1.96^2 * 05 * (1-0.5) \right) \right]}{\left[ (0.05)^2 \right]} \right]$$

Since the calculated sample size was greater than the total number of healthcare facilities (99), we applied a correction formula [28] to obtain a sample size of 79.

$$N = \frac{X}{1 + X/n}$$

$$N = \frac{384}{1 + 384/99}$$

Upon sample size estimation, an aggregated list of all health facilities at levels III, IV, and hospitals was generated from the healthcare facility inventory, after which a random sample was derived using the Microsoft Excel RAND function. The illustration of the sampling strategy for the quantitative and qualitative study is provided in Fig 2, and Fig 3 shows the map of the GKMA and the distribution of the study HCFs in the study area.

The specific base map shapefile used can be accessed at: (https://github.com/wmgeolab/geoBoundaries/raw/905b0ba/releaseData/gbOpen/UGA/ADM2/geoBoundaries-UGA-ADM2.geojson). The map was created using ArcGIS software, with the base map shapefile obtained from the open-source GeoBoundaries Global Database of Political Administrative Boundaries (www.geoboundaries.org). This database provides standardized, open-licensed boundaries for every country worldwide.

## Data collection and study tools

Data collection was undertaken between October and November 2020, a period during which the first wave of the COVID-19 pandemic, which had started in March 2020 in Uganda, ended. At that time, Uganda was gradually opening following a three months total lockdown which started in March 2020. A structured questionnaire was administered to healthcare facility managers/in-charges to assess IPC/WASH status and programming. Upon completion of the quantitative component, 20 key informant interviews (KIIs) were conducted with district healthcare managers, IPC focal persons, healthcare facility managers and hospital administrators, and representatives of the Ministries of Water and Environment, and health. A total of 10 KIIs were conducted among managers or IPC focal persons in public HCFs. Where KIIs were to be conducted at a HCF, a different respondent, other than the one who participated in the survey component (IPC/WASH assessment), was purposively selected. Five KIIs were conducted among healthcare facility managers or IPC focal persons in PNFP HCFs, while the remainder (5) were with representatives of government ministries on water and environment, and health. KIIs aimed to explore the IPC/WASH status. Specifically, we explored the role of the IPC committees, knowledge, status, and facilitators of hand hygiene practice, and

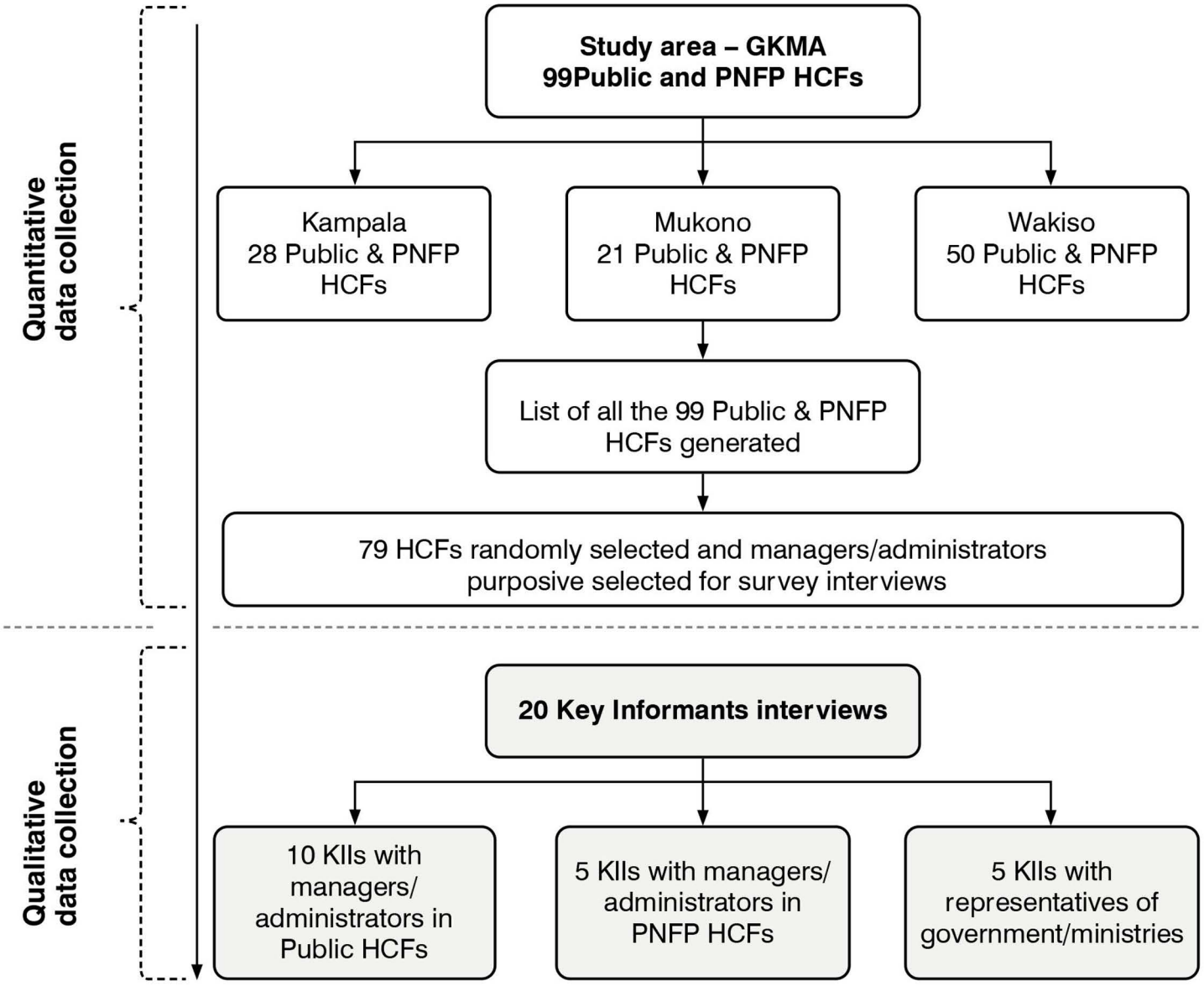


**Fig 2. Illustration of the sampling strategy for the quantitate and qualitative data collection.**

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healthcare waste management. Data collection tools were developed after a critical review of the literature on IPC/WASH in HCFs [7,22,29,30].

## Measurement of study variables

The main outcomes of the quantitative study component were IPC and WASH status of HCFs. IPC was assessed by asking dichotomous questions on the availability of an IPC committee, an IPC focal person, a clear annual activity plan and a budget. An IPC committee was considered functional if there was evidence of meetings (for example minutes for the committee meetings).

