Using the Behaviour Centered Design to understand the facilitators and deterrents to hand hygiene among healthcare providers in the greater Kampala metropolitan area: Qualitative findings from a formative phase of a cluster-randomized trial

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Article

Keywords: Hand hygiene, Behaviour Centered Design, Infection Prevention and Control, Uganda

Posted Date: June 3rd, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1604259/v1

Abstract

Background

Hand hygiene is known to reduce healthcare-associated infections. However, it remains suboptimal among healthcare providers. In this study, we used the Behaviour Centered Design to explore the facilitators and deterrents of hand hygiene among healthcare providers in the greater Kampala Metropolitan area, Uganda.

Methods

A formative qualitative study, enshrined in a cluster randomised trial was conducted in 19 healthcare facilities (HCFs). A total of 19 semi-structured and 18 key informant interviews were used to collect data on hand hygiene status, and facilitators and deterrents of hand hygiene. Data were transcribed verbatim and NVIVO 12.0 software was used to ease the analysis following a thematic framework.

Results

About 47.4% of the HCFs had sufficient hand hygiene infrastructure, and 57.9% did not report total compliance to hand hygiene during patient care. Constant reminders such as nudges, and frequency of patient contact and the nature of clinical work were the physical and biological deterrents respectively. Heavy workload in HCFs was the only biological deterrent. Executive brain facilitators included knowledge of workplace health risks and infection prevention and control (IPC) guidelines, and a positive attitude. A negative attitude was the executive brain deterrent to hand hygiene. Recognition and rewards and fear of infections were pointed out as the only motivated brain facilitators. Behavioural setting facilitators included proximity to functional hand hygiene infrastructure, the existence of active IPC committees, good leadership and availability of a budget for hand hygiene supplies. Behavioural setting deterrents included non-functionality and non-proximity to hand hygiene infrastructure and inadequate supplies.

Conclusions

Compliance to Hand hygiene practice and provisions was reported to be poor. Deterrents to hand hygiene included a heavy workload, negative attitude, inadequate supplies, non-functionality and long-distance to hand washing stations. Facilitators included constant reminders, fear of infections, frequency of patient contact and nature of clinical work, positive attitude, knowledge of IPC guidelines, recognition and reward, good leadership, availability of budgets for hand hygiene supplies, availability and proximity to hand hygiene supplies and infrastructure and active IPC committees. There is a need to remove the barriers and to maintain the facilitators to achieve optimal hand hygiene.

ISRCTN Registry with number ISRCTN98148144. The trial was registered on 23/11/2020.

Background

Ensuring universal and equitable access to water, sanitation and hygiene (WASH) is one of the 17 interlinked global goals designed to be "A blueprint to achieve a better and more sustainable future for all people and the world by 2030" [1-4]. However, access to WASH services in healthcare facilities (HCFs) remains a challenge not only in low-and middle-income countries (LMICs) but also in the developed world [5]. Globally, a quarter of all HCFs have no basic water services, which means 712 million people have no access to water when they use health care facilities. About 10% of HCFs have no sanitation services and one in three do not have adequate facilities to clean hands at the point of care [5, 6]. In low-income countries (LICs), half of the HCFs lack basic water services and 60% have no sanitation services. Seven out of ten HCFs in LICs lack basic health care waste management services. Hand hygiene data at points of care is still lacking in many countries (WHO and UNICEF, 2020).

Uganda is no exception to the global WASH in HCFs deficit. Our recent estimates of the WASH status in HCFs in the greater Kampala Metropolitan area (GKMA) indicated that less than half, 41.6% of the HCFs had a fully functional hand hygiene facility (HHF) in patient care areas while 10% did not have hand hygiene supplies in patient care areas. Only 56.6% HCFs had functional HHF with soap and water within five metres of the toilet block [7]. A similar deficit has been reported among HCFs in western Uganda [8, 9]. Hand hygiene if practised at the right time, using the right technique, with either alcohol-based hand rub (ABHR) or soap, water and disposable/clean towels has the potential to prevent healthcare-associated infections (HAIs), including central line-associated bloodstream infections, catheter-associated urinary tract infections, surgical site infections and ventilator-associated pneumonia [10-13].

Transmission of pathogenic microorganisms in healthcare settings primarily occurs through contaminated healthcare providers' hands (HCPs) [14-17], and about 50 to 70% of HAIs are linked to non-compliance with hand hygiene during the critical moments of patient care [12]. These pathogens can be received from infected or draining wounds, frequently colonized areas of the intact patients' skin, patients' gowns, bed linen, bedside furniture and other objects in the immediate environment of the patient, and can stay for 2-60 minutes on health care providers' hands

[18]. Whereas the actual burden remains unknown [19], the consequences of HAIs at the individual, patient and community levels are widely documented [18, 20]. WHO estimates indicate that 7% of patients in developed countries and 10% in developing countries acquire at least one HAI [18], which leads to death in about 10% of the patients [18]. HAIs are associated with prolonged hospital stays, long-term disability, increased antimicrobial resistance, massive additional costs for health systems, and high costs for patients and their families [18, 19]. The impact of poor WASH conditions and consequently the risk of HAIs is highest among mothers and neonates [21, 22].

Given the impact of non-compliance with hand hygiene during patient care, WHO developed and provided technical guidance to streamline how, when and what products should be used for hand hygiene [11]. The WHO requires that alcohol-based hand rub products should contain at least 60% alcohol to be effective. It discourages the use of chlorinated water of a concentration of 0.05% for routine hand hygiene due to its skin and other toxic effects [11]. The recommended duration of hand hygiene with ABHR is 20-30 seconds and 40-60 seconds for water and soap [11]. In healthcare settings, hand hygiene should be practised every time a healthcare provider conducts a clean/aseptic procedure, before and after touching a patient or the patient's surroundings, and after exposure to body fluids [11, 23]. For Uganda, the importance of hand hygiene is emphasized in the infection prevention and control guidelines (2015) [24], and the draft national guidelines for WASH in health care facilities.

Despite the guidance provided by WHO and the Ugandan Ministry of Health, hand hygiene among healthcare providers in Uganda remains poor [25, 26]. It has previously been linked to low levels of knowledge, inadequate hand hygiene infrastructure, and supplies [8, 25, 27]. Aside, there is limited evidence of the facilitators and deterrents since available data focuses on the availability of WASH infrastructure [8, 28], with less attention given to the behaviour. This study, therefore, explored the status of hand hygiene, facilitators and deterrents to hand hygiene compliance among healthcare providers in the GKMA, Uganda.

The theoretical basis of the Behaviour Centered Design

The Behaviour Centered Design (BCD) is a theory and model that blends insights from behavioural science and design thinking to create sustainable behaviour change in a given environment. The BCD theory and model (Figure 1) suggests that the right behavioural response depends on the behaviour setting (physical, social and temporal context) in which individuals find themselves and that three causal links must be made i.e. the environment (modified by an intervention) to psychological change in the target population (body and brain), to performance of the target behaviours (which results in changes to the state-of-the-world) [29, 30]. Existing interventions have to produce changes in the environment, which cause changes in the brain and/or body of the target audience, which then impact behaviour. The aggregate of these individual behaviours then has some impact on the state-of-the-world such as better health [30-34]. The BCD theory is being applied to improve hand hygiene practice in some high-income countries [33], although results are not yet documented. The definitions of the different components of the BCD model are given in supplementary file 1.

Materials And Methods

Study design, context, setting and population

A cross-sectional study utilizing qualitative data collection methods was conducted in HCFs in the GKMA, between October and November 2020. The study was conducted at a time when the number of COVID-19 cases presenting with severe and acute disease in Uganda, especially in the GKMA was on the increase. At that time, Uganda had registered a total of 31,384 confirmed cases of COVID-19, 10,549 recoveries and 238 deaths [35]. During the month of November, Uganda had recorded a total of 13,716 cases and 38 deaths [35], which was a worrying statistic.

The GKMA is comprised of Kampala City and the neighbouring districts of Wakiso and Mukono. The region hosts 46% of all formal employment and contributes a third of Uganda's overall gross domestic product (GDP) [36]. The GKMA accounts for approximately 10% of Uganda's population (3.5 million) during the day [37], with an annual growth rate of about 5% per annum [37]. According to the Ministry of Health (MOH), Kampala district has a total of 1,458 HCFs (26 public, 61 private not-for-profit (PNFP), 1,371 Private for-Profit (PFP), of which 48 are health centre (HC) IIIs, 13 are HC IVs and 22 are at the hospital level [38]. Wakiso district has 589 HCFs (72 public, 40 PNFP, 477 PFP), with 165 HC IIIs, 19 HC IVs and 15 hospitals [38]. Conversely, Mukono district has a total of 113 HCFs (40 public, 22 PNFP, 51 PFP), 16 of which are HCIIIs, 3 are HCIVs and 3 are hospitals [38]. The description of the levels of healthcare facilities in Uganda is given in our earlier publication on the status of WASH in HCFs [39]. The current study was conducted among healthcare providers, officials from the district public health department, and staff of non-governmental organizations (NGOs) serving the GKMA population.

