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Infection prevention and control: knowledge, practices and associated factors among cleaners at a National Referral Hospital in Uganda

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SUMMARY

Background: While most infection prevention and control (IPC) studies focus on healthcare professionals, IPC is everyone's responsibility in any healthcare facility. There is little known about the IPC knowledge among the cleaners who are responsible for housekeeping, environmental cleaning, and waste management within hospitals. This study sought to evaluate the knowledge and practice of IPC among cleaners at Mulago National Referral Hospital (MNRH) to establish a foundation for empowering a strategic workforce that will improve IPC practices within the hospital.

Methods: A cross-sectional study was conducted among the cleaners in a national referral hospital in Uganda. The participants were purposively sampled, and data was collected using a web-based, interviewer-administered, questionnaire about IPC knowledge and practices.

Results: Of the 120 cleaners recruited, 52.5% were female. Good IPC knowledge was demonstrated in 58.3%, and 30.8% reported good IPC practices. Participants with at least 5 years' work experience had higher knowledge levels (aOR: 10.3, P=0.006, 95% CI: 2–54). Those closely supervised had lower IPC knowledge compared with those with less supervision. Participants with fixed work schedules (aOR: 0.2, P=0.028, 95%CI: 0–0.8), were less likely to exhibit good IPC practices. In addition, 63.1% were knowledgeable about waste segregation, recognising bin colours and the correct disposal of sharps and needles. Despite good compliance with personal protective equipment, poor hand-washing practices were reported. A positive correlation between knowledge and practice scores was established.

Conclusion: Hospital cleaners in a national referral hospital in Uganda IPC reported poor infection prevention practices despite good knowledge. For IPC knowledge and practice to correlate positively, ongoing practical training is vital to maintain knowledge and good practice to establish a successful IPC program.

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Introduction

Infection prevention and control (IPC) is a fundamental, evidence-based approach aimed at safeguarding patients, healthcare workers, students, visitors, and carers from preventable infections [1]. It is everyone's concern, and serves as a cornerstone for delivering high quality patient care and fostering a secure working environment within healthcare settings [2]. Despite their integral role in IPC, cleaners often find themselves overlooked within the healthcare workforce [3,4].

The management of hospital waste presents a critical challenge, serving as a reservoir for pathogenic microorganisms and a potential source for healthcare-associated infections (HCAIs), particularly when sharps and bodily fluids are involved. Effective handling throughout waste management stages, including generation, segregation, collection, transportation, storage, treatment, and disposal, is imperative in mitigating the risk of HCAIs [5]. Strengthening IPC capacities, particularly within hospital-based infection control departments, is vital for curtailing the transmission of HCAIs on a global scale [6].

Sub-Saharan Africa faces heightened risks of HCAIs due to inadequate IPC measures, resulting in high infection rates [7]. Insufficient implementation of IPC procedures and resources such as hand hygiene, medical equipment, personal protective equipment (PPE), and safe waste disposal, contributes significantly to this risk. Personal health and safety education, immunisation programmes, and post-exposure prophylaxis are also key components of IPC [8,9]. Cleaners, tasked with crucial IPC duties such as ward decontamination and waste management, are often undertrained, lack motivation, and face marginalisation within healthcare systems, thereby hindering effective IPC implementation [10]. Because of marginalisation, this key section of the healthcare workforce is often overlooked in IPC training programmes. This not only denies cleaners opportunities to enrich their knowledge but may also compromise their safety from exposure to pathogens and infections acquired in the workplace.

In Uganda, previous studies had largely focused on the knowledge, attitudes, and practices of healthcare workers (HCWs) on IPC and overlooked the cleaners in their assessments [11,12]. Moreover, there was no clear documentation of the vaccination status of this key workforce population despite being at high risk of HCAI due to their constant exposure. This study sought to evaluate the knowledge and implementation of IPC among cleaners at Mulago National Referral Hospital (MNRH) with the aim of establishing a foundation for empowering a strategic workforce that will help to improve IPC practices within the hospital.

Methods

Study design and setting

This cross-sectional, quantitative study was conducted among cleaners between October and November 2021 in in-patient wards, operating theatres and out-patient departments (OPD) of MNRH, the biggest Ugandan national and teaching hospital of Makerere University College of Health Sciences (MAKCHS).

Selection criteria

Participants were eligible to participate in this study if they were recruited as a cleaner in any department of MNRH, aged at least 18 years and willing to participate. Those who had assumed a different role other than cleaning were excluded.