The WASH status was categorized based on the Joint Monitoring Programme service ladders for monitoring WASH services in HCFs [31]. Water service was classified as 1) basic if

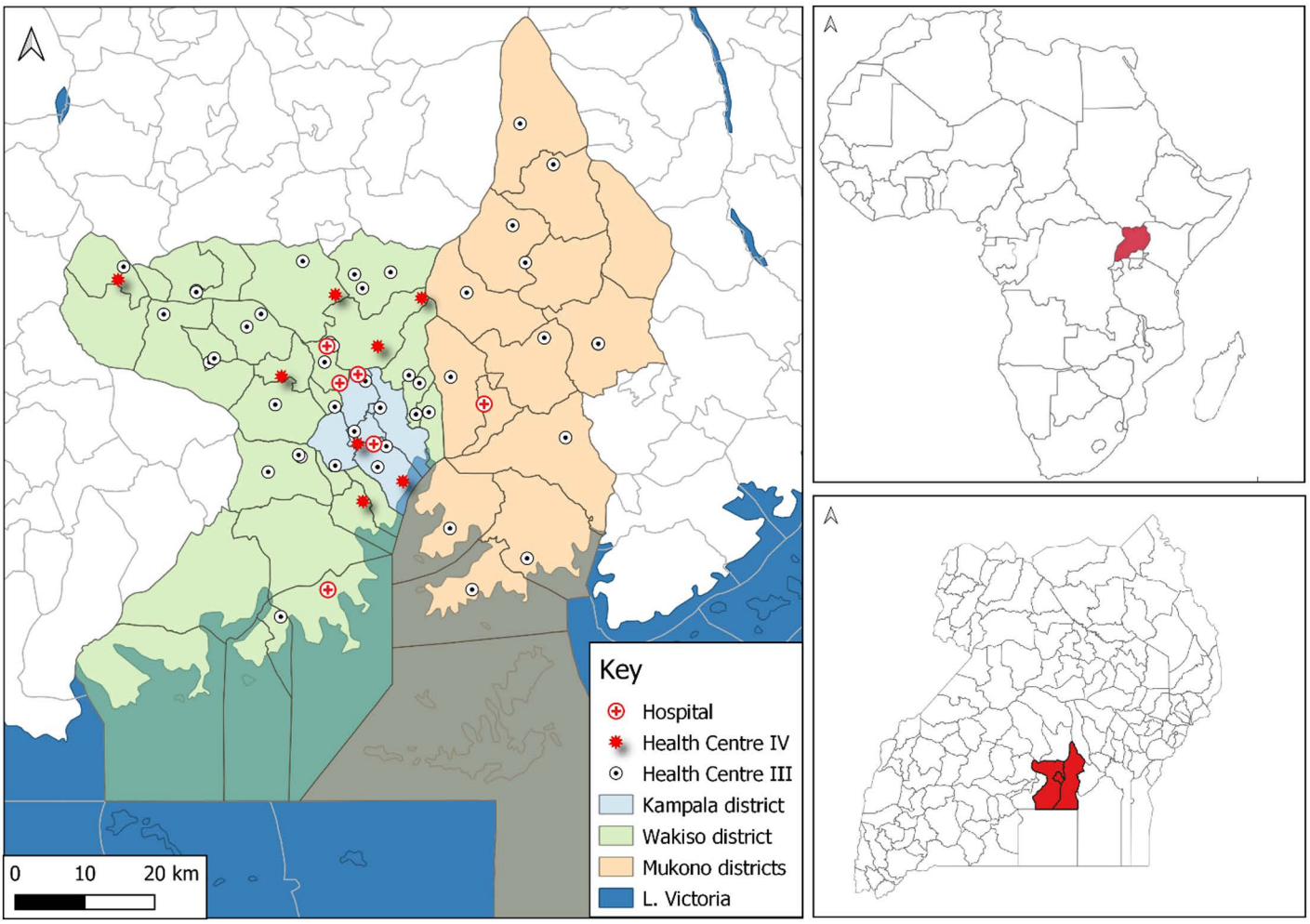


**Fig 3. A map of the greater Kampala Metropolitan showing the distribution of the study healthcare facilities.**

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an HCF accessed water from an improved source situated on the facility premises; 2) limited if an HCF had access to an improved water source located within 500 metres of the premises, but not all requirements for basic service are met; and 3) no service if water for the HCF was taken from unprotected dug wells or springs, or surface water sources or a HCF had access to an improved source that is more than 500 meters from the premises/or there was no water source [31].

Sanitation service was classified as: 1) basic if a HCF accessed improved usable sanitation facilities, with at least one toilet dedicated for staff, at least one sex separated toilet with menstrual hygiene facilities, and at least one toilet accessible by people with limited mobility; 2) limited if HCF had access to at least one improved sanitation facility, but not all requirements for basic service are met; and 3) no service if HCF had access to unimproved toilet facilities (for example a pit latrine without a slab or platform, hanging latrines, bucket latrines) or there are no latrines [31].

Hygiene was categorized as: 1) basic if functional hand washing facilities with water and soap and/alcohol-based hand rub (ABHR)) were available at points of care and within five meters of toilets in the HCF; 2) limited if functional hand hygiene facilities

were available either at the points of care or toilets but not both; and 3) no service if the HCF had no functional hand hygiene facilities available either at the point of care or toilets [31].

Waste management was classified as: 1) basic if healthcare waste was safely segregated into at least three bins and sharps and infectious waste were treated and disposed of safely; 2) limited if the HCF had limited separation/or treatment and disposal of sharps and infectious wastes, but not all requirements for basic service were met; and 3) no service, if there were no separate bins for sharps or infectious waste/or infectious wastes, were not treated/disposed of safely. Environmental cleaning was categorized as: 1) basic if HCF had basic protocols for cleaning available, and all staff with cleaning responsibilities trained; and 2) limited if HCF had cleaning protocols and/or at least some staff trained on cleaning and no service if HCF did not have cleaning protocols available and no staff trained on cleaning [31].

### Quality control, data management, and analysis

We recruited research assistants with a minimum of a bachelor's degree in Environmental Health Science, Nursing, or Social Sciences and trained them on research ethics, mobile data collection, and the mWater study protocol, a free for-unlimited use platform used by water and sanitation service providers [32], was used to design the questionnaire. During the design of the questionnaire, we ensured appropriate skips and validation checks to ensure quality data capture [33]. The questionnaire and interview guides were pretested using a sample of 20 participants at Nyimbwa health centre IV, Luweero district, to identify errors, estimate average time for a healthcare assessment, and improve the research assistants' familiarity with the study tools. The study coordinator also supervised research assistants to ensure compliance with the study protocol. Research assistants were required to upload the data daily for real-time quality control checks and preliminary analyses. Data were downloaded from the mWater as a comma-separated (CSV) file and exported to Stata 16 for statistical analysis. Frequencies and percentages were used to present categorical data. The mean and its corresponding standard deviation were used for data that were normally distributed, while median and the interquartile range were used to summarise continuous data that failed the assumptions of normality. Illustrative quotes based on the analysis of the KIIs have been used to explain or strengthen the quantitative findings.