Sample size, sampling and data collection techniques

The detailed protocol relating to this trial has been published elsewhere [40]. During the formative phase, we selected 19 public and PNFP HCFs at levels III and IV since these have a core mandate to deliver Maternal, Newborn and Child Health services to a group of people (mothers and children), who are at the greatest risk of getting HAIs. A total of 19 key informant interviews were conducted. Key informants were purposefully selected based on their knowledge, position and experience on WASH in HCFs. They included managers of HC IIIs and IVs, nurses,

administrators, Environmental Health Officers as well as officials from the MOH, district Public health team and NGOs. Some KIs were recruited through snowball sampling until saturation of data was achieved. Before the interviews, researchers scheduled interviews with the participants either by phone or by physically visiting their workplaces. All key informant interviews were conducted in English, with the aid of a KI interview guide. The interview guide was used to elicit data on the deterrents and facilitators to hand hygiene during critical moments among healthcare providers in the GKMA. A total of 19 semi-structured interviews were conducted with healthcare providers from HC IIIs and IVs, including clinical officers, midwives, theatre assistants, nurses and nursing assistants to obtain data on the deterrents to hand hygiene, motives of hand hygiene, social norms related to hand hygiene, behavioural settings and touchpoints.

Assessment of the status of hand hygiene infrastructure and behaviour

Our semi-structured questionnaire included questions for assessing the availability of hand hygiene infrastructure, supplies, and behaviours among healthcare providers. The quantitative component included questions on whether healthcare providers were motivated to practice hand hygiene, the presence of leaders to foster compliance to hand hygiene, availability and utilization of hand hygiene supplies and infrastructure, the presence of an IPC committee and the rating for hand hygiene at the HCF. The qualitative component of the study elicited information on compliance to hand hygiene, knowledge of IPC related policy guidelines and standards, and facilitators and deterrents to hand hygiene.

Data management and analysis

Interviews were transcribed verbatim by two experienced research assistants (RAs). Thematic analysis, using key themes related to the study objectives, was employed for data analysis. The NVIVO 12.0 Software was used to ease the analysis. The typed transcripts were read several times by all members of the study team and codes and codebook definitions were developed based on the objectives of the study. Coding was done independently by two members of the research team, who later agreed on the themes, subthemes and illustrative quotes. The code reports were discussed and agreed upon by the study team, and then codes were grouped into categories and themes. The data analysis involved triangulation of data from the semi-structured interviews with findings from key-informant interviews.

Quality control measures

We recruited RAs with vast experience in qualitative research methodologies and WASH in HCFs. The RAs underwent a day's training on the study protocol and ethical issues surrounding the study, such as obtaining informed consent. Before data collection, pretesting of the data collection tools was conducted in Kisenyi health centre (HC) IV, Kampala district, to help the RAs familiarize themselves with the data collection tools and also correct any errors if discovered. Kisenyi HC IV was purposively selected as a pretest site because it shared similar characteristics with healthcare facilities in our study area. Thorough supervision of RAs was also done to ensure that they follow the study protocol and ethical issues when interviewing the respondents. All interviews were digitally recorded to capture the respondents' views. Besides, note-takers took handwritten notes during the interviews using forms prepared for this purpose to document a wide range of information. The team leader stored backup copies of recordings of qualitative interviews on a password-protected hard drive.

Results

Background characteristics of the study participants

A total of 19 semi-structured and 18 key informant interviews were conducted. The majority, 40.5% (15/37) of the respondents were clinical officers, 43.2% (16/37) were aged between 35 and 44 years, more than a tenth, 18.9% (7/37) had between 6 and 10 years of experience in the delivery of healthcare services (Table 1).

Status of hand hygiene

An assessment of hand hygiene was conducted in 19 HCFs. About 73.6% (14/19) of the HCFs were at the level of health centre III, 68.4% (13/19) were public and more than half, 57.9% (11/19) were urban. Less than half, 47.4% (9/19) of the HCFs had sufficient hand hygiene infrastructure. More than a third, 36.8% (8/19) of the healthcare providers mentioned that their colleagues sufficiently complied with hand hygiene, 68.4% (13/19) knew the roles of the IPC committee, and more than half, 57.9% (11/19) mentioned that there was no compliance to hand hygiene during all the critical moments at their facility (Table 2).

Facilitators and deterrents to hand hygiene among healthcare providers

The facilitators and deterrents of hand hygiene have been classified based on the sub-components of the BCD model components (Environment, Brains, Body, Behavioural setting and interventions) (Figure 2).

Facilitators of hand hygiene among healthcare providers (Figure 3)

Physical environment determinants

Constant reminders such as mobile text messages, nudges and posters

Healthcare providers, mainly those in public HCFs mentioned that the presence of nudges and information, education and communication (IEC) materials such as posters acted as reminders and thus facilitated them to practice hand hygiene, especially hand washing during the critical moments of patient care.

"Yes, environmental cues are everywhere in the healthcare facility. These continuously remind us to adhere to hand washing during critical moments of patient care. The hand washing posters at the healthcare facility, especially in the wards also teach and remind us how and when we should wash hands during patient care since learning is a continuous process. The in-charge himself also always encourages us to wash hands and monitors us regularly." (Enrolled midwife).

"Yes, it is practised. We have different posters at sinks which remind healthcare providers on hand washing." (Clinical officer)

Partners such as the Uganda Virus Research Institute provided healthcare providers with posters that reminded them to practice hand hygiene during critical moments.

"Uganda Virus Research Institute sends us hand hygiene posters which we are supposed to pin at all strategic points. These posters act as reminders for practising hand hygiene, for instance when you are in the laboratory you are reminded to wash hands after taking off a sample, and so on." (Enrolled Nurse).

Mobile text messages sent through the mTrac (a mobile phone-based health information system strengthening tool) platform also reminded healthcare providers and village health team members to practice hand hygiene thence fostering compliance during the critical moments.

"Through the mTrac platform, we receive messages from the district. These messages are sent to all healthcare providers who are registered on the platform, including VHTs. Since majority of the health providers are registered, we receive reminders on hand hygiene through the platform. Secondly, the other way we have been receiving reminders is through training." (Enrolled nurse)

"There are some messages that are sent to our phones, I don't know if they come from the ministry of health. What I know is that they come from a code 6767 on a daily basis, and they remind us to frequently wash our hands. Actually, even before we started chatting, I had received a message" (Nursing officer).

Social environment determinants

Existence of IPC Committees/ active focal persons

Almost all the HCFs had a committee or a focal person in charge of infection prevention and control. The IPC committee or focal persons were involved in routine monitoring and provision of feedback on hand hygiene, display of reminders on hand hygiene, conducting routine continuous medical education (CME), and ensuring availability of hand hygiene supplies at all points of care.

"The IPC committee reminds us and encourages us to clean our hands all the time. Each day, the focal person or any other person on the committee moves around to check and monitor hand hygiene in the different departments. In addition, they conduct CMEs at least every month and also carry out weekly supervisions. They also make duty plans for cleaners, and ensure that water and soap are available at hand washing stations." (Senior Clinical Officer).

" *Yes, we have an IPC committee and its role is to ensure that people wash their hands. The committee holds meetings regularly, ensures that hand washing supplies are available and also conducts evaluations to ascertain the gaps in hand hygiene, that is, are people washing hands or not, and what should be done to improve hand washing*." (Nursing Officer).

"The IPC committee does monthly assessments in each department. Like when we go to the theatre, we have to assess whether it is thoroughly cleaned, well dusted, equipment well sterilized and then we score. We score and give them feedback at the end of the day. Also, before we start our other duties, we move around to ensure that waste is properly segregated and hand hygiene is adhered to. We have to ensure that supplies like water and soap are in place. That is what we always do daily." (IPC committee member/theatre assistant).

In some HCFs, the IPC committee had someone in charge of enforcing infection prevention and control including hand hygiene and availing hand hygiene supplies to the different departments. The IPC committee provided support supervision, during which they reminded the different staff to practice hand hygiene during the critical moments.

"We have an IPC committee which sits regularly and there is someone appointed for hand hygiene. This person makes sure that there are enough supplies for washing hands. We have enough hand washing facilities available for everyone to use. Also, we have a water tank donated by water aid for rainwater harvesting and in addition to national water connection. We have sinks in every room and sanitation stations in every corner. The clients are always reminded to wash their hands by the IPC focal person "(Healthcare facility in-charge).

"Like the maternity people, we encourage them to wash hands in these scenarios; before touching a mother, after touching a mother and putting on and off gloves in between examinations of different clients. The mid wives working with pregnant mothers, some of them wash hands but many prefer using the sanitiser especially after examining different clients because it dries easily. We make sure each clinical and injection room has water, sanitiser and jelly so that they keep on washing hands after working on every client." (Healthcare facility in-charge).