Sample size estimation

The sample size was determined using Kish Leslie's formula [13], where a 1.96 level of confidence, for a 95% confidence limit, a 5% standard sampling error and 50% *P*-value were estimated, since no study in IPC had been carried out among cleaners in the local context. This estimated a sample size of 384, which was higher than the total population of cleaners at the facility. Cochran's formula was then applied as below:

Taking $\mathbf{n_0} = \mathbf{384}$; estimation per Kish Leslie's formula (1965),

N (The total number of cleaners) = **175**

$n = \frac{n0}{1+(n0-1)/N}$ hence a of **120** participants was estimated.

Sampling procedure

Participants were sampled purposively, approached from their place of work. Upon identification of the potential participants, the team explained the study aims and objectives and those who consented to take part were interviewed using an interviewer-administered, web-based tool designed using KoBo Toolbox [14].

Data collection instrument

The questionnaire consisted of three parts: Sociodemographic characteristics, knowledge, and practices of IPC, with nine, six and thirteen questions respectively, as adopted from the Uganda National IPC guidelines 2013 [15] with expert advice from the Department of Nursing, Makerere University. Data collection was conducted by a group of four students who were in their final year of Bachelor of Nursing at Makerere University. These were prepared for the exercise through training for use of the study tools.

Ethical approval

The study approved by the Institution Review Board of School of Health Sciences, Makerere University (MAKSHSREC-2021-125). Additionally, we obtained hospital administrative clearance through the office of research and ethics committee. Participation in the study was voluntary, and written informed consents were obtained from participants after explaining to them the proposed research including the anticipated risks and potential benefits before taking part in the study.

Data analysis

Responses extracted from KoBo Toolbox were exported into Microsoft Excel 2016 for cleaning and coding. Statistical analysis was done using STATA version 16.0 (StataCorp, College Station, TX, USA). In a grading system generated, each correct response on both knowledge and practices was awarded 1 mark

Table I
Mean IPC knowledge and practice scores among participants

Variable	Knowledge score (SD)	Practice score (SD)
Gender		
Female	19.5 (3.4)	14.4 (2.6)
Male	18.8 (4.2)	14.1 (2.4)
Work area/station		
Ward	19.8 (3.3)	14.5 (2.3)
Outpatient (OPD)	19.2 (3.7)	14.2 (2.6)
Theatre	20.4 (2.5)	15.2 (1.8)
Level of education		
No Education	19.2 (4.4)	14.3 (2.9)
Primary	19.6 (3)	13.4 (2.4)
Secondary	18.3 (4.5)	14.3 (2.6)
Tertiary	20.5 (2)	14.7 (2.1)
Marital status		
Divorced	21 (3.6)	15.7 (3.5)
Married	20.6 (2.5)	15.1 (1.9)
Single	17.4 (4.3)	13.2 (2.7)
Widowed	17.4 (4.6)	13.8 (2.9)
Work experience		
Between 1-2 years	18.4 (4.6)	14.5 (1.9)
Between 2 and 5 years	20.7 (2.5)	14.3 (2.6)
Less than 1 year	16.2 (4)	12.4 (2.6)
More than 5 years	20.7 (2.5)	15.5 (1.8)
Working days per week		
5—7 days	18.6 (3.9)	13.9 (2.5)
Between 1-4 days	21.7 (2)	15.8 (1.7)
Monthly supervision		
Every after 2 weeks	20.5 (2)	14.8 (2.4)
Every week	20.4 (3.4)	14.7 (1.8)
Everyday	18 (4)	13.8 (2.6)
Never supervised	21.6 (2.1)	14.7 (2.6)
Once a month	21.4 (2.6)	16.1 (2)
Last IPC training		
Less than a month ago	18.4 (4.9)	13.3 (2.8)
More than a month ago	19.6 (3.2)	14.6 (2.3)
Never received training	17.9 (4.9)	13.8 (2.8)

and a wrong response awarded 0 marks and the scores determined basing on the summation of correct answers from each participants' attempt. Bloom's cut-off of 80% was used to determine good knowledge and practices ($\geq$80%) [16]. Associations between variables were assessed at bivariate and multivariate analysis. Only factors with a P value $<$0.2 at bivariate analysis were considered for multivariate analysis. A P value $\leq$ 0.05 was considered significant.

Results

A total of 120 participants were recruited in this study. Of the 120 participants, 52.5% were female. The median age was 31.5 years. Sixty-one (50.8%) were married. Only 31 (25.4%) had attained tertiary level education. Eleven (9.2%) participants had not received formal education.