### Ethical considerations

This study was conducted per the relevant ethical guidelines and regulations. This study was approved by the Makerere University School of Public Health Research and Ethics Committee under the reference No. 775, and registered by the Uganda National Council for Science and Technology under the reference No. HS882ES [34]. Informed written consent was obtained for the survey participants at the time of data collection. Confidentiality and use of data for research purposes was emphasized prior to starting the interviews.

## Results

### Background characteristics of the healthcare facilities

A total of 75 out of 79 HCFs were surveyed, representing a response rate of 95%. Close to two thirds, 61.3% (46/75) of the HCFs surveyed were in Wakiso district. More than three quarters, 77.3% (58/75) were health center IIIs, and 78.7% (59/75) were urban HCFs. More than half, 60.0% (45/75) of the HCFs were public facilities (Table 1).

**Table 1. Background characteristics of study healthcare facilities.**

| Description | Attribute | Frequency (N = 75) | Percentage (%) |
|---|---|---|---|
| **District where HCF is located** | Kampala | 15 | 19.2 |
| | Wakiso | 46 | 61.3 |
| | Mukono | 14 | 18.7 |
| **Level of HCF** | Health Centre III | 58 | 77.3 |
| | Health Centre IV | 11 | 14.7 |
| | Hospital | 6 | 8.0 |
| **Ownership of HCF** | Private Not for Profit | 30 | 40.0 |
| | Public | 45 | 60.0 |
| **Location of HCF** | Rural | 16 | 21.3 |
| | Urban | 59 | 78.7 |

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## Infection prevention and control

**Presence of IPC programmes and focal persons in the HCFs.** Functional written IPC programmes are critical in HCFs for the prevention of HCAIs. We assessed the status of IPC programmes, and our results revealed that slightly less than half of the HCFs had an IPC programme with a clear annual activity plan. The majority, 90.7% (68/75) of the HCFs had an IPC focal person. Majority of the HCFs were reported to be having an IPC committee. Fortunately, a significant proportion of 72.3% (47/65) of the HCFs reported having functional IPC committees. Of these, only a third, 32.3% (21/65) of the HCFs had their IPC activities/ work plans supported by budget lines (Table 2).

**Roles of IPC committees.** Regarding the roles of IPC committees, key informants mentioned that these were involved in routine monitoring and providing feedback on IPC strategies, provision of reminders on IPC, quality improvement and training of HCPs on disinfection.

> "*The committee is very dedicated because they keep on asking us about hygiene on our WhatsApp group. They keep on sending us messages on how to mix jik (a commercial bleach product) and chlorine, and they have just finished training us about how to mix chlorine" - Health facility manager.*

> *"I think it's to promote hygiene and prevent infection within the facility and among the health workers. They also deal with quality improvement" - Environmental Health Officer.*

> *"We are putting in place mechanisms and we have an infection prevention and control team that keeps on seeing what goes on every day. They meet regularly and give us feedback accordingly" - Health facility manager.*

**IPC training.** Nearly three-quarters, 73.3% (55/75) of the HCFs had managerial staff trained regarding IPC (Table 2). Besides, many respondents reported that HCWs within their facilities frequently received IPC training. However, the training frequency among the HCWs was low, given that monthly training was reported by only half of the health facility managers.

**Training in COVID-19 prevention and management.** Almost all HCFs, 93.3% (70/75), had staff trained in the prevention and management of COVID-19. Of these, the majority, 97.1% (68/70), trained staff on detecting COVID-19 symptoms, and only 22.9% (16/70) trained them on treatment of COVID-19. The majority, 81.3% (61/75) of the HCFs, gave daily IPC talks to patients and caretakers to minimize the spread of COVID-19 (Table 2).

**Table 2. Infection prevention and control in healthcare facilities in the greater Kampala metropolitan area, Uganda.**

| Description | Attribute | Frequency (N = 75) | Percentage (%) |
|---|---|---|---|
| HCF had an IPC focal point person | No | 7 | 9.3 |
| | Yes | 68 | 90.7 |
| IPC focal point received in-service training IPC (n = 68) | No | 6 | 8.8 |
| | Yes | 62 | 91.2 |
| Presence of IPC programme with an annual activity plan | No | 38 | 50.7 |
| | Yes | 37 | 49.3 |
| HCF had an IPC committee | No | 10 | 13.3 |
| | Yes | 65 | 86.7 |
| Composition of IPC committee* | Environmental Health Worker, e.g., health inspector, health assistant etc. | 25 | 33.3 |
| | Nurses/Midwives | 65 | 86.7 |
| | Hospital Administrator | 30 | 40.0 |
| | Laboratory staff | 57 | 76.0 |
| | Clinical Officers or Doctors | 59 | 78.7 |
| | Cleaners and support staff | 24 | 32.0 |
| Clinical officer on the IPC committee was trained in IPC and WASH | No clinical officer on the committee | 16 | 21.3 |
| | No | 7 | 9.3 |
| | Yes | 52 | 69.3 |
| IPC committee functional (n = 65) | No | 18 | 27.7 |
| | Yes | 47 | 72.3 |
| IPC committee supported by a budget line (n = 65) | No | 44 | 67.7 |
| | Yes | 21 | 32.3 |
| IEC materials (e.g., brochures, posters) on displayed | No | 20 | 26.7 |
| | Yes | 55 | 73.3 |
| HCWs frequently received IPC training | No | 23 | 30.7 |
| | Yes | 52 | 69.3 |
| Frequency of IPC trainings (n = 52) | Ad-hoc (not regular) | 8 | 15.4 |
| | Every quarter | 14 | 26.9 |
| | Monthly | 26 | 50.0 |
| | Other | 4 | 7.7 |
| Administrators/managerial staff trained on IPC | No | 20 | 26.7 |
| | Yes | 55 | 73.3 |
| HCF staff received training on prevention and management of COVID-19 | No | 5 | 6.7 |
| | Yes | 70 | 93.3 |
| Type of training received by the staff (n = 70)* | Detecting COVID-19 (signs and symptoms) | 68 | 97.1 |
| | Treatment of COVID-19 | 16 | 22.9 |
| | Other | 30 | 42.9 |
| Patients and care takers received IPC information to minimize the spread of COVID-19 | No | 14 | 18.7 |
| | Yes | 61 | 81.3 |

*means participants gave multiple responses.

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## Water service

**Types of water sources available in HCFs.** As indicated in Fig 4, nearly three-quarters of HCFs, 73.7% (55/75), had piped water supply inside the building as the primary water source.