We have a committee on IPC, and we identified someone responsible for enforcing infection prevention and control in each department. Everyone is encouraged to wash their hands!" (Healthcare facility in-charge).

Good leadership in the healthcare facility

The study revealed that good leadership by the healthcare facility in-charges and administration portrayed through ensuring a constant and reliable supply of hand hygiene infrastructure and supplies motivated healthcare providers to adhere to hand hygiene during all the critical moments.

"At times we may need hand washing facilities in the different departments. When we identify the need, we tell the in-charge and he quickly comes in and provides them. He also ensures that water is available all the time." (HCF Deputy Manager).

"The administration has provided IPC infrastructure, for example, every clinical room has soap and water. We are encouraged every after a procedure to wash hands or even before touching a client." (Key informant).

Biological environment determinants

Frequency of patient contact and nature of clinical work

Healthcare providers who were frequently involved in the physical examination of patients practised hand hygiene more than their counterparts who did not physically examine patients. Healthcare providers working in the maternity ward, theatre and laboratory were more likely to practice hand hygiene compared to their counterparts at the outpatient department (OPD), pharmacy, and other prescription or dispensing stations.

"The fact that my duties in the maternity ward require a lot of examining and constant touching of the patients motivates me to wash hands. I wash my hands more frequently because most of the time we don't wear gloves, especially during antenatal yet the patients always sweat." (Enrolled midwife)

*"Yes, for example, maternity and lab healthcare providers may practice hand hygiene more than people at OPD or pharmacy, where touching the patient is not necessary." (*Assistant Nursing Officer).

"Healthcare providers in maternity and those in lab practice hand washing more frequently than their counterparts at OPD yet we all have similar hand washing stations. I think it's because we (healthcare providers at maternity and OPD) get into more contact with the patients." (Enrolled midwife)

"The roles these people (healthcare providers) play influence the frequency of hand hygiene. For instance, someone in the pharmacy department may not wash hands as frequently as someone in theatre or maternity. For some people, it is their culture to wash hands and others are not used to hand washing." (Registered midwife)

Executive brain determinants

Knowledge of health risks associated with the work environment

Healthcare providers became knowledgeable of the health risks their work environment posed, and the benefits of hand hygiene through the continuous training provided by the district health office, partner organizations, healthcare facility in-charges and IPC committees. These built their capacity on hand hygiene, disinfection, waste management, and donning and doffing protective gears. Some respondents mentioned that one of the aims of these trainings was to make sure that healthcare staff adhered to hand hygiene during all the critical moments of patient care.

"*We had training on how to wash hands, which solutions to use for hand hygiene, and dilution and mixing of these solutions. So, the training was conducted mainly to make sure that people (healthcare providers) adhere to hand washing during all the critical moments, and also to*

learn how to mix the chlorine solutions" (Clinical Officer).

"We received training from the district health office. Our in-charge and the IPC focal person also train us during the CMEs, which happen every two weeks. We have been trained in hand washing, waste segregation, general cleanliness of the ward, how to mix chlorine powder or JIK (brand name of a chlorine solution on the market), how to decontaminate surfaces, and how to don and doff PPE. All our staffs were trained in these especially those on duty" (Enrolled nurse, public HC III).

"We orient new staff and tell them where to wash their hands from. We show them where the sink is located and where to always find soap and gloves." We tell them everything! And if they forget, we remind them" (Enrolled Nurse, HC III).

"These days AMREF has come up to teach us about the 7 steps of hand hygiene. We used to wash our hands normally but when we were taught about the 7 steps, it became a part of us" (Clinical officer).

Knowledge of infection prevention and control guidelines, policies and standards

Knowledge of some IPC guidelines, policies and standards among healthcare providers facilitated hand hygiene in the healthcare facility. Although no guidelines were seen in majority of the HCFs, most respondents were aware of some contents of the guidelines such as the hand hygiene technique, critical moments of hand hygiene in a healthcare setting and how to mix chlorine for purposes of disinfection. Respondents pointed out that these guidelines reminded them of the benefits of hand hygiene and the dangers of hand hygiene non-compliance. These guidelines were enforced by the IPC committees at the respective HCFs.

"We have Continuous Medical Education sessions where we integrate Infection Prevention and control. We also have infection prevention and control committee members who enforce these guidelines in the different departments." (Healthcare facility in-charge).

"The guidelines usually remind us of the importance of hand washing and the danger of cross-infection in the facility. They remind us of having the IPC committee that should be functional with meetings that discuss issues of IPC." (Healthcare facility in-charge).

Knowledge on hand hygiene was derived from training which was conducted by the Ministry of Health and partners like the Infectious Diseases Institute (IDI), GIZ, AMREF and UNICEF.

"AMREF and GIZ have sensitized us about the steps of hand hygiene. We used to wash our hands normally but when we were taught the steps, it became a part of us." (Clinical officer).

"IDI trained us on the five critical moments of hand hygiene in a healthcare setting. The Ministry of Health has also provided us with brochures talking about hand hygiene." (Enrolled midwife).

"IDI has trained us. We have so far received two trainings within two months. IDI taught us about mixing JIK (brand name for a chlorine solution on the market) to improve hand hygiene and disinfection of medical instruments, and waste segregation." (Registered midwife).

While knowledge of some aspects of the guidelines facilitated hand hygiene, it was evident that the knowledge of the policies, guidelines and standards was sub-optimal. For example, some respondents confused the five moments of hand hygiene with the hand hygiene technique.

There is a policy with the five steps of hand hygiene, the policy of washing hands during all the critical moments, the policy of washing hands at the entry and exit of the health facility and the policy of washing hands after handling medical wastes. (Healthcare facility in-charge).

We have the 5 steps of hand hygiene and also the procedure of mixing JIK. The five steps are never followed but the rest are followed. There are no repercussions but we supply the health care provider with whatever they need to practice hand hygiene. (Enrolled midwife).

Whereas some healthcare providers had knowledge of which aspects of hand hygiene were covered in the infection prevention and control guidelines, others, particularly those in private-not-for profit HCFs were not.

"I have not heard about the national policy, guidelines or standards on hand hygiene and I have not heard of regulations about hand hygiene. What I can say is that in the medical setting we use hand hygiene to control infections." (KI-PNFP).

A positive healthcare provider attitude towards hand hygiene

A positive healthcare worker attitude was reported by a few respondents as a facilitator of hand hygiene during critical moments.

"*The attitude of health providers is key. I have been involved in training health providers here and they are positive about hand hygiene. They do practice it not because I am around but do it in good faith*." (Enrolled midwife)

Motivated brain determinants

Recognition and reward of compliant healthcare providers

Some healthcare providers pointed out that the recognition of best performing departments and staff facilitated hand hygiene compliance during the critical moments of patient care. Respondents mentioned that departments that were viewed as non-compliant during recognitions were motivated to improve their hand hygiene behaviour to be proclaimed as best performers.

"Of course, when you're viewed as a department that is non-compliant, then you get the urge to improve. There is no penalty, however, the next time, you would also want to be recognized as the best performer in relation to hand hygiene. So, they (management) majorly do recognitions to motivate compliant departments and healthcare providers." (Enrolled nurse).

"We have an infection prevention and control focal person who monitors and keeps track of healthcare providers who practice hand hygiene, and we reward them at the end of the year. Every year, we keep records of the people that comply to hand hygiene" (Manager).

Fear of healthcare-associated infections

The fear of contracting healthcare-associated infections such as COVID-19 motivated healthcare providers in this study to practice hand hygiene at all possible opportunities. Respondents mentioned that working in a risky environment that is prone to infections instils fear among them, hence they comply in order to protect themselves and their families.

"Before COVID 19, hand hygiene was not taken seriously now it is. It is practised continuously with soap and water or sanitisers due to fear of contracting the infection. So yes, being that we are in an environment prone to infections, we have to practice hand hygiene to protect ourselves and our families." (Assistant Nursing Officer, Wakiso district)

"It's due to fear of infection. You can see there is that in-built fear among the people especially when this corona virus emerged. Hand washing is always practised now. So yes, fear of infections can motivate health providers to wash hands." (Clinical Officer)

"*This COVID-19 pandemic has also facilitated hand washing because when they are aware that COVID-19 exists, then they have to wash hands. It's like the fear of spreading the pathogens gets people to wash their hands. And also, regarding keeping yourself safe, for example, if you want yourself and your patient to be safe, then you are motivated to practice hand washing."* (Clinical Officer)

Besides the fear of contracting healthcare-associated infections such as COVID-19, some HCWs were knowledgeable of the health risks their work environment posed, and the role hand hygiene played in controlling and reducing the risk of acquiring infections. They acknowledged that they are exposed to both visible and non-visible dirt, hence the need to practice hand washing.