The majority, of cleaners 70 (58.3%) worked in more than one department. As a result, 78 (65%) were working on in-patient wards, 77 (64.2%) and 60 (50%) working in the out-patients and theatres respectively. Nearly a third, 40 (33.3%) had work experience of more than 5 years and 30 (25%) had work experience of less than one year. The majority, 99 (82.5%) worked for 5—7 days a week, and 73 (60.8%) reported being supervised every day. Moreover, 82 (68.3%) of participants, had undergone IPC training organised by either the hospital IPC team or another recognised body such as their company over a month before responding to this survey.

The mean IPC knowledge and practice scores for the participants is shown in Table I. Of the study participants, 70 (58.3%) had good IPC knowledge with an overall mean knowledge of score of 14.3$\pm$2.5. A majority of respondents (63.1%) demonstrated familiarity with waste segregation protocols, distinguishing between red, black, blue, yellow, and brown bins, along with the proper disposal of sharps and needles.

Mean knowledge scores were higher among female participants (19.5/38.3) compared with males. Theatre cleaners had a knowledge score of 20.4/59.4, which is higher than that of their counterparts working in in-patient wards and OPDs. Others with higher knowledge scores included those who had attended a tertiary education institution (20.5/77.6), the divorced (21/77.6), those with two years and above work experience (20.7/76.0), those working between 1-4 days a week (21.7/76.0), those never supervised (21.6/76.0) and those who received their last IPC training more than a month ago (19.6/76.0).

There was a positive correlation between working experience and IPC knowledge and participants with a working experience of more than 5 years were 10 times more likely to have good knowledge compared to those with less than one-year experience (aOR: 10.3, P=0.006, 95% CI: 2—54). Participants closely supervised had significantly less IPC knowledge compared to those not supervised (aOR: 0.1, P=0.047, 95%CI: 0—1) with mean knowledge scores of 18$\pm$4 and 21.6$\pm$2.1 respectively (Table II).

Despite good knowledge, only a third of participants, 37 (30.8%) had good IPC practices with an overall mean practice score of 14.3$\pm$2.5. Overall vaccination practices among the cleaners were low with 96 (80%) of them not vaccinated against yellow fever, 67(55.8%), 33(27.5%) and 29 (24.2%) were not vaccinated against hepatitis B, COVID-19 and tetanus respectively.

Only 46 (38.3%) of the cleaners reported hand washing with soap and water for 40—60 seconds as recommended, 51 (42.5%) and 23 (19.2%) practiced hand washing with soap and water for less than 40 seconds and more than 60 seconds respectively after touching dirty surfaces.

All cleaners reported the use of protective footwear such as gum boots and closed shoes during work, while 69(57.5%), 118(98.3%), 49(40.8%), 111(92.5%) and 61 (50.8%) reported use of caps, face masks, scrub suits, heavy duty utility gloves and plastic aprons respectively as PPE during work.

Mean Practice scores were generally low among the cleaners; however, females had a slightly higher practice score (14.4/28.5) than males. Cleaners who work in the theatres had a practice score of 15.2/43.9, which is higher than that of their counterparts working on Wards and Outpatient departments (Table I). Being married, more than 5 years work experience, 5—7 days weekly working days were associated with practices (Table II). At multivariate analysis respondents who worked between 2-4 days were more likely to have good IPC practices (aOR: 0.2, P= 0.028, 95%CI: 0—0.8) compared to their counterparts who worked for more than 5 days (Table III). There was

Table II
Bivariate analysis of factors associated with IPC knowledge and practices