**Accessibility to the existing water sources.** Almost all 97.3% (73/75) of the respondents, reported that their main water supply was on HCF premises. Besides, most respondents

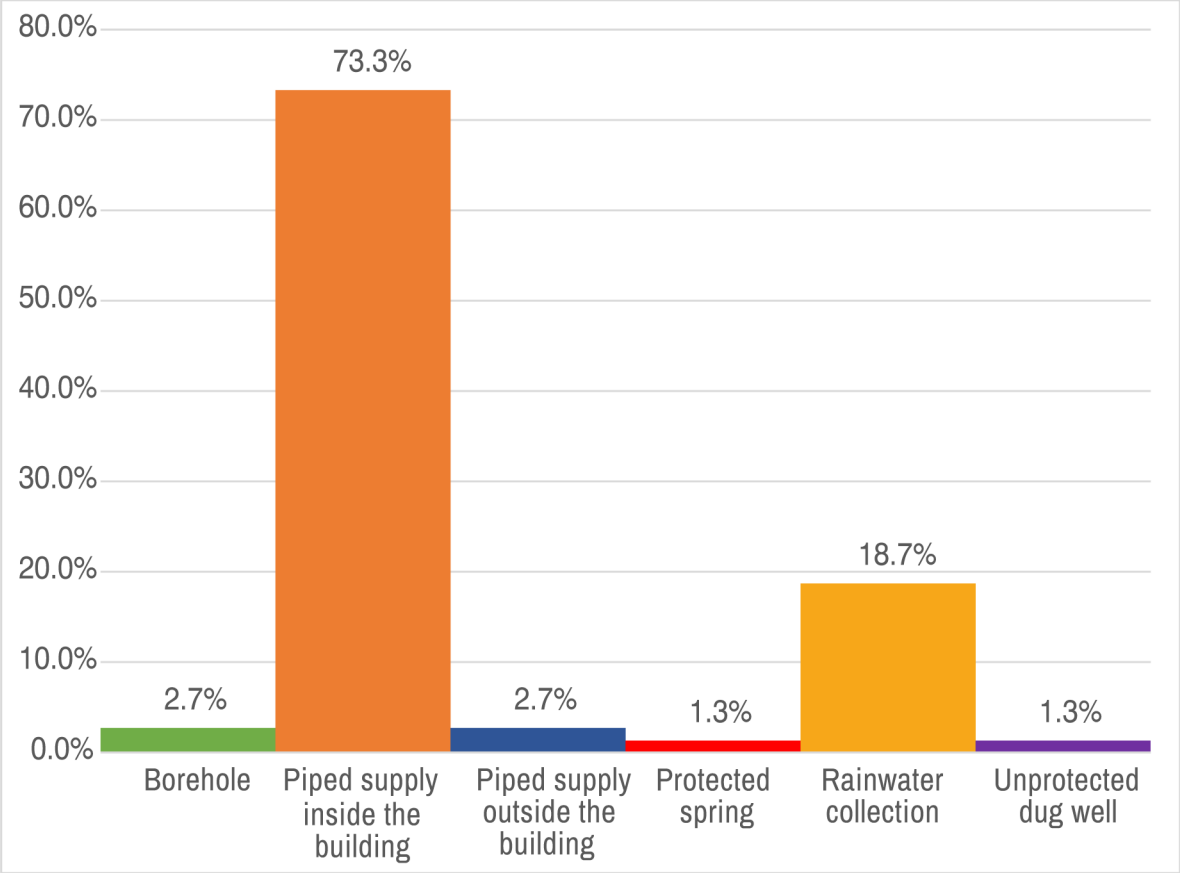


**Fig 4. Main water sources available in the HCFs.**

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reported that water from the main supply was available during the survey. In the majority of the HCFs, water was reported to be available to both HCWs and 92.0% (69/75) and 93.3% (70/75) patients/caregivers all the time (Table 3).

**Water quality monitoring.** Only 6.7% (5/75) of the HCFs had water from the main water source regularly tested for microbial quality within the last 12 months. On being asked on whether water was treated, 70.7% (53/75) of the HCF managers reported that water at the main water source in their HCFs was treated for the purpose of improving quality and reduce risks of transmission of diseases.

## Sanitation service

**Type and status of sanitation facilities available.** All HCFs had access to a sanitation facility. More than two-thirds, 68.0% (51/75) of the HCFs had a pit latrine with a slab as the primary type of sanitary facility present (Fig 5). More than three quarters, 80.0% (60/75), had separate toilets or improved latrine stances for men and women on-premises. Less than half, 41.7% (25/60) had at least one usable improved toilet designated for women and girls which provided facilities to manage menstrual hygiene needs. Majority, 88.0% (66/75) had at least one separate toilet or improved latrine stance for staff on the premises. Only 16.0% (12/75) had at least one toilet or improved latrine stance that meets the needs of people with reduced mobility.

**Table 3. Water service in healthcare facilities in the greater Kampala metropolitan area.**

| Description | Attribute | Frequency (N = 75) | Percentage (%) |
|---|---|---|---|
| Location of main water supply | 500 meters and above | 1 | 1.3 |
| | On facility premises | 73 | 97.3 |
| | Within 500 meters | 1 | 1.3 |
| Water was available from the main supply at the time of the survey | No | 2 | 2.7 |
| | Yes, observed | 71 | 94.7 |
| | Yes, reported but not observed | 2 | 2.7 |
| Water was available to staff | All the time | 69 | 92.0 |
| | Only at times | 6 | 8.0 |
| Water was available to patients/caregivers | All the time | 70 | 93.3 |
| | Only at times | 5 | 6.7 |
| Main water source unreliable | No | 36 | 48.0 |
| | Yes | 39 | 52.0 |
| Water storage at HCF sufficient to meet the needs for 2 days | Less than 75% of needs met | 7 | 9.3 |
| | More than 75% of needs met | 4 | 5.3 |
| | Yes | 64 | 85.3 |
| HCF routinely suffers from severe shortage or lack of water | No | 62 | 82.7 |
| | Yes | 13 | 17.3 |