"We know that we are supposed to practice hand washing since this is not a safe or clean environment. We are exposed to visible and non-visible dirt every day, so we have to wash our hands. During the COVID-19 pandemic, we know that through hand washing, we can prevent further infections." (Clinical Officer)

"They are knowledgeable of hand hygiene as one of the ways of controlling and reducing the risk of infection in a healthcare setting." (Clinical Officer).

"*Awareness has been created; we have been sensitizing healthcare providers on the dangers of not adhering to hand washing. So, they practice hand washing to prevent these risks."* (Clinical Officer).

Behavioural setting- Roles' determinants

Availability of a budget for hand hygiene supplies

It was pointed out that having a budget for infection prevention and control facilitated hand hygiene compliance. Availability of a budget facilitated procurement, and thus the availability of hand hygiene supplies at the HCF.

"We have a budget which supports the procurement of hand hygiene supplies such as soap and sanitisers. It is a sufficient budget and as an in charge, I make sure that hand hygiene supplies and equipment are provided on time." (Manager, Hospital).

"Our budget is enough to "foot" (cater for) the supplies for practising hand hygiene. The budget for medicine also includes hand washing supplies, so they are ever enough." (Key informant, PNFP).

Behavioural setting - Props and infrastructural determinants

Availability of functional hand hygiene infrastructure and supplies

Some healthcare providers mentioned that the provision and availability of hand hygiene infrastructure and supplies such as soap, water, sinks, jerry cans and alcohol-based hand rub/sanitiser at every point of care and working station facilitated adherence to hand hygiene during the critical moments. Hand hygiene supplies were often provided by the Ministry of Health and partners such as UNICEF, AMREF and Water Aid Uganda. Some healthcare providers also mentioned that the management of their HCFs often ensured continuous supply and availability of hand hygiene supplies which eases hand hygiene compliance during critical moments. Availability of hand hygiene supplies was more common in private not for profit HCFs compared to public HCFs.

"First of all, hand hygiene supplies are always available. For instance, after using the toilet, you will be looking at the sink so you can't pass by it without washing your hands. In case you are going to touch a patient, definitely, the sanitiser or alcohol-based hand rub will be there. If you are done attending to a patient, you wash your hands because the sinks are available." (Enrolled Nurse)

"*They (management) provide us with the supplies we need to practice hand hygiene such as soap and water. Water is always available at the sink. This eases the process of hand washing during the critical moments."* **(**Enrolled midwife PNFP**).**

"*Yes, the management makes sure that there are enough hand washing facilities, water and soap. Hand sanitisers are provided to every health worker and the in-charge supervises to make sure these items are always in place*." (Assistant Nursing Officer).

"The healthcare facility in-charge motivates us by providing liquid soap. Each healthcare worker is also provided with 3 bars of soap for personal use. The IPC focal person makes sure that the hand washing stations are filled with water and also makes it a point that hand hygiene supplies are available. The water is always available and we have a water harvesting tank in addition to the national water supplies!" (Enrolled midwife).

"*Yes, UNICEF and Water Aid provided us with hand washing facilities. UNICEF provided the powdered JIK, soap and sanitiser to support in hand washing*." (Assistant Nursing Officer)

The role of healthcare providers and other support staff was also evident in ensuring the functionality of hand hygiene infrastructure, safety and availability of hand hygiene supplies. The functionality of hand hygiene infrastructure was facilitated by regular notification of healthcare facility management (i.e., to the in-charge or IPC focal person) about break-downs, and immediate replacement of non-functional parts such as taps and sinks. Healthcare providers and other support staff collaboratively worked together in ensuring that hand washing stations at all points of care had water and soap. The cleaning staff also ensured the safety of the hand hygiene stations through regular cleaning, which in the end attracted healthcare providers.

"We work as a team, in that if the water can does not have water, you cannot just look on. As an individual, you have to ensure that there is water in the hand washing facility. If your colleagues are busy, then you take up the initiative to refill the hand washing facility. The support staff as well as fellow clinical staff often ensure that there is a constant supply of soap. In case it's exhausted, one can just cut a piece and make a replacement. It's not an individual but team effort." (Enrolled nurse).

"The lady who cleans makes sure that the sink is clean. She makes sure soap and water are available. We also make sure we refill the jerry can every single time." (Enrolled nurse).

"*We have trained the cleaners to ensure that break down of hand hygiene infrastructure is reported to management. For example, when the tap is broken, we buy new ones for immediate replacement. We want to ensure that there aren't any excuses from people like, "I should not wash my hands because the tap is not functioning."* (Senior clinical officer)

"The in-charge and IPC focal person take care of the maintenance of hand hygiene infrastructure. If there is a breakdown of the hand hygiene infrastructure, we report to the focal person who in turn reports to the healthcare facility in-charge. I can also report to the in-charge directly." (Enrolled nurse)

Besides the availability of hand hygiene supplies and infrastructure, the strict enforcement of hand hygiene before entry and during other critical moments among healthcare providers further reinforced the practice.

"*Currently, we have made it mandatory for healthcare providers to wash their hands at the gate and to put on a face mask, which safe guards us and the clients. When a healthcare provider is entering the gate, he/she needs to put on a face mask, undergo temperature screening and wash hands using soap and water. In addition, if one is a health worker, he/she must put on gloves, and properly segregate medical wastes."* (In-charge, Public HC IV).

Proximity to hand hygiene infrastructure and supplies

The majority of the healthcare providers, particularly those working in public HCFs pointed out that hand hygiene during the critical moments was possible due to the proximity to equipment and supplies such as soap and sinks, water, and jerry cans. Respondents mentioned that having these supplies close to their working stations and points of care motivated them to practice hand hygiene. They further highlighted that the flexibility of movable hand washing cans also eases hand washing.

"They are motivated because of the proximity and the availability of hand washing materials like sanitisers, soap and water. They are too close because every department has a hand washing facility with soap and water. For example, there's a station both in and out of the laboratories, at OPD, clerking room, theatre and also in the maternity. Even in this room, there is a provision of an in-built sink that you can see with flowing water and soap." (Clinical Officer)

"The hand washing stations are very close to us. We don't need to move long distances to access them. This motivates us to wash hands during all the critical moments." (Assistant Nursing Officer).

"We have stations at each critical point of care in the ward for example the antenatal, examination, delivery room, postnatal room and also at the entrances. Of course, the movable hand washing stations have also improved hand hygiene among health providers because you can place them wherever you want or wherever you're seated. In case you want it closer, you can just pull it." (Enrolled midwife).

Deterrents to hand hygiene compliance among healthcare providers (Figure 4)

Biological environment deterrents

Heavy workload

The heavy workload was cited by healthcare providers as one of the deterrents to compliance with hand hygiene during the critical moments of patient care, particularly among those working in health centre IIIs. Healthcare providers in HC IIIs pointed out that the shortage of staff left healthcare providers on duty exhausted after performing their roles, and consequently, they neglected hand washing.

"Due to the nature of HC IIIs, there is one nurse and a mid-wife who performs all the duties. So as the day goes by, they become tired and might neglect hand washing." (Enrolled midwife, HC III)

"They just forget to wash hands. At times, they tell you that they were so busy to an extent that they didn't find time to practice hand hygiene during the critical moments." (Healthcare facility in charge, private not for profit HC III).

Executive brain deterrents

Negative healthcare provider attitude towards hand hygiene

A negative attitude towards hand hygiene coupled with unfavourable beliefs and perceptions hindered hand hygiene during the critical moments of patient care. Some healthcare providers in both public and private not for profit HCFs believed that hand washing wasn't necessary when they did not get into contact with a patient's body and for procedures performed while wearing gloves, whereas others believed that gloves offered adequate protection and eliminated the need to perform hand hygiene after patient care.

*"Sometimes people's attitudes hinder them from practising hand hygiene during the critical moments of patient care. There are those health providers who have the belief that hand washing isn't necessary when you perform a procedure while putting on gloves. They think it's okay and safe because she has protected herself with gloves. Yet, if I touch you and then others, am transferring infections." (*Senior Clinical Officer*).*

"*So, for the ART clinic, they (healthcare providers) rarely examine patients. As you have observed, when they are seeing their patients, they only do refills of ARVs, and when they are dispensing their patients, it's less interaction with the patient's body. They think it's safe yet one of the moments for hand washing is after touching the patients surrounding.* (Clinical officer).

Furthermore, some healthcare providers, most especially those in public and private-not-for profit lower-level HCFs such as HC IIIs, believed that some clients were not infectious, because they didn't appear so, hence the reluctance to practice hand hygiene.

"Some (healthcare providers) believe that their clients are not infectious. The appearance of the clients influences the healthcare providers' tendency to wash hands, while others are just lazy to wash hands." (Enrolled midwife)

Body- Traits, physiology and senses deterrents

The smell of hand hygiene supplies

A few healthcare providers cited the smell of hand hygiene supplies, particularly chlorine as a hindrance to practising hand hygiene during all the critical moments of patient care. These healthcare providers mentioned that the sharp pungent smell of chlorine discouraged them from practising hand washing during the critical moments of patient care. A few healthcare providers also pointed out that the use of chlorine made their skins rough.

