Hospital cleaners' knowledge, attitude and practices and the influence of training regarding cleaning roles in two government hospitals in the Erongo Region, Namibia

A Dissertation/Thesis presented by

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Declaration

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List of Abbreviations

CDC – Centre for Disease Control

HAI – Hospital Acquired Infections / Healthcare Associated Infections

HCW – Healthcare Workers

ICAN – Infection Control Africa Network

IPC – Infection Prevention and Control

KAP – Knowledge Attitude and Practices

MDROs - Multi-Drug Resistant Organisms

REACH – Researching Effective Approaches to Cleaning in Hospitals

UNICEF – United Nations Children's Fund

WASH – Water, Sanitation and Hygiene

WHO – World Health Organization

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Journal Requirements

This publication-ready manuscript is prepared for the International Journal of Infection Control

For original articles the word count is 5000 words.[i] The abstract should have a word count of 250 words and 5 to 10 keywords must be identified. The document must include a comprehensive list of references. The full set of requirements is appended to this research assignment.

[i] For the purposes of the research assignment, some deviation from the word count is allowed. The reason is to ensure that the examiner be provided with richer information in the Introduction section.

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Abstract

Introduction: Healthcare associated infections may arise following transfer of microorganisms from the hospital environment to patients. Effective cleaning and disinfection of hospital surfaces reduces the risk of pathogen transmission. This study explored the knowledge, attitudes and practises concerning their cleaning role and training influences of hospital cleaners at two governmental hospitals in the Erongo region, Namibia.

Methods: A cross-sectional, mixed-methods design was used. Data were collected using a structured interviewer-administered questionnaire. Participants' hospital cleaning knowledge, attitudes and practices were evaluated using quantitative analysis Open-ended questions explored their training experiences and thematic analysis was conducted.

Results: Sixty-one hospital cleaners were interviewed. Eight participants (13,1%) received formal training. In terms of knowledge 68,9% knew they could carry germs without getting sick, and 55,7% reported that wearing gloves could sufficiently protect against germs. Sixty-five percent felt that they were not supported by other staff. In terms of practices, most of the reported challenges related to absence of necessary resources. Regarding the association between current knowledge, attitudes and practices and training, significant associations were shown for most measures. With regards to whether cleaners can protect themselves against germs without getting sick, and whether they can infect others with germs that they carry, knowledge levels were lowest for those with informal training (59,7%) and job-shadowing (60,1%) (p=0,01).

Conclusion: This research study highlights limited formal training for hospital cleaners at two large Namibian hospitals, and demonstrates the need for formal training and better resource allocation of hospital cleaners who play a vital role in IPC and patient and healthcare worker safety

Keywords: hospital cleaners, training, knowledge, attitudes and practices, cleaning role
Funding: The research study was self-funded.

Introduction

Infection Prevention and Control (IPC) is defined by the World Health Organisation (WHO) as an evidence-based practical approach which aids in the prevention of infections in healthcare settings, also referred to as healthcare-associated infections (HAI).[1] Sub-optimal cleaning and disinfection of hospital surfaces such as beds, bedrails, bedside tables, privacy curtains, hospital utensils and equipment has been associated with transmission of pathogens, which may cause HAI.[2] [3]

It has been documented that bacterial organisms, including potential pathogens, can survive for weeks to months in the hospital environment.[4] Patients who occupy a hospital room of a previous patient infected with specific multi-drug resistant organisms (MDROs), are at increased risk of acquiring infection with these MDROs, suggesting that transmission can occur via the contaminated areas, despite routine cleaning efforts.[4] The HAI's caused by these pathogens can lead to adverse clinical outcomes including increased length of stay, morbidity and death.[2]

Several products are used in the cleaning process. According to the ICAN-CDCs (Infection Control Network Africa-Centre for Disease Control) *Best Practices for Environmental Cleaning in Healthcare Facilities in Resource-Limited Settings* document, detergents are a mixture of soap and surfactant and are defined as synthetic cleansing agents that can emulsify and suspend oil.[5] The surfactant aids in the removal of organic soil and oils, fats, and greases. Soaps and detergents clean surfaces but do not inactivate microorganisms. Disinfectants however are described as chemical compounds that inactivate pathogens and other microbes.[5] Cleaning with water, soap and/or detergents is not sufficient to inactivate pathogens as they do not contain antimicrobial properties.[6] Although they may physically remove pathogens during the cleaning process, cleaning with water, soap and/or detergents is not sufficient to inactivate pathogens as they do not contain antimicrobial properties.[6]