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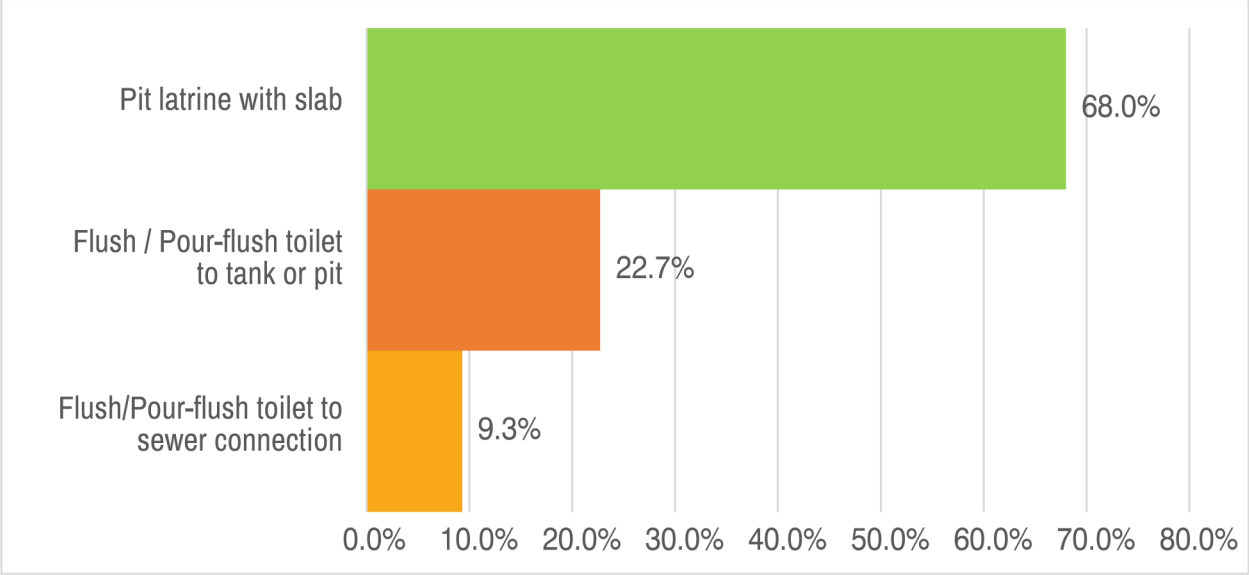


**Fig 5. Types of sanitation facilities available in the HCFs.**

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## Hand hygiene service

**Presence of functional hand hygiene stations.** As shown in Table 4, 66.7% (50/75) of the respondents reported that their HCFs had a functional hand-washing facility within 5 meters of existing toilet blocks, and 70.7% (53/75) had a functional hand-washing facility with soap and water or hand sanitizer at all points of care. More than three quarters, 81.3% (61/75) had a functional hand washing facility with soap and water or hand sanitizer at the main entrance/gate.

**Table 4. Observation of hand hygiene facilities in selected wards in the greater Kampala metropolitan area.**

| Description | Attribute | Frequency (N = 75) | Percentage (%) |
|---|---|---|---|
| Ward observed | Female ward | 1 | 1.3 |
| | Maternity ward | 71 | 94.7 |
| | Other wards | 3 | 4.0 |
| One bed with ABHR within arm's reach | Yes | 5 | 6.7 |
| | No | 70 | 93.3 |
| At least one functional hand washing facility available | Yes | 36 | 48.0 |
| | No | 39 | 52.0 |
| At least one functional hand washing facility with clean water available | Yes | 40 | 53.3 |
| | No | 35 | 46.7 |
| At least one functional hand washing facility with soap or disinfectant | Yes | 33 | 44.0 |
| | No | 42 | 56.0 |
| At least one functional hand washing facility with disposal towels | Yes | 14 | 18.7 |
| | No | 61 | 81.3 |
| At least one ABHR dispenser available | Yes | 12 | 16.0 |
| | No | 63 | 84.0 |
| HCF had hand hygiene reminders posted | No | 38 | 50.7 |
| | Yes | 37 | 49.3 |
| All HCPs sanitized hands before examining patients (n = 36) | No | 16 | 45.4 |
| | Yes | 20 | 55.6 |
| All HCPs sanitized hands after examining patients (n = 41) | No | 10 | 24.4 |
| | Yes | 31 | 75.6 |
| All HCPs sanitized hands after touching patient surroundings (n = 39) | No | 15 | 38.5 |
| | Yes | 24 | 61.5 |
| Hand rinsates stayed overnight at the hand hygiene station | No | 43 | 57.3 |
| | No hand washing facility | 19 | 25.3 |
| | Yes | 13 | 17.3 |
| Clean Hand washing facilities | No | 6 | 8.0 |
| | Not applicable | 17 | 22.7 |
| | Yes | 52 | 69.3 |
| Evidence of stocktaking/auditing for hand hygiene supplies available | No | 16 | 21.3 |
| | Not applicable/No store | 5 | 6.7 |
| | Yes | 54 | 72.0 |

https://doi.org/10.1371/journal.pwat.0000189.t004

**Hand hygiene compliance.** Only 37.3% (28/75) of the HCFs undertook routine hand hygiene compliance monitoring. Of these, 64.3% (18/28) observed hand hygiene compliance directly every three months or more often. In nearly half (45.4% or 16 out of 36) of the HCFs, HCPs did not practice hand hygiene before examining patients. Additionally, in over a tenth (24.4% or 10 out of 41) of the HCFs, HCPs neglected hand hygiene after examining patients. Hand hygiene after touching the patient's surroundings was practiced in just over a third (38.5% or 15 out of 39) of the healthcare facilities. Over half, 57.3% of the HCFs had soap in stock at the time of the observation, and 50.7% (38/75) had ABHR in stock. The majority, 72.0% (54/75), had evidence of stocktaking/auditing for hand hygiene supplies at the HCF (Table 4).

Interviews with the HCFs' managers revealed that HCPs practiced hand hygiene because they acknowledged the health risks their working environment posed. It was also pointed out that the fear of contracting COVID-19 motivated them to practice hand hygiene at all possible opportunities.

*"In a health facility, we know that definitely, we are meant to practice hand washing since we are aware that we are not in a good or clean environment here. We know that we are exposed to dirt, both visible and non-visible, so we have got to wash our hands. Now we are within the times of the COVID-19 pandemic where we know that through hand washing, we can prevent further infections." (Manager, Hospital)*

*"The hands they use to eat and drink are the same hands they use while in toilets and touching the hospital environment. Therefore, it is really important that they wash their hands to prevent acquiring infections." (Manager, Health centre III)*

Regarding hand hygiene knowledge, respondents pointed out that most HCPs were knowledgeable about critical hand hygiene moments. However, to some, the knowledge on critical moments was sub-optimal.

*"Wash hands before touching a patient, wash hands after touching a patient, wash hands after any procedure, wash hands before and after eating…. yeah." (Manager, Health centre III)*

*"The 5 critical moments are when a healthcare provider has to practice handwashing. These include; after touching the patient, before touching the patient, before a procedure, then after administration of drugs. The rest I don't know." (Manager, Health centre IV).*

Healthcare managers pointed out that some healthcare facilities strategically displayed information, education, and communication materials, such as posters at various points within the wards, including sinks, to remind healthcare workers to practice hand hygiene.