"Yes, something like chlorine, it has a pungent smell. The hands also feel rough after use and the smell is sharp. So, such sensitivities sometimes deter health providers from doing hand hygiene." (Enrolled nurse).

Behavioural setting- Props and infrastructural deterrents

Inadequate hand hygiene supplies

Healthcare providers failed to practice hand hygiene during the critical moments due to a lack of supplies such as water, soap and sanitisers. The large number of healthcare providers which included healthcare facility staff, students and volunteers for example made it difficult for each of them to own sanitisers. Due to the failure to access hand hygiene supplies, some healthcare providers were forced not to practice hand hygiene or to wash hands with only water till supplies were availed. Water scarcity, especially during the dry season was also reported as a significant barrier to hand hygiene not only among the public but also in private not for profit HCFs.

"There are times when we have a scarcity of hand hygiene supplies. We get our supplies from NMS (National Medical Stores) periodically. So, when our supplies get used up, there isn't any other option but to do without them or to improvise by supporting each other to have these materials. As of today, sanitisers are out of stock. You are aware that it's very important for every health worker to have a pocket sanitiser. However, this may not be feasible for everyone because we have students and volunteers, you know! You cannot start buying for everybody. Even if you decide to buy for yourself, it does not help." (Clinical Officer).

"Water is inadequate and we fetch it off the facility premises. Now, in the dry seasons, we have to resort to fetching water from the borehole which is very far away from this facility. The potters make sure that they collect water and fill all the jerry cans and the hand washing stations because it's their duty. However, some wards like the labour ward don't have a hand washing station. So, from the labour and post-natal ward, you have to come here to the centre to wash your hands. So that's the challenge. There are also those times when there is no soap. It's kept in the stores, and if the person who has the store keys is not around, you go without it." (Nursing Officer).

Long-distance to hand washing equipment/ station

The distance to a hand washing station or equipment discouraged some healthcare providers in both private not for profit and public HCFs from practising hand hygiene during the critical moments of patient care. Healthcare providers mentioned that hand hygiene stations such as hand washing basins and sinks, and jerry cans were located far away from the users' workstations, which made it inconvenient for them to practice hand hygiene during the critical moments of patient care.

"*Hand washing stations are far away from some healthcare providers' workstations. You may find that in some departments, the hand washing facility is several meters away which can affect hand hygiene during critical moments. At times they find it difficult to move from one room to the other just to wash their hands. As my colleagues at that clinic, their hand washing facility is a bit far from them. They move from room to room*." (Clinical Officer).

"There is limited space in the antenatal room, and no sink as well. So, one has to move to the wash rooms to clean their hands. The lab also lacks a sink and they have to move out. In a nutshell, the hand washing stations are not close to the points of care. This makes people reluctant to wash hands." (Enrolled midwife)

"There are places in the healthcare facility that lack hand washing stations, like the clerking room in the OPD. If you don't have a sanitiser, it becomes so difficult to move to another room to practice hand hygiene." (Clinical Officer).

Non-functionality of hand hygiene infrastructure

Non-functional or faulty hand washing stations hindered healthcare providers from performing hand hygiene during critical moments of patient care. Healthcare providers noted that taps usually break down due to misuse on busy immunization days, which discourages them from adhering to hand washing. Furthermore, they highlighted that hand washing stations are often stolen due to their temporary nature, which also hinders them from complying with the practice.

"Another thing is that some hand washing stations are faulty or non-functional. Every time we have an immunization clinic, taps get broken. So, at times, breakdowns hinder us from practising hand hygiene during the critical moments of patient care. They are also not permanent like you see, so they get stolen since the healthcare facility is not fenced." (Senior Clinical Officer).

Discussion

The current study used the BCD model to explore the facilitators and deterrents to hand hygiene during the critical moments of patient care among healthcare providers in the greater Kampala Metropolitan region, Uganda. The facilitators of hand hygiene during the critical moments included fear of healthcare-associated infections, presence of functional infection prevention and control Committees/ active focal persons, knowledge of infection prevention and control guidelines, policies and standards, availability of a budget for hand hygiene supplies, provision of hand hygiene supplies and availability of functional hand hygiene infrastructure, the close proximity to hand hygiene infrastructure and supplies, the use of constant reminders such as mobile text messages, nudges and posters, frequency of patient contact and nature of clinical work, good leadership, a positive healthcare provider attitude towards hand hygiene, and recognition and reward of compliant healthcare providers. The deterrents of hand hygiene during the critical moments included inadequate hand hygiene supplies, long-distance to hand washing equipment/ stations, negative healthcare provider attitude toward hand hygiene, a heavy workload, non-functionality of hand hygiene infrastructure and the smell of hand hygiene supplies.

The current study revealed that the use of constant reminders such as mobile text messages, nudges and posters facilitated hand hygiene. Based on the BCD, the use of constant reminders such as posters, nudges and mobile text messages in the healthcare environment can create a surprise that may attract and grab the attention of the healthcare providers to practice hand hygiene [29]. There is evidence that creating a surprise in an environment like a healthcare setting can help stimulate healthcare providers to practice hand hygiene. Text messages, nudges and posters act as stimuli that can foster learning in a healthcare setting. Without such stimuli, healthcare providers may not acquire new knowledge. Besides, posters, mobile text messages and nudges help to nullify wrong perceptions about hand hygiene thereby fostering the practice among healthcare providers. This being a formative stage of a cluster-randomized trial, the study team will expose the participants to nudges, posters and mobile text messages to increase their level of knowledge on hand hygiene, and grab their attention for better practice.

The fear of healthcare-associated infections including COVID-19 facilitated hand hygiene among healthcare providers. Biological agents such as viruses, bacteria and fungi among others, often cause intrinsic disgust, a motive that facilitates disease-avoidance behaviour. Practising hand hygiene in a healthcare setting is critical for reducing the risk of healthcare provider contamination, and consequently infection. The fear of healthcare-associated infections such as COVID-19, therefore, may prompt healthcare providers to frequently practice hand hygiene. The failure to practice hand hygiene compromises the safety of healthcare workers and patients, and also puts at risk the health of the family members and close contacts of the healthcare providers. Therefore, the motive to care for and protect (also termed as nurture) one's kin and patients from healthcare-associated infections may drive hand hygiene [41].

This study revealed healthcare providers' knowledge of IPC guidelines, policies and standards as a facilitator of hand hygiene during critical moments of patient care. Based on the BCD approach, knowledge of infection prevention and control measures such as hand hygiene and its benefits influences intentions and plans and eventually the performance of a given behaviour (which in this case was hand hygiene) [42, 43]. Healthcare providers who were knowledgeable of IPC guidelines, policies and standards, therefore, may have been prompted to practice hand hygiene since Uganda's IPC guidelines highlight the importance of hand hygiene, types of hand hygiene, recommended agents, and their use/technique and application [24]. Being knowledgeable of IPC guidelines helps healthcare providers to evaluate and make trade-offs between practising the desired behaviour or not. Healthcare providers in the current study re-emphasized the importance of knowledge of IPC guidelines as a facilitator of hand hygiene compliance in healthcare settings, as reported in earlier studies [44–46]. Despite the evidence derived from the current study and earlier studies [44–46], it was evident that some healthcare providers lacked adequate knowledge of IPC guidelines, policies and standards. This gap, therefore, highlights the need for implementing partners and the health authorities to disseminate these guidelines and to sensitise healthcare providers on their importance. Improving the knowledge of IPC guidelines, policies and standards and hand hygiene is likely to improve the attitude of healthcare providers and thus, achieving optimal hand hygiene in HCFs. There is evidence that knowledge of IPC is associated with better practices among healthcare providers [47].

The current study revealed that some healthcare providers were motivated to practice hand hygiene during the critical moments of patient care if they anticipated being rewarded or recognized. This is not surprising given the fact that some individuals' actions, including hand hygiene, are goal-oriented, and that without a goal, individuals are not bound to practice certain behaviours, including hand hygiene. To some healthcare providers, hand hygiene was a motivated behaviour since it was guided by the desire to achieve goals (in this case rewards and recognition). There is evidence of rewards being a guide along the path to meeting the desired behaviour (hand hygiene) [48–50]. Our findings are supported by several studies that have previously reported recognition and rewards as motivators of hand hygiene in healthcare settings [51, 52]. Nonetheless, the fact that healthcare providers in our study are motivated to practice hand hygiene implies that withdrawal or failure to sustain recognition and rewards can lead to low hand hygiene compliance during critical moments.