Factor	Knowledge		Practices	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Gender				
Female	1.0		1.0	
Male	0.6 (0.3—1.3)	0.229	0.7 (0.3—1.5)	0.309
Level of education				
None	1.0		1.0	
Primary	0.9 (0.2—4.2)	0.892	0.5 (0.1—2.6)	0.412
Secondary	0.6 (0.2—2.2)	0.409	0.8 (0.2—3.1)	0.76
Tertiary	1.4 (0.3—6)	0.652	0.8 (0.2—3.5)	0.804
Marital status				
Single	1.0		1.0	
Married	5.8 (2.5—13.3)	**<0.001***	2.9 (1.2—7)	**0.019***
Divorced	3.4 (0.3—40.7)	0.326	8.9 (0.7—109)	0.088
Widowed	1.3 (0.3—6.4)	0.755	1.8 (0.3—10.7)	0.529
Work experience				
Less than 1 year	1.0		1.0	
Between 1-2 years	5.3 (1.5—18.5)	**0.008***	2.8 (0.6—13.4)	0.194
Between 2 and 5 years	10.5 (3.1—35.2)	**<0.001***	4.1 (1—16.9)	0.055
More than 5 years	13.8 (4.3—44.1)	**<0.001***	9 (2.3—34.5)	**0.001***
Working days per week				
Between 2-4 days	1.0		1.0	
5—7 days	0.3 (0.1—0.9)	**0.027***	0.3 (0.1—0.7)	**0.006***
Monthly supervision				
Never supervised	1.0		1.0	
Everyday	0.2 (0—0.9)	**0.031***	0.3 (0.1—1.1)	0.08
Every week	0.5 (0.1—3.3)	0.485	0.5 (0.1—2.2)	0.364
Every after 2 weeks	0.8 (0.1—7)	0.84	0.4 (0.1—2.5)	0.346
Once a month	0.5 (0.1—4.7)	0.543	1.3 (0.2—8.7)	0.764
Last IPC training				
Never received training	1.0		1.0	
Less than a month ago	1.2 (0.3—4.4)	0.758	0.9 (0.2—3.9)	0.841
More than a month ago	2.1 (0.5—8.4)	0.137	1.6 (0.5—4.7)	0.435

a positive correlation between knowledge scores and practices ($P<0.001$) (Figure 1).

Discussion

The study suggests that more than half of the participants had good IPC knowledge, a finding in line with a similar study in Chinese hospitals which included environmental service workers as well as a study involving the healthcare cleaners in Ethiopia [17,18]. Although reported on findings from different population, a previous study conducted amongst Ugandan HCWs found 55% of participants to have had good IPC knowledge [19]. This similarity in reported findings can be attributed to the fact that both participants receive some degree of IPC training in a similar context. However, our findings differ from a related study among support staff at a Nepal teaching hospital where less than half of participants having sufficient IPC knowledge [20], which suggests the role of social determinants of health in knowledge acquisition and retention. Knowledge among the cleaners was greatly influenced by work experience and supervision needs, but not gender, marital status, level of education, work area, weekly days of work and duration from their last IPC training. In contrast, a similar study from Turkey found no significant influence of work experience on knowledge but rather a positive relationship between knowledge and the area of work as well as a negative correlation between knowledge and gender, or level of education [21]. Differences in similar studies may be explained by the frequency and intensity of IPC training among cleaning staff in the two countries which facilitated knowledge retention and seeking habits. The more one practices the same activity over and over again, the more they get better and learn more, hence a similar relationship between knowledge and working experience in this study compared with a similar study in Rwanda [22].

In addition, there has been an institutional neglect of cleaning and cleaners within healthcare facilities which prompts wider societal marginalisation, and lack of training. This not only affects environmental hygiene in healthcare faciltites but also does not recognise the valuable role cleaning staff play in preventing infection in healthcare [3].

In this study, theatre cleaners had higher knowledge scores compared to those on general wards and OPD attributed to the level of cleanliness and, the emphasis on asepsis in theatres which requires increased vigilance. Most cleaners (63.1%) had knowledge on waste segregation, suggesting awareness of the health hazards it poses to them. Only a third of participants

Table III
Multivariate analysis of factors associated with IPC knowledge and practices

Factor	Knowledge		Practice	
	aOR (95%CI)	*P*-value	aOR (95%CI)	*P*-value
Marital status				
Single	1.0		1.0	
Married	1.7 (0.5—5.2)	0.377	1.2 (0.4—4.1)	0.744
Divorced	0.2 (0—6.3)	0.384	1 (0—20.5)	0.977
Widowed	0.3 (0—2.8)	0.304	0.6 (0.1—5.8)	0.69
Work experience				
Between 1-2 years	1.0		1.0	
Between 2 and 5 years	5.7 (1.3—24.6)	**0.02***	1.9 (0.3—10.3)	0.462
Less than 1 year	7.2 (1.6—32.9)	**0.01***	2.4 (0.4—14)	0.327
More than 5 years	9.4 (1.9—47.8)	**0.007***	5.5 (0.9—32.5)	0.062
Working days per week				
5—7 days	1.0		1.0	
Between 2-4 days	0.9 (0.2—4.2)	0.891	0.2 (0—0.8)	**0.028***
Monthly supervision				
Never supervised	1.0		1.0	
Everyday	0.1 (0—1)	**0.045***	0.7 (0.1—3.7)	0.704
Every week	0.2 (0—2.1)	0.179	0.2 (0—1.7)	0.143
Every after 2 weeks	0.3 (0—4.5)	0.396	0.3 (0—2.2)	0.223
Once a month	0.2 (0—2.5)	0.206	1.8 (0.2—15.5)	0.588
Last IPC training				
Never received training	1.0		1.0	
Less than a month ago	2.4 (0.4—13.5)	0.316	0.6 (0.1—3.8)	0.546
More than a month ago	1.9 (0.5—6.9)	0.323	1.2 (0.3—4.4)	0.82

*$P<0.05$ (Significant).