*"We have posters on the walls next to the sinks so people do adhere to it. Even before the COVID period, we already had the posters. For example, in the maternity ward we have posters so there is no way a healthcare worker can remove the gloves and not wash hands." – Senior Nursing Officer.*

Hand hygiene in the study healthcare facilities was also possible due to the availability of supplies and infrastructure. The availability and close proximity of hand washing supplies and infrastructure such as; sinks, water, jerry cans to them, and environmental clues facilitated hand hygiene.

*"The availability of hand washing supplies like sinks and water, the environmental clues, the constant reminder from the IPC focal person through continued medical educations (CMEs) For us in the maternity section, we take it as our responsibility to wash hands to prevent cross infection more especially HIV/AIDS." - IPC Focal Person.*

*"The infrastructure helps because we have the hand washing space, the basins, hand washing jerrycans, the water is not from far away so all those are in place so it is about the health worker to wash hand or not wash hands." - IPC Focal Person.*

## Environmental cleanliness service

**Availability of cleaning guidelines, roster and supplies.** Only 26.7% (20/75) of the HCFs had guidelines or procedures for cleaning surfaces and worktops in the service areas, and 33.3% (25/75) had a visible cleaning roster specifying responsibility for cleaning tasks and frequency at which they should be performed. More than half, 65.3% (49/75) had staffs

with cleaning responsibilities trained on WASH/IPC. More than three quarters, 77.3% (58/75) had enough supplies for cleaning in the wards and outpatient area, and 84.0% (63/75) had enough cleaning supplies in the labor and delivery ward. Close to two thirds, 65.3% (49/75) had PPE available at all times and in sufficient quantity for all uses for all HCWs and cleaners (Table 5).

**Cleanliness of wards.** Majority, 88.0% (66/75) had visibly clean wards, and only 4.0% (3/75) had uncleaned spills from bodily fluids at points of care. Only 4% (3/75) of the HCFs had evidence of open defecation on the premises (Table 5).

## Waste management service

**Segregation, storage, and treatment/disposal of solid waste.** Our results revealed that only 5.3% (4/75) of the HCFs had uncontained solid waste on the premises. When asked about healthcare waste segregation, most respondents, 88.0% (66/75), reported safely segregating waste into at least three labelled bins, including sharps, infectious, and general waste. In 81.3% (61/75) of the HCFs, infectious or sharps waste was safely stored and treated before disposal. Additionally, 82.7% (62/75) reported that their HCFs had a placenta pit.

**Incineration.** Most of the HCFs, 74.7% (56/75) HCFs lacked incinerators for waste treatment. However, according to the HCF managers, there were arrangements for the safe disposal of healthcare waste. It was, for instance, pointed out that healthcare facilities relied on the services of a contractor who collected and disposed of healthcare wastes.

*"All the medical wastes are taken away by the qualified people. We would like to have all but! The set-up pit is available but the incinerator is not available. We would love to have it but the resources are not sufficient."- Manager Health Center III*

*"I think all the measures are put in place where by sharps are supposed to be put in the safety box and they are kept there. At the end of the period, qualified companies come and take all the medical wastes for destruction." - Manager Health Center III*

**Table 5. Environmental cleanliness of the healthcare facilities in the greater Kampala metropolitan area.**

| Description | Attribute | Frequency (N = 75) | Percentage (%) |
|---|---|---|---|
| Cleaning guidelines or procedures (SOP) available | No | 55 | 73.3 |
| | Yes | 20 | 26.7 |
| Cleaning roster or schedule available | No | 50 | 66.7 |
| | Yes | 25 | 33.3 |
| HCF staffs with cleaning responsibilities received IPC training | No | 26 | 34.7 |
| | Yes | 49 | 65.3 |
| HCF had enough cleaning supplies and equipment | No | 17 | 22.7 |
| | Yes | 58 | 77.3 |
| PPE for HCWs and cleaners were available at the HCF at all times | No | 26 | 34.7 |
| | Yes | 49 | 65.3 |
| HCF wards visibly clean and free from dust | No | 9 | 12.0 |
| | Yes | 66 | 88.0 |
| Points of care had uncleaned spills from bodily fluids at | No | 72 | 96.0 |
| | Yes | 3 | 4.0 |
| There is evidence of open defecation at the HCF | No | 72 | 96.0 |
| | Yes | 3 | 4.0 |

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*"We give protective gears to the cleaning team. For waste management, we have the three-bucket system with the bin liners. Although we have a contract with a bio-waste company that collects the waste from the facility, we also have a functional incinerator." - Manager Hospital.*

The waste contractors also played a critical role in training the waste handlers on waste segregation and storage. Besides, some healthcare facilities held CME sessions, which they used to orient the different HCPs on healthcare waste management.

"Yes, the bio-waste company trains our people on how to segregate the waste so that it is easily collected. We also have internal CME sessions where we educate our staff about IPC and good enough, we have not gotten any infection." - *Manager Hospital.*

Some respondents observed and emphasized that waste segregation was done at different healthcare facilities. The majority of the healthcare facilities used the different colour-coded bins with their respective liners and safety boxes.

"We are making sure that we manage our waste well by using the different colour-coded bins with their respective liners, that is to say using red, yellow, black bins and a safety box for the sharps." - *Manager Health Center IV.*

### WASH status stratified by district, location, level, and ownership of the healthcare facility

Overall, almost all HCFs, 96.0% (72/75) had a basic water service, 10.7% (8/75) had a basic sanitation service, 60.0% (45/75) had a basic hand hygiene service, 82.7% (62/75) had a basic waste management service, and 22.7% (17/75) had a basic environmental cleanliness service. All HCFs in Kampala city, 85.7% (12/14) in Mukono, and 97.8% (45/48) in Wakiso district had basic water service. Less than a tenth, 5.2% (3/58) of the Health Centre IIIs, 27.3% (3/11) of the Health Centre IVs, and 33.3% (2/6) of the hospitals had a basic sanitation service. None of the rural HCFs had a basic sanitation service, and only 13.6% (8/59) of the urban HCFs had a basic sanitation service. The majority, 83.3% (5/6) of the hospitals and 72.7% (8/11) of the Health centre IVs, had a basic hand hygiene service. However, slightly more than half, 55.2% (32/58) of the Health centre IIIs, had a basic hand hygiene service. Close to three quarters, 73.3% (22/30) of the PNFP facilities and only 51.1% (23/45) of the public HCFs had a basic hand hygiene service. About 62.7% (37/59) of the urban HCFs and half of the rural HCFs had a basic hand hygiene service (Table 6).