Our study revealed that the nature of the behavioural setting was critical in facilitating or hindering hand hygiene among healthcare providers. The presence of active IPC committees/ focal persons, good leadership and a positive healthcare provider attitude were particularly critical for compliance with hand hygiene during the critical moments of patient care. Conversely, a negative attitude negatively impacted hand hygiene during the critical moments of patient care. IPC committees and focal persons have a responsibility of ensuring adherence to standard

precautions, and therefore have a role in influencing healthcare providers' perceptions and attitudes towards hand hygiene. IPC committees and focal persons have a responsibility of influencing the normative setting in which hand hygiene is practised [53–58]. IPC committees and focal persons have the responsibility of influencing descriptive, personal, injunctive and subjective norms. With regard to descriptive norms, IPC committees and focal persons have the responsibility of influencing the perceptions of healthcare providers so that they embrace hand hygiene while in healthcare settings. IPC committees and focal persons also have the responsibility of influencing personal norms by ensuring that hand hygiene is part of the normal behaviour exhibited by the healthcare providers. Besides, on behalf of the healthcare staff, IPC committees and focal persons make rules and approve IPC measures, which influences the social setting [29]. Approval of hand hygiene (injunctive norm) as an effective measure of breaking transmission of healthcare-associated infections by the IPC committee and focal persons is likely to have facilitated compliance.

Besides, the existence of IPC committees and focal persons and good leadership and availability of budgets for hand hygiene supplies were critical in facilitating hand hygiene during the critical moments of patient care. With good leadership, healthcare providers can plan and allocate resources to hand hygiene. Once there is favourable allocation of resources to IPC and hand hygiene, in particular, then supplies such as water and soap are likely to be available, which fosters hand hygiene during the critical moments of patient care. Also, good leadership implies that HCFs are in a position to plan for capacity building interventions such as IPC training. The role of IPC committees and focal persons in facilitating hand hygiene has also been documented by other scholars [58–60].

Availability and proximity to hand hygiene infrastructure and supplies facilitated hand hygiene among healthcare providers. Based on the BCD approach, hand hygiene infrastructure such as hand washing facilities and related supplies may be classified as objects that can facilitate healthcare providers to comply with hand hygiene during the critical moments of patient care [33, 48]. The availability of hand hygiene facilities in healthcare settings is not enough to facilitate hand hygiene. These facilities and supplies need to be accessible and user friendly to be used by the healthcare providers. Long distances to and non-functionality of hand hygiene facilities, as indicated in our study hinder healthcare providers' intentions to practice hand hygiene during the critical moments. Non-availability and long distance to a hand hygiene facility at times turn out as an inconvenience and a waste of a healthcare provider's time [42, 61, 62], thus increasing non-compliance to hand hygiene during the critical moments of patient care. Our findings, therefore, highlight the need of ensuring the availability and proximity to hand hygiene facilities. Hand hygiene facilities/stations may be put in strategic points which can easily be accessed by the healthcare providers to facilitate hand hygiene whenever required.

Hand hygiene during the critical moments of patient care was facilitated by the frequency of patient contact and the nature of clinical work. Healthcare providers working in departments such as maternity and laboratory where there is frequent patient contact were reported to practice hand hygiene during the critical moments more often compared to their counterparts working in departments (such as OPD) where there was less patient contact. The close interaction between the healthcare providers and the biological environment may have prompted healthcare providers to practice hand hygiene. Healthcare providers who are in constant contact with the biological environment often practice hand hygiene due to fear of infection given their constant exposure to infectious agents such as coronavirus [63–65]. Conversely, a heavy workload was an important deterrent to practising hand hygiene during the critical moments of patient care. A heavy workload means that healthcare providers need to see more patients which leaves them with less time for hand hygiene during the critical moments and in-between patients. At times, healthcare providers are only motivated by clearing all patients as opposed to practising hand hygiene. Therefore, having no waiting patients turns out to be a reward that happens at the expense of hand hygiene. This implies that hand hygiene may not provide a tangible benefit as working on patients in a queue, yet it is rewards that drive behaviour [29, 43, 48]. Our findings are consistent with those of other scholars [66–68], which have all indicated the negative impact of workload on hand hygiene.

Our study revealed the smell of hand hygiene supplies as a barrier to hand hygiene during critical moments. Hand hygiene supplies like bleach, which is often made from a chlorine solution have a pungent and irritating odour. Similarly, the smell produced by alcohol is at times unpleasant and irritating [69, 70]. Therefore, healthcare providers often avoid practising hand hygiene with the view of avoiding unpleasant and irritating smells. In a nut shell, smelly hand hygiene supplies become a disgust that healthcare providers avoid. Disgust as a human behaviour motive is elaborated by R Aunger and V Curtis [48] and [71]. Smell as a hindrance to hand hygiene should therefore be considered in WASH in HCFs' interventions. Availing of hand hygiene supplies such as soap and alcohol-based hand rub that have a pleasant smell is likely to increase hand hygiene compliance, as reported by [71].

Strengths and limitations

This being a qualitative study, it provides an in-depth understanding of the facilitators and deterrents to hand hygiene which quantitative studies may not. The study used a relatively large sample size which enabled the researchers to reach the level of theoretical saturation. Besides, it quantifies key indicators such as healthcare provider knowledge of the roles of the IPC committees, availability of such committees, and hand hygiene infrastructure. Nonetheless, it had some limitations. Being a qualitative study, it is not statistically representative. In addition, it was subject to social desirability bias.

Conclusions

Our study revealed that a multitude of facilitators and deterrents influence hand hygiene behaviour during the critical moments of patient care. The facilitators of hand hygiene compliance included constant reminders such as mobile text messages, nudges and posters, fear of healthcare-associated infections including COVID-19, frequency of patient contact and nature of clinical work, knowledge of infection prevention and control guidelines, policies and standards, a positive healthcare provider attitude, recognition and reward of hand hygiene compliant healthcare providers, the existence of active IPC Committees/ focal persons, good leadership, availability of a budget for hand hygiene supplies, and proximity to functional hand hygiene infrastructure and supplies. The deterrents to hand hygiene included a heavy workload, negative healthcare provider attitude, smell of hand hygiene supplies, non-proximity to functional hand hygiene infrastructure/station, and inadequate hand hygiene supplies. This study illustrates that the availability of hand hygiene infrastructure alone is not enough to influence hand hygiene among healthcare providers, rather these need to be proximal to the users. Besides, hand hygiene is at times driven by recognition and rewards, reminders and policies, guidelines and standards.

Abbreviations

ABHR:	Alcohol-based hand rub
BCD:	Behaviour Centered Design
GKMA:	Greater Kampala Metropolitan Area
HAIs:	Healthcare Acquired Infections
HCF:	Healthcare facility
HC:	Health centre
IPC:	Infection Prevention and Control
MOH:	Ministry of Health
PNFP:	Private Not for Profit
RA:	Research assistant
UN:	United Nations
WASH:	Water Sanitation and Hygiene
WHO:	World Health Organization

Declarations

Ethics approval and consent to participate

This study was conducted in in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Makerere University School of Public Health Research and Ethics Committee ((Protocol 775) and was registered by the Uganda National Council for Science and Technology (HS882ES). The investigators then sought administrative clearance from Wakiso and Mukono District local governments and the administration of the participating healthcare facilities. Participation in the study was entirely voluntary and informed written consent was obtained. Privacy and confidentiality were ensured during the study. Participant names, titles and positions and study healthcare facilities have been de-identified to ensure confidentiality.

Consent to publish

Not applicable

Availability of data and materials

The transcripts analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was funded by the National Academies of Science (NAS) and the United States Agency for International Development (USAID) (Award Number AID-OAA-A-11-00012). The study protocol was independently peer-reviewed by the funding body, however, any opinions, conclusions, or recommendations expressed in this article are those of the authors alone, and do not necessarily reflect the views of USAID or NAS.

Authors' contributions

RKM, HY and CLM obtained the funding for this study. TS, RKM, HY, and CLM conceptualized the study, participated in data collection, and analysis and drafted the manuscript. JBI, RKW, AN, CA, STW, EB, RN, JB and LL participated in the analysis and drafting of the manuscript. All authors read and approved this manuscript before submission to this journal.

Acknowledgement

We would like to thank the administration of Wakiso and Mukono District Local governments for granting clearance to undertake the study. We remain indebted to the administration of both private and public healthcare facilities for allowing their healthcare facilities to participate in the study, and the healthcare providers who responded to the study tools. The support of Nansinguza Jacob in designing the illustrations used in this manuscript is highly appreciated. Finally, we thank our diligent team of research assistants and coordinators who made this study a success.