In terms of the link between HAI's and the process of cleaning and disinfection in hospitals Alfa et al.[7] undertook a study to determine whether cleaning high-touch surfaces daily with disinfectant as opposed to using non-disinfectant cleaning products such as detergents alone (with a minimum of 80% cleaning compliance) would reduce HAI's. When cleaning compliance was equal to or greater than 80% a significant reduction in Methicillin-resistant *Staphylococcus aureus,* Vancomycin-resistant enterococci and *Clostridium difficile* cases was observed.[7] The use of detergents alone however, compared to cleaning with

disinfectant, has been disputed given that it has been documented that detergent solutions may become contaminated with bacteria during the cleaning process and can thus lead to the further spread of bacteria.[4]

A report by Peters et al.[8] revealed a paucity of studies on hospital cleaning in resource-limited settings, specifically a lack of interventional studies. Cleaning methods and products reported in the literature are inconsistent, and the hospital cleaners, who are often also referred to as the environmental hygiene personnel, were said to be mostly "untrained, underpaid, unmotivated and underappreciated" by other staff in the hospital.[8] Given the findings, one can argue that hospital cleaners, even though they play a vital role in IPC have not been recognized for their role as part of the health workforce nor for their role in hospital cleaning/hygiene practices.[8]

Another study which explored the training and knowledge of healthcare workers with regards to the proper handling and disposal of healthcare waste was conducted in an academic hospital in Pretoria, South Africa. Various healthcare professionals, including hospital cleaners completed a self-administered questionnaire. The results showed that hospital cleaners were the highest number of participants (90,4%) who received training on healthcare waste management, most of whom received their training at work.[9]

Salerna et al.[10] suggests that hospital cleaners' work should be considered as a "cure-job" thus combining cleaning activities with patients' well-being. It could be argued that limited resources have been spent in the past on equipping hospital cleaners with the necessary skills to provide quality services and effective practices within the realm of their job description. Many hospitals do not have an effective structure for training hospital cleaners; thus, this category of staff is seldom trained nor are they certified. Without proper certification there is no mechanism for the advancement and quality improvement of this group of hospital cleaners as staff within health care settings. [8]

Since the outbreak of the global COVID-19 pandemic there is a new focus on the importance of IPC and WASH (water, sanitation and hygiene) practices within the healthcare system. Hospital cleaners are at the centre of these two components. The World Health Organisation (WHO) describes cleaning staff as a vital part of the health workforce especially with regards to IPC and suggests that this group be targeted for training given their role in health services delivery.[11] The WHO further states that awareness amongst hospital cleaners with regards to their role should be emphasised and training should be given so that they apply the basic

principles of IPC in their daily cleaning routines and be afforded the necessary support.[11] According to the literature as summarised by Peters et al.[8] despite advances in cleaning products and technologies, education of hospital cleaners and their integration into the healthcare system have not evolved.

The Researching Effective Approaches to Cleaning in Hospitals (REACH) study was a randomised control trial conducted in nine public and two private hospitals in Australia during 2016 and 2017. The objectives of the study were to evaluate the effectiveness of an environmental cleaning bundle to reduce HAI's and to estimate the cost-effectiveness of a decision to adopt the environmental cleaning bundle in Australian hospitals.[12] The cleaning bundle targeted communication, staff training, improved cleaning technique, product use and an audit of frequent touch-point cleaning. Nested within the REACH study was a cross-sectional questionnaire designed to explore the "knowledge, practice, attitudes, roles and perceived organizational support of environmental services staff in the hospitals participating in the REACH study."[13]

Within the Namibian context a literature search revealed no studies that focused on hospital cleaners with regards to their training or knowledge, attitudes and practices (KAP) of cleaning practices; however, one study explored the KAP of healthcare workers (HCW) with regards to waste segregation at two intermediate hospitals in Windhoek, Namibia. Part of the study population of 100 HCW's included 20 hospital cleaners. All the cleaners who were interviewed displayed good knowledge on the storage of infectious and biohazardous material. They also reported adequate knowledge on how to handle soiled linen.[14]

In this research study we aimed to establish the extent of training that hospital cleaners received, and whether there is an association between training received on cleaning practises, hygiene and infection prevention and control, and the knowledge, attitudes and practices of hospital cleaners of two governmental hospitals in the Erongo Region, Namibia concerning their cleaning role.

Methods

Study Design

A cross-sectional, mixed-methods design was used to gather the data, utilising a structured interviewer-administered questionnaire. Participants' hospital cleaning knowledge, attitudes and practices were evaluated using quantitative analysis. Open-ended questions explored hospital cleaners' experience of training and determined which domains of IPC were covered during training.