## Discussion

The study investigated WASH and IPC practices in HCFs within the GKMA during the COVID-19 pandemic. Most HCFs had IPC focal persons and provided health education to patients and their caregivers to reduce the spread of SARS-COV-2. The proliferation of training and mentorship programs enabled deployment of trained IPC focal persons in most HCFs. The significant social and public health burden of COVID-19 prompted the government, private sector, and non-state actors to invest in IPC efforts. These efforts included financial contributions, WASH supplies, and training initiatives provided by national and international agencies such as WHO and the United Nations Children's Fund (UNICEF). Additionally, inactive or non-existent IPC committees in HCFs were reactivated or formed during the pandemic, alongside reinforced IPC mentorship programs [35,36]. Guidance from

**Table 6. Water, sanitation and hygiene status of healthcare facilities in the greater Kampala Metropolitan region based on JMP indicators, and stratified by district, ownership, level and location.**

| Service ladder | Classification | Overall (N = 75) | District | | | Level of the healthcare facility | | | Ownership of the HCF | | Location | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Kampala (n = 15) | Mukono (n = 14) | Wakiso (n = 48) | Health Centre III (n = 58) | Health Centre IV (n = 11) | Hospital (n = 6) | Private Not for Profit (n = 30) | Public (n = 45) | Rural (n = 16) | Urban (n = 59) |
| Water service | Basic | 72 (96.0) | 15 (100.0) | 12 (85.7) | 45 (97.8) | 55 (94.8) | 11 (100.0) | 6 (100.0) | 30 (100.0) | 42 (93.3) | 14 (87.5) | 58 (98.3) |
| | Limited | 1 (1.3) | 0 (0.0) | 1 (7.1) | 0 (0.0) | 1 (1.7) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 1 (2.2) | 1 (6.3) | 0 (0.0) |
| | No service | 2 (2.7) | 0 (0.0) | 1 (7.1) | 1 (2.2) | 2 (3.4) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 2 (4.4) | 1 (6.3) | 1 (1.7) |
| Sanitation service | Basic | 8 (10.7) | 1 (6.7) | 0 (0.0) | 7 (15.2) | 3 (5.2) | 3 (27.3) | 2 (33.3) | 4 (13.3) | 4 (8.9) | 0 (0.0) | 8 (13.6) |
| | Limited | 67 (89.3) | 14 (93.3) | 14 (100.0) | 39 (84.8) | 55 (94.8) | 8 (72.7) | 4 (66.7) | 26 (86.7) | 41 (91.1) | 16 (100.0) | 51 (86.4) |
| Hygiene service | Basic | 45 (60.0) | 12 (80.0) | 3 (21.4) | 30 (65.2) | 32 (55.2) | 8 (72.7) | 5 (83.3) | 22 (73.3) | 23 (51.1) | 8 (50.0) | 37 (62.7) |
| | Limited | 29 (38.7) | 3 (20.0) | 11 (78.6) | 15 (32.6) | 25 (43.1) | 3 (27.3) | 1 (16.7) | 8 (26.7) | 21 (46.7) | 8 (50.0) | 21 (35.6) |
| | No service | 1 (1.3) | 0 (0.0) | 0 (0.0) | 1 (2.2) | 1 (1.7) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 1 (2.2) | 0 (0.0) | 1 (1.7) |
| Waste management service | Basic | 62 (82.7) | 14 (93.3) | 12 (85.7) | 36 (78.3) | 45 (77.6) | 11 (100.0) | 6 (100.0) | 24 (80.0) | 38 (84.4) | 13 (81.3) | 49 (83.1) |
| | Limited | 13 (17.3) | 1 (6.7) | 2 (14.3) | 10 (21.7) | 13 (22.4) | 0 (0.0) | 0 (0.0) | 6 (20.0) | 7 (15.6) | 3 (18.8) | 10 (16.9) |
| Environmental cleanliness service | Basic | 17 (22.7) | 5 (33.3) | 3 (21.4) | 9 (19.6) | 12 (20.7) | 3 (27.3) | 2 (33.3) | 6 (20.0) | 11 (24.4) | 3 (18.8) | 14 (23.7) |
| | Limited | 34 (45.3) | 7 (46.7) | 6 (42.9) | 21 (45.7) | 26 (44.8) | 5 (45.5) | 3 (50.0) | 13 (43.3) | 21 (46.7) | 8 (50.0) | 26 (44.1) |
| | No service | 24 (32.0) | 3 (20.0) | 5 (35.7) | 16 (34.8) | 20 (34.5) | 3 (27.3) | 1 (16.7) | 11 (36.7) | 13 (28.9) | 5 (31.3) | 19 (32.2) |

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the WHO and CDC underscored the necessity of training healthcare workers, patients, and caregivers due to their heightened infection risk [37–42]. Uganda has similarly observed these trends in its responses to other infectious diseases [43].

The study found that fewer than three-quarters of HCFs had functional IPC committees, with only a third having budget allocations to support IPC activities. This lack of funding reflects in insufficient supplies, such as alcohol-based hand rub and handwashing facilities. Poor governance and limited financing contribute to the non-functionality of IPC committees as previously highlighted [44,45]. Before the pandemic, Uganda lacked a well-established national IPC unit with dedicated staff, budgets, and strategic action plans [35]. Our results align with studies in other developing countries, citing limited funding as a barrier to implementing IPC programs [16,46]. This study, therefore, emphasizes the urgent need for increased investment in IPC activities, including strengthening national IPC structures, dedicated budgets, and staff.

Only a third of HCFs had an IPC committee with an environmental health practitioner, such as an environmental health officer, health inspector, or health assistant. The shortage of environmental health staff in IPC committees is concerning since these cadres possess crucial expertise in WASH, IPC, and health education, which are essential for behavioral change related to IPC. Environmental health practitioners play vital roles in workplace risk assessment, implementing IPC measures, monitoring hygiene procedures, managing personal protective equipment, and providing training on workplace risk factors [47–50]. The limited involvement of environmental health staff is partly due to limited funding, and a lack of clearly defined job descriptions which many times confine environmental health officers to the environment outside HCFs [51]. Additionally, the health sector's human resource gaps and financial constraints exacerbate the problem [12,46,52–55]. This study recommends increasing the presence of environmental health staff on IPC committees by integrating the head of the environmental health department into the national IPC committee and including

environmental health staff in sub-country health committees and Health Unit Management Committees at lower levels.

Our study found that less than half of HCFs had an IPC program with a clear annual work plan, which is concerning since IPC committees' performance relies on such plans [12]. Activity plans define goals, objectives, and sequencing of activities crucial for improving IPC performance, guiding stakeholders, operationalizing national IPC policies, and promoting a sector-wide approach to safe healthcare delivery [56,57]. These plans are essential for monitoring and evaluating IPC programs. The absence of clear annual work plans compromises strategic improvements in HCFs and investments by stakeholders, leading to confusion among HCPs on responsibilities. Consequently, a third of HCFs lacked visible cleaning rosters, thus limiting IPC efforts.