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Tables

Table 1
Background characteristics of the respondents

Description	Category	Frequency	Percentage (%)
Nature of interview	Key informant	18	48.6
	Semi-structured	19	51.4
Cadre/position of respondent	Administrator	1	2.7
	Clinical officer	15	40.5
	M&E officer*	1	2.7
	Midwife	8	21.6
	Nurse	8	21.6
	Nursing assistant	1	2.7
	Program advisor	1	2.7
	Program manager	1	2.7
	Theatre assistant	1	2.7
Age category	25–34	10	27.0
	35–44	16	43.2
	45 and above	11	29.7
Years of experience in the delivery of healthcare services	2–5	9	24.3
	6–10	7	18.9
	11–20	16	43.2
	21 and above	5	13.5
Place of work	Health centre III	27	73.0
	Health centre IV	6	16.2
	NGO	4	10.8
Ownership	PNFP	17	45.9
	Public	20	54.1
Location of the entity where the respondent works	Rural	12	32.4
	Urban	25	64.9

**M&E officer = Monitoring and valuation officer, NGO =* Non-governmental Organisation

Table 2
Healthcare facility characteristics and status of Hand hygiene infrastructure and practice

Variable	Response	Frequency (n = 19)	Percentage (%)
Level of HCF	Health centre III	14	73.6
	Health centre IV	5	26.4
Ownership	PNFP	6	31.6
	Public	13	68.4
Location	Rural	8	42.1
	Urban	11	57.9
Healthcare providers at the healthcare facility are motivated to practice hand hygiene	No	5	26.3
	Yes	14	73.7
The leadership of the HCF facilitates compliance to hand hygiene among healthcare workers	No	2	10.5
	Yes	17	89.5
HCF has a functional hand hygiene infrastructure	No	4	21.0
	Yes	15	79.0
HCF has sufficient hand hygiene infrastructure	No	10	52.6
	Yes	9	47.4
Healthcare providers know the roles of the Infection Prevention and Control (IPC) committee	No	6	31.6
	Yes	13	68.4
How the respondent rated compliance to hand hygiene among the healthcare providers	Average	4	21
	Good	8	42.1
	Very good	6	31.6
	Very poor	1	5.3
Healthcare providers sufficiently comply with hand hygiene	No	12	63.2
	Yes	7	36.8
Health providers comply to hand hygiene during all the critical moments of patient care	No	11	57.9
	Yes	8	42.1
HCF received support on the implementation of hand hygiene interventions	No	5	26.3
	Yes	14	73.7
Respondent aware of any IPC guidelines	No	4	21.0
	Yes	15	79.0
HCF usually conducts training for healthcare providers	No	3	15.8
	Yes	16	84.2
HCF usually conducts training for support staff	No	3	15.8
	Yes	16	84.2
Patients/Caretakers are satisfied with healthcare providers' hand hygiene	No	5	26.3
	Yes	14	73.7

Figures

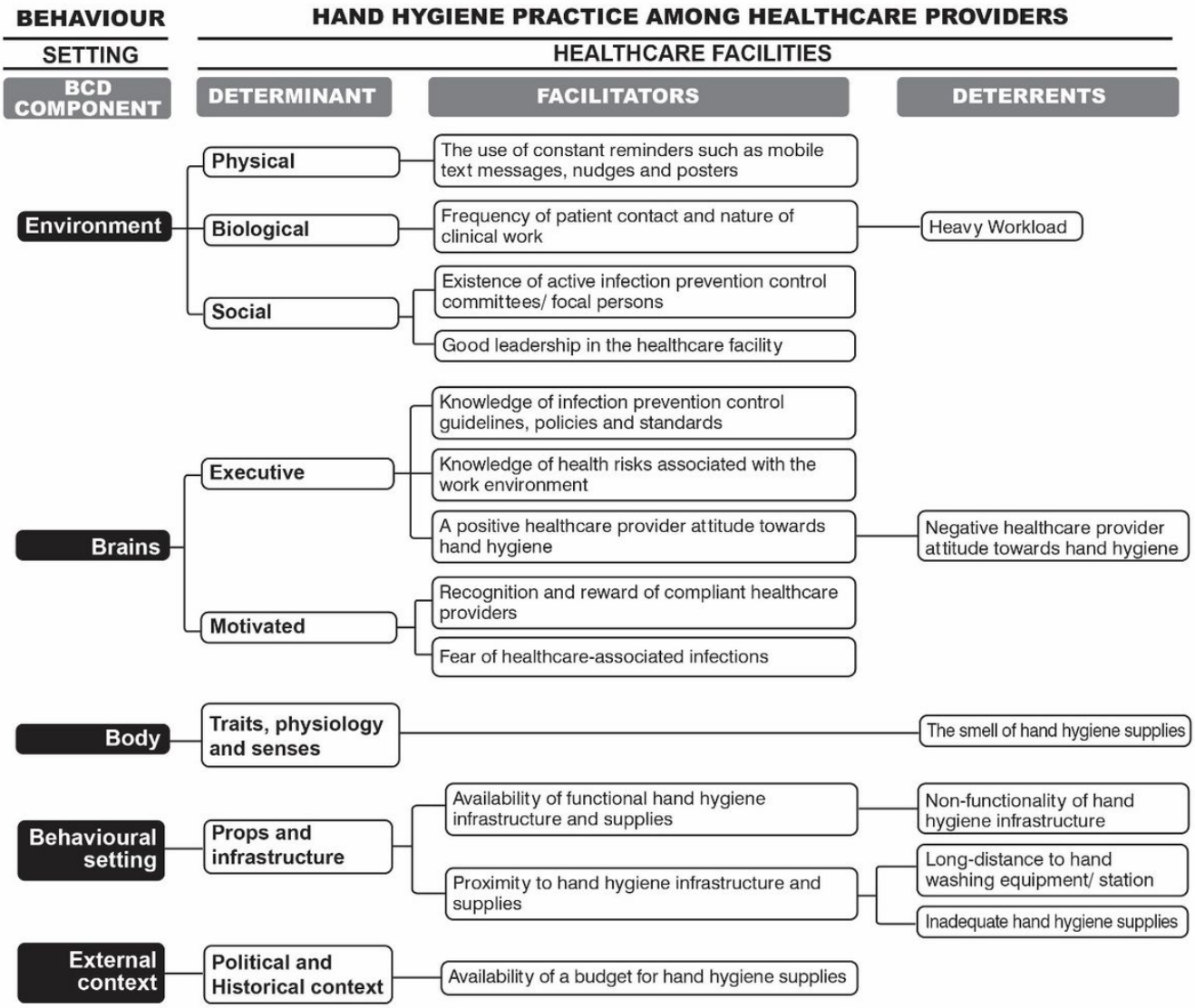

Figure 1

The BCD theory and model

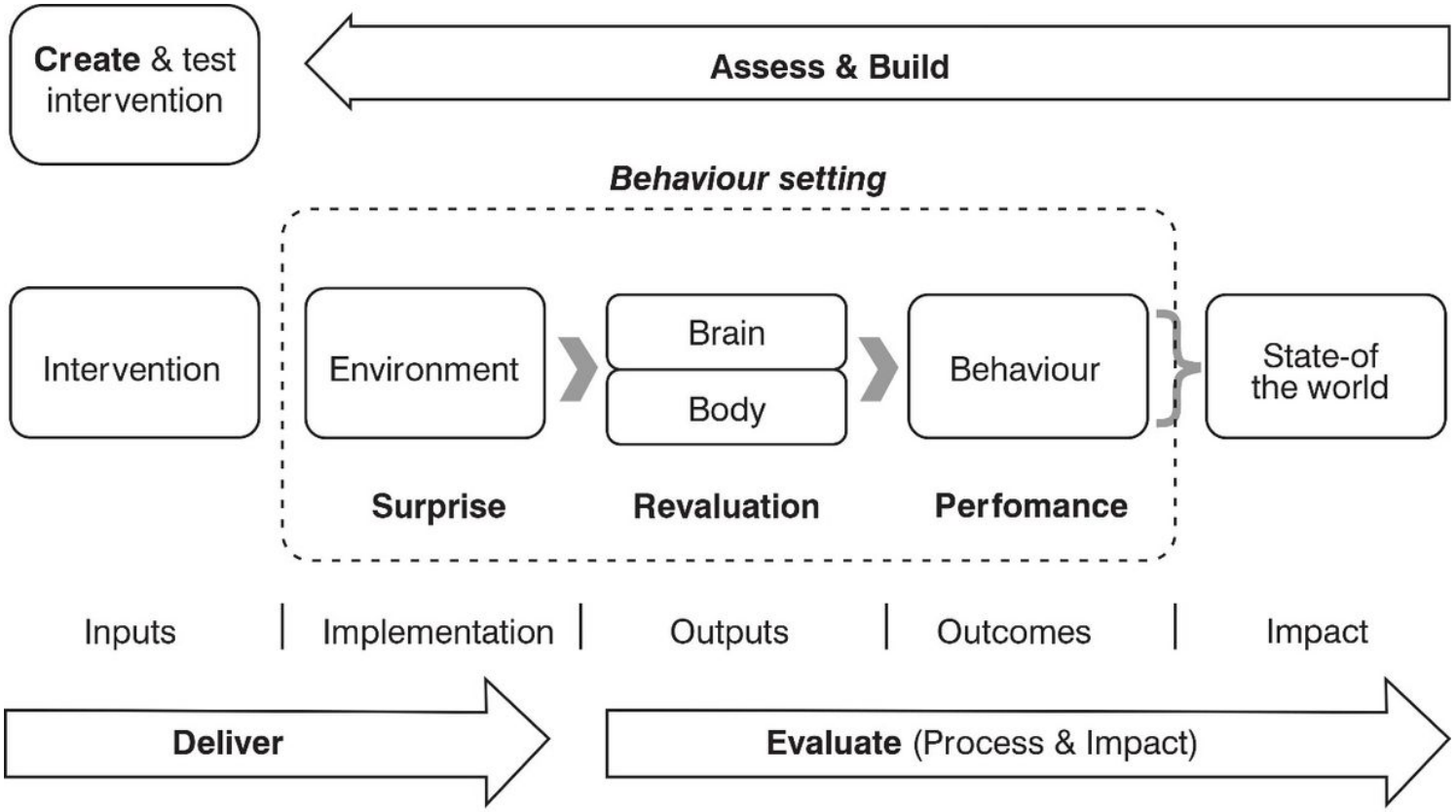

Figure 2

The Behaviour Centered Design approach [31]