Setting

This study was undertaken in two district hospitals within the Erongo region, namely Swakopmund Hospital and Walvisbay Hospital (bed capacity 140 and 96 respectively). The region is divided into four health districts. In Namibia a district hospital typically offers in-patient services, small surgical procedures and primary health care services, and links surrounding clinics in the urban areas. These two hospitals are the largest of the four in the region and therefore consists of a larger population of hospital cleaners (88 in total). The study was conducted over a two-day period at each hospital. The hospitals were chosen for their convenience with regards to the geographical location and distance to travel.

Study Population

The study population was hospital cleaners who were employed by the Ministry of Health and Social Services in Namibia and appointed at either of the two hospitals. No official definition or classification of hospital cleaners exists within the Namibian public health service. Therefore, for the purpose of this study we defined hospital cleaners as "cleaners" working in the various hospital wards and departments, or as "labourers" who work on a rotational basis outside and inside the hospital in various departments or wards. There are also cleaners appointed at the day clinics within town, who work on a rotational basis between the clinics and the hospital.

At the time of the study, the only requirement when applying for a job as a governmental hospital cleaner was that the candidate had to be able to communicate in the national language, which is English. Candidates did not require previous experience in cleaning, however they were expected to write a test upon application. The test questionnaire typically includes questions related to public service, as well as questions about the job description

of a hospital cleaner. Shortlisted candidates who passed the test were invited for an oral interview.

Sampling

The supervisors arranged for the hospital cleaners to be available for the interviews. On the day of data collection, the daily duty sheets were used to invite cleaners to participate in the study. Voluntary participation was emphasised and they were allowed to decline and/or stop the interview at any point should they feel uncomfortable. Each participant received an informed consent form to read and sign before the interview process commenced. None of the cleaners declined to be interviewed. The interviews were voice recorded.

A non-probability convenience sampling technique was used to recruit members from the target population. The total number of cleaners comprising the study population was 88 across the two hospitals, according to data provided by the Ministry of Health and Social Services, Erongo regional offices human resources database. A total of 61 (69%) cleaners were interviewed. Power calculations show that a sample size of 61 can provide 82% power of detecting differences in attitudes and practices among hospital cleaners (assuming a significance level $\alpha = 5\%$, a standardised effect size $\delta = 0.3$ and a total population size $N = 88$).

Study Instruments and Data Collection

The data was collected by means of a semi-structured Knowledge, Attitudes and Practices (KAP) questionnaire which was interviewer-administered (Appendix 1). The questionnaire was designed by adapting the REACH (Researching Effective Approaches to Cleaning in Hospitals) study questionnaire as described in the article by Mitchell et al.[13] The questionnaire used in the REACH study was developed through research and drew on existing literature. The questionnaire was designed to include information about demographics, knowledge, reported practices and attitudes.[13] The study focused on four training components that are essential in ensuring that cleaners are conversant with their tasks and responsibilities at the workplace, namely: cleaning practices; environmental hygiene; IPC; occupational health.

Each of the sections under knowledge, attitudes and practices were expanded to 15 questions or statements. The *knowledge* part of the questionnaire included questions that focused on their duties, IPC and cleaning practices. *Attitudes* questions were directed at

how they experience their role as part of the healthcare workforce as well as how they feel about their job and colleagues. The *practices* section directed questions in terms of their everyday cleaning practices. The knowledge section included questions to which the respondents could answer using either one of the responses; “yes”, “no”, “do not know”, while the sections attitudes and practices were each measured using a Likert Scale where 1 represents strongly agree, 2 = agree,3 = disagree and 4 = strongly disagree.

The adapted questionnaire contained open-ended questions, which were not part of the original REACH study questionnaire. The primary researcher asked about demographics and included open-ended questions regarding their hospital cleaning training and employment backgrounds.

Data Analysis

The data was transferred manually from the hard copy questionnaires into a Microsoft Excel document and transferred into Stata statistical software v. 14 (StataCorp, College Station, TX). The data were cleaned and basic descriptive statistics conducted. Data analyses were carried out using default settings for variance estimation in non-simple sampling designs. A cut-off $\alpha = 0.05$ (two-side) was used to define statistical significance in hypothesis testing. A Pearson chi-square test was used to assess the association between previous training and attitudes of cleaners in the two hospitals.