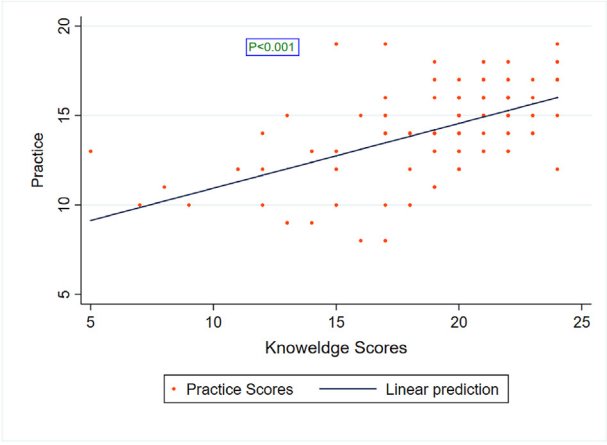

Figure 1. Relationship between IPC knowledge and practice.

demonstrated good IPC practices with mean score of 14.3±2.5. This differs from a study conducted among supportive a hospital in Sri Lanka where a mean practice score of 70.0±7.7% [23]. The differences in designing, implementation strategies and monitoring systems to ensure adherence explain this observed difference in practices.

Similar to findings in other studies in which low rates of vaccination were identified among hospital support staff [24], few cleaning staff were vaccinated against COVID-19, tetanus or hepatitis B. Only 52.8% of those vaccinated against hepatitis B had completed 3 doses which is a similar rate that reported in HCW in Wakiso district in Uganda where 57.8% were fully vaccinated [25]. This vaccination rate is low given the risk of infection associated with hospital waste and the need for prompt intervention.

This current study revealed poor hand hygiene practices where only 38.3% of the hospital cleaning staff performed hand washing for the recommended duration 40—60 seconds. This correlates poor hand hygiene practices reported among cleaning staff of a hospital in Turkey [26]. The poor compliance may be explained by the heavy workload, lack of guidance protocols and inadequate training programs [27,28]. All cleaners adhered to the use of personal protective equipment (PPE), similar to a Ghanaian study with a 90.6% compliance to PPEs among cleaning staff [29], which may be explained by the threat of infection transmission and the COVID-19 pandemic. A positive correlation between IPC knowledge and practices confirms knowledge and attitudes to health risks associated with medical waste as an important factor to drive good IPC practices [30,31] and this explains how training based on the most recent IPC guidelines improves cleaners' knowledge and skills enabling them to readily learn and consistently implement essential hygiene practices so as to reduce healthcare risks [9].

In this study, the number of years of work experience and work days per week were associated with good practice, in line with an Ethiopian study where longer experience and more in-service training significantly associated with both good knowledge and practice of infection prevention [32]. In addition, related studies reveal that provision of adequate IPC training to cleaners supports good knowledge of IPC and they

were more likely to have good IPC practice than those who were not trained. This approach may not be equally effective for all the cleaners since they are likely to have different education backgrounds which may affect knowledge retention and comprehension [9,33].

Conclusions

The majority of the cleaners in this study demonstrated good IPC knowledge but poor practice suggesting that having knowledge is not always adequate to result in behavioural change. Duration of work experience and supervision were significantly associated with good IPC knowledge while cleaners with a fixed weekly schedule were more likely to have poor practices. Overall the findings support that healthcare cleaners contribute to strategies for the prevention of HCAI. Continuous practical education and training is recommended to address existing gaps and to support the development of a successful IPC programme [34,35].

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Conflict of interest

This work is an extract from a dissertation submitted to the Makerere University Undergraduate dissertations repository in partial fulfillment of academic requirements [36]. The authors look at publishing this work as a better peer-reviewed, open-access version that fits the journal's research and authors' academic contributions. Besides this, the authors declare no other conflicts of interest regarding this work.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.infpip.2024.100376.

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