All HCFs in the current study had a basic water service, contrasting with our prior study, which showed only 50% coverage [13]. This difference may stem from using different assessment tools: the Mwater survey tool in the current study versus WASHCon in the earlier one [13], which considers water quality. Additionally, the current water service status may be influenced by the COVID-19 pandemic since increased investments in IPC and WASH are crucial for reducing the transmission risk of infectious diseases such as Ebola and COVID-19 [13,16]. Nearly three-quarters of HCFs in the study area relied on piped water, primarily sourced on-site, signaling progress in water access. However, over half of the surveyed HCFs experience intermittent supply, and over a tenth faced severe shortage.

Additionally, a tenth of the HCFs did not have water storage capacity for at least 2 days of collection. These shortages result from budgetary constraints and infrastructure breakdowns, with some hospitals experiencing disconnections due to non-payment of water bills [58,59]. The literature also extensively documented water shortages in HCFs [60–63]. Insufficient storage and intermittent supply compromise IPC measures, increasing the risk of Healthcare-Associated Infections (HCAIs) like COVID-19 [29,30,64]. Addressing these challenges necessitates strategic planning and investment in water supply by stakeholders such as the Ministry of Health and HCF administrations to ensure continuous access and enhance IPC compliance, thereby reducing HCAIs—fewer than one in ten HCFs conducted regular microbial tests on the primary water source. Despite most HCFs relying on piped water, often chlorinated for safety, health departments must test water quality regularly. A pre-pandemic study revealed that one in ten HCFs had water samples failing to meet WHO microbial standards [13]. Neglecting water quality monitoring in HCFs heightens the risk of waterborne infections. With most HCFs achieving basic water supply, investing in water quality monitoring through training environmental health staff and community health workers is imperative.

Unlike our previous findings, all HCFs in the current study had access to sanitation facilities, which found that one HCF lacked such amenities [13]. Sanitary facilities are crucial for curbing open defecation and reducing the transmission of diarrheal diseases [65]. It's possible that COVID-19 WASH sensitizations and guidelines implemented by the Ministry of Health (MOH) for public places [66,67], including HCFs, have contributed to this improvement. However, despite access to sanitation facilities, 16% of HCFs exhibited signs of unsafe fecal waste disposal. Utilizing WASH infrastructure is a behavioral issue; merely providing infrastructure may not be enough to ensure safe disposal practices [68]. The unsafe disposal of fecal matter, demonstrated by indiscriminate disposal of feces around toilet areas, is concerning as it can increase the spread of HCAIs, diminish aesthetics, and negatively impact the health-seeking behaviors of patients and caretakers.

Additionally, over half of the HCFs lack usable improved toilets designated for women and girls, highlighting a critical need for menstrual hygiene facilities. The absence of these facilities hinders user dignity and the operation and maintenance. Lack of menstrual hygiene facilities

may lead female users to dispose of pads in toilets, potentially causing blockages [69]. Our findings are consistent with evidence in the literature [13,29].

Only two-thirds of HCFs had a functional hand washing facility within 5 meters of existing toilet blocks, and less than three-quarters had one with soap and water or hand sanitizer at all patient care areas, a concern amid the COVID-19 pandemic. All HCFs must provide adequate hand hygiene facilities in the toilet and patient care areas to promote hand hygiene among patients, caregivers, and HCPs [70]. Additionally, only 70.4% of HCFs enforced hand hygiene at the main entrance or gate, missing an opportunity to prevent pathogen spread, especially for COVID-19. This highlights a gap in hand hygiene enforcement, a critical preventive measure against COVID-19. Limited human resources and hand hygiene supplies like alcohol-based hand rub (ABHR), soap, and sanitizer may contribute to this lack of enforcement in some HCFs [12].

Observations across wards revealed that many HCPs did not wash or sanitize their hands before and after patient examinations and after touching patient surroundings. This lapse in hand hygiene may stem from inadequate hand hygiene supplies, limited HCP knowledge of IPC, notably WASH, and a negative attitude towards hand hygiene. However, non-compliance with these critical hand hygiene moments will likely increase infection transmission between HCPs and patients. Our findings align with those of Powell-Jackson et al. [71], showing low hand hygiene compliance among HCPs in Tanzania during the COVID-19 pandemic.

Most HCFs lacked guidelines for cleaning surfaces and worktops in service areas. However, the absence of waste management and cleaning guidelines in these facilities doesn't imply that Uganda's Ministry of Health (MOH) hasn't developed such protocols. Uganda has guidelines for healthcare waste management and cleaning in HCFs [72], integrated with cleaning and disinfection aspects in the MOH Guidelines for COVID-19 prevention in public places [73]. The lack of these guidelines in HCFs could be due to the MOH's insufficient dissemination and distribution efforts. Given the current COVID-19 pandemic, having cleaning guidelines in HCFs is crucial for safety [70], underscoring the need for health authorities to provide them to all healthcare facilities regardless of ownership, level, or location.

### Strengths and limitations

Our study is one of the few studies in Uganda that provides insights into the IPC and WASH status during the COVID-19 pandemic. It accounts for the IPC status and WASH service levels, which was critical in informing interventions during the COVID-19 pandemic in Uganda. Besides, the study used qualitative and quantitative methods, which helped appreciate the challenges related to IPC and WASH provisions. The use of the mWater tool, which is a comprehensive tool for studying both WASH and IPC was of great value in this study. However, the study had some limitations as well. Firstly, we could not infer causal relationships since this study was cross-sectional. Fortunately, we surveyed 75 HCFs across the three districts within the GKMA, and this provided a large sample size to help understand and generalize the situation. Secondly, the responses of the HCF managers and administrators were prone to response bias since they self-reported. We tried to minimize this by undertaking observations in the HCFs to confirm some of the responses.

## Conclusions

Generally, this study reports improvements in IPC/WASH in the GKMA. The majority of HCFs had IPC committees, although some of them were not functional. A third of the IPC committees also lacked budgetary support for their work plans. Almost all HCFs in the

GKMA had a basic water supply, hand hygiene, and waste management services. However, this study identified some severe gaps in IPC and WASH practices, which may impact the capacity of HCFs to combat COVID-19 and future pandemics. Critical to note is that some HCFs still grappled with the lack of an alternative water supply, especially during periods of discontinuity/scarcity. Besides, most of the HCFs had a limited sanitation and environmental cleanliness service level. We, therefore, recommend IPC and WASH improvements in HCFs to ensure preparedness in fighting against COVID-19 and future pandemics that require IPC and WASH as preventive measures. HCFs should have an earmarked budget for IPC and WASH activities, with deliberate investments in alternative WASH infrastructure and supplies. HCFs need clear plans to operate and maintain WASH infrastructure to ensure long-term sustainability.

## Supporting information

**S1 Appendix. Structured observation tool for assessing IPC and WASH status of health-care facilities in the GKMA.**
(DOCX)

**S1 Dataset. Dataset.**
(XLSX)

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