Transcriptions of the open-ended questions were manually completed by the primary researcher, and categories relating to training received and experiences thereof were identified using existing categories as guides. For practices and content of training the categories were: cleaning practices, hygiene, infection control and occupational health risks. For format of training the categories were: formal, orientation, job shadowing and in-service training. These were then tabulated on an MS Excel spreadsheet. Additional themes were identified based on their training received and their experiences of the training received. A thematic analysis was manually done by the primary researcher. Codes and themes were used to identify common responses. The analysis was verified by the research supervisor.

Ethical Approval

Approval to conduct this research study was granted by the Health Research and Ethics Committee (HREC) from the University of Stellenbosch. Written permission was granted by the Ministry of Health and Social Services, Namibia to conduct the study in government facilities.

Results

Socio-demographics

A total of 61 cleaners were interviewed of which 31 worked at Swakopmund Hospital and 30 at Walvisbay Hospital (Table I). Most of the hospital cleaners were female (Swakopmund Hospital (24;77.4%); Walvisbay Hospital (18;60%)); and had attained secondary level education between grade 10 and 12 (52;85,2%). Twenty-seven (44,3%) reported having had previous cleaning jobs.

Training background

At Swakopmund Hospital 3 (9,7%) and Walvisbay Hospital 5 (16,7%) received formal training (Figure I). At Swakopmund Hospital (13;41,9%) cleaners reported that they had received in-service training compared to Walvisbay Hospital where only 6 (20,0%) had in-service training.

Training Content by hospital

Of the 31 cleaners at Swakopmund Hospital 51,6 % reported receiving training on the topic of cleaning practices; 48,4% on hygiene; 61,3% on IPC, and 51,6% on occupational health risks. (Figure II). Only 8 out of 30 cleaners from Walvisbay Hospital received training on hygiene.

Experiences of training

When exploring cleaners' training perceptions and experiences, most requested training. Some had received no training, while others who had received some form of training also expressed the desire for additional and more regular training.

Responder (SWK 5): *"I think I will be very happy if I get more and more trainings also still. I think it's not enough"*

Responder (SWK 15):" *we are not okay, we have to get some training"*

Responder (SWK 17): *"… at least we need training…at least"*

Responder (WB.7): *"Because I don't know more, I am happy for what they did for me. If there is any training I can get I'm ready and I am happy for it"*

Responder (WB 9): "No, it is not enough, especially to use the soap, because sometimes we just get the cleaning material, but I don't know how to use it…".

Responder (WB 10): *"but we really require more training about this. Like where we can attend a course or a workshop where they can show us, this is the tools, this is what you need to use, this is how you mix the chemicals…."*

Knowledge

Most (54;88,5%) felt part of the healthcare workforce. Fifty-one (83,6%) agreed that they could infect other people with the germs that they might be carrying *(See Table II)*. Fifty-seven (93,4%) indicated that through regularly washing their hands they could protect themselves and others against germs. Forty-two (68,9%) knew that healthcare workers and cleaners can carry germs without getting sick. Furthermore, 95,1% of the cleaners knew how to protect themselves against harmful practices such as when working with strong chemicals. Just over half (35;55,7%) reported that by wearing gloves they are sufficiently protected against germs.

Attitudes

The cleaners strongly agreed (47;77%) that patients are the most important people in a hospital. Similarly, most (47;77%) strongly agreed that doing a good job mattered to patients and families. Furthermore, 43 (70,5%) strongly agreed and agreed (14;23%) that they are responsible for their own safety while at work. Most (56;91,8%) were satisfied with their working environment, whilst all of them (61;100%) agreed that they knew what was expected of them at work. However, only a small proportion felt that they did not need training ((11;18.0%) strongly agreed and (9;14,8%) agreed). Additionally, they reported mostly working well with each other (52; 85%), however 40 (65,5%) felt unsupported by other ward staff and often felt overwhelmed by work demands (strongly agree (16;26,2%) and agree (24;39,3%)).

Practices

Most cleaners strongly agreed (51;83,6%) that they could reduce infections by washing their hands before they touch patient surfaces (see Table IV). Most strongly agreed (47;77%) to wearing gloves when performing a cleaning task. However, some (11;18%) reported that heavy duty gloves were not always available. Furthermore, most (45;73,8%) cleaners strongly agreed and agreed (13;21,3%) that they washed their hands at least five times per day. Only a small proportion indicated that they never washed their mops before using it ((7;11,5%) strongly agreed and (8;13,1%) agreed with the statement). Most strongly disagreed (30;49,2%) with the statement that they use the same cloth to clean different surfaces. However, the majority of the cleaners reported limited access to cleaning equipment and supplies ((strongly agreed (21;34,4%) and agreed (29;47,5%) to the statement). Cleaners had to share cleaning materials between the wards (strongly agreed (22; 36,1%) and agreed (15;24,6%)).

Association between previous training and current knowledge, attitudes, and practices for hospital cleaning

Knowledge and training

With regards to the association between the current knowledge of cleaners the various training formats are significantly associated ($p<0,01$) with all the knowledge statements, except for the following: ‘I can protect myself against harmful situations, such as when

working with strong chemicals' and; 'Latex gloves are as efficient as heavy-duty gloves' (Table V). With regards to washing of mops, the lowest level of knowledge was observed amongst those who did not receive training.

Overall, with regards to whether cleaners can protect themselves against germs without getting sick (p=0,01), and whether they can infect others with germs that they carry, knowledge levels were lowest for those with informal training (59,7%) and job-shadowing (60,1%) and was variable across the other training type categories (p<0,01). For the use of gloves and knowledge regarding the various types of gloves and general hand hygiene, the knowledge levels were also variable across the training categories, with those who had no training (100,0%) or orientation only (100,0%) correctly scoring the highest for the knowledge statement that says that regularly washing hands can protect health care workers against germs (p=0,04).

For knowledge regarding cleaning practices, namely cleaning with soap knowledge levels were lowest for those with no training (55,0%;p<0,01). For the use of cloths to clean different surfaces, knowledge was lowest for those with in-service (78,1%) and no training (68,1%). Those who were formally trained had the best knowledge scores for the statement regarding bedrails, doorknobs, patient curtains as a source of germs (100%;p<0,01).

Attitudes and training

The results showed that training and attitudes were significantly associated for all the attitude statements except for the following: I feel motivated/happy to go to work each day (p=0,07), and I like getting feedback about my work (p=0,30) (Table VI). Attitude response levels were variable across the various training types for all categories of responses (p<0.05). Those who received formal training were more likely to demonstrate positive attitudes such as asking the supervisor for help and liked to get regular feedback on their work. For the response *I am happy if one of my co-workers tells me when I am doing something wrong in my job*, those who received no training were most likely to strongly agree (94,2%).

Practices and training

When determining the association between type of training and practices, no significant association was observed with washing hands at least five times per day (p=0.23), and always wearing a facemask when working in the tuberculosis wards (p=0.31) (Table VII). Significant associations were shown for all the other measures, and the results shows that differences were variable across the training types for the various practice measures. Those who were formally trained all strongly agreed that they can help reduce infections by washing their hands before they touched patient surfaces (100%). They also strongly agreed (75,7%) that they knew how to mix and use detergents when cleaning (scoring a combined score of 73,1% for disagree or strongly disagree with the following statement: *I only clean with soap and water*).

Discussion

This study aimed to determine whether there is an association between training received on cleaning practices, hygiene and infection prevention and control, and the knowledge, attitudes and practices of hospital cleaners working in two government hospitals in Namibia.

To our knowledge this is the first such study conducted in Namibia. In line with literature, [6] [8] this study's results show that very few hospital cleaners received formal training. For example, Mitchell et al.[15] reported that all the hospitals participating in their study provided IPC training to the hospital cleaners when they were first employed. However, the scope of the training varied among hospitals from a week-long intensive course to simply being "shown the ropes" by a fellow colleague. Training information for most of the hospitals was also often unclear and not well documented.[13] Another study reported that in Bangladesh, India, Gambia, and Zanzibar, researchers found that less than a third of 56 health care facilities delivered formal training to cleaners.[16] These studies highlight that health service managers and staff may not fully understand the vital role that hospital cleaners play in preventing HAIs.[10] [11] Since the outbreak of the Covid-19 pandemic, more emphasis has been placed on the frontline workers. However, hospital cleaners are still being disregarded as part of the core group in health services delivery.[8]

Despite variation in training across this study's sample, the results suggest that these hospital cleaners have a good level of understanding of their role as it pertains to the well-being of patients as well as their role as part of the health workforce. On comparing knowledge and practice responses, there is a positive relationship between what the cleaners know and how they perform their daily tasks. Some differences between those who received formal training as opposed to those who did not receive formal training were however observed. Those without formal training had lower knowledge levels regarding how to reduce infections amongst patients and cleaning practices. They were however open to receiving feedback on their work and requested more training. Formally trained staff were more knowledgeable about disease transmission and how to mix detergents.

The findings highlight the importance of a structured and standardized approach to training hospital cleaners and the importance of ensuring that they are recognized as members of the health workforce. The global IPC guideline of 2016[17] recommends in its minimum

requirements that all patient areas must be