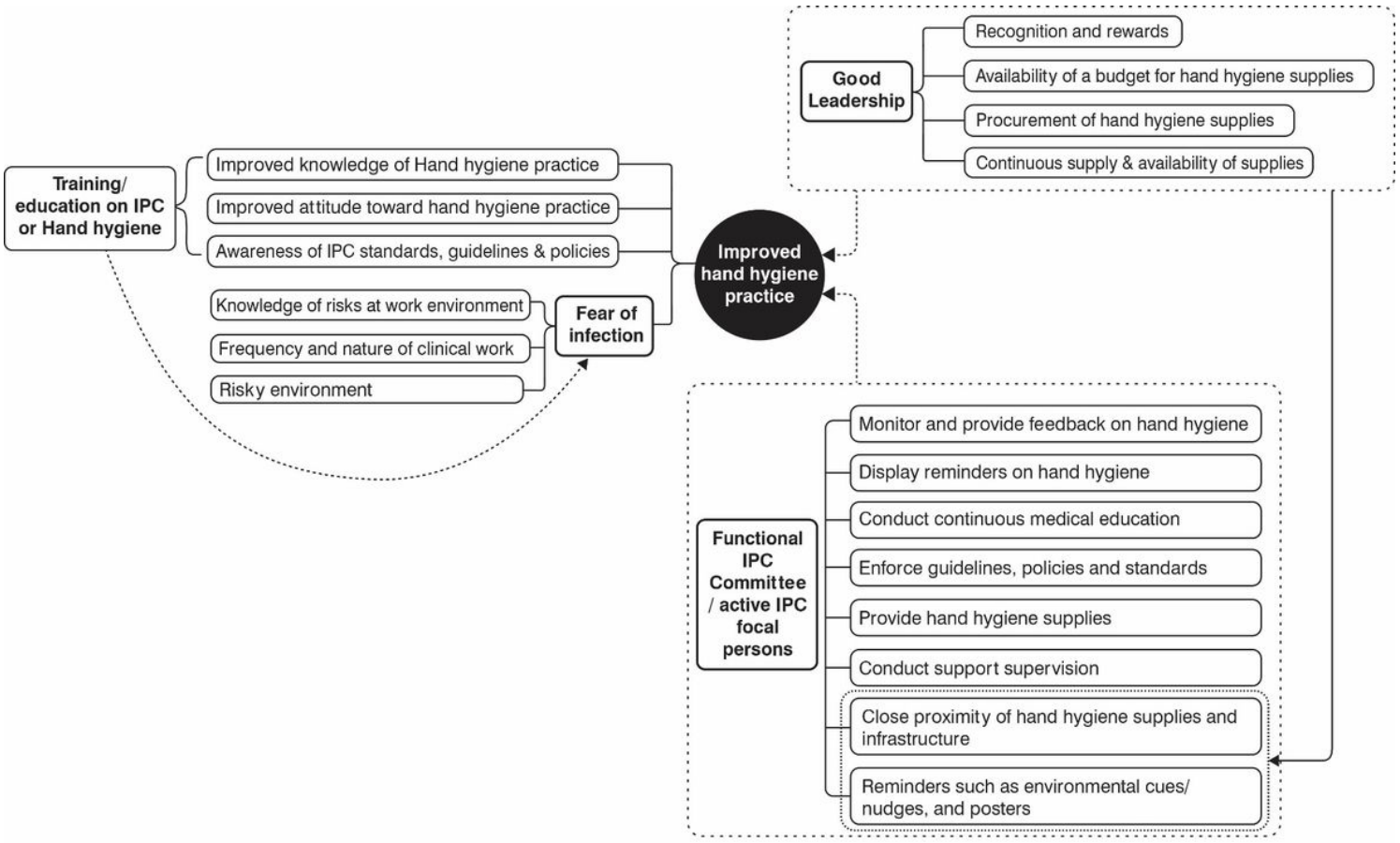

Figure 3

Facilitators of hand hygiene among healthcare providers in the greater Kampala metropolitan region, Uganda

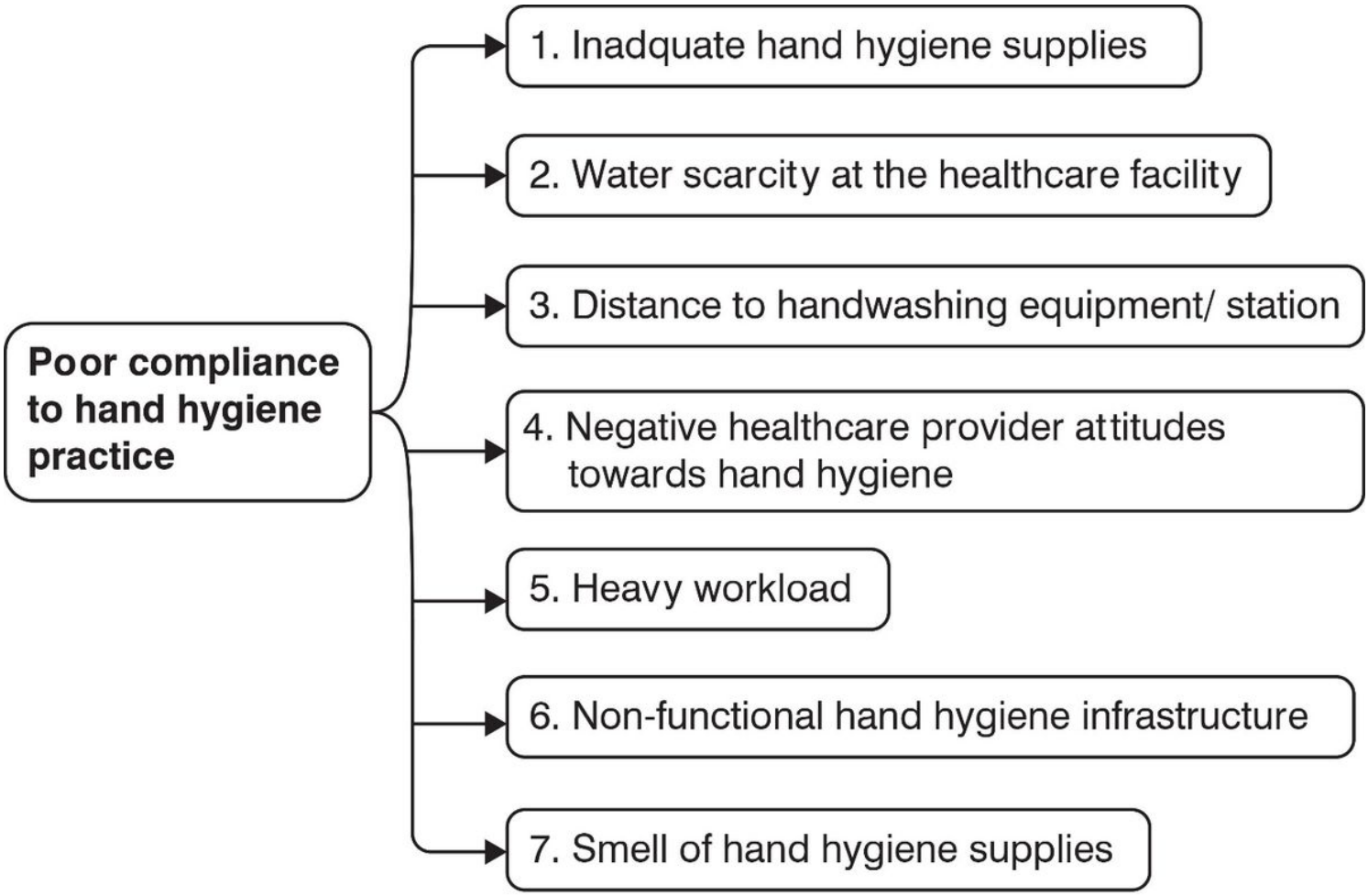

Figure 4

Deterrents of hand hygiene among healthcare providers in the greater Kampala metropolitan region, Uganda

Supplementary Files

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- Supplementaryfile1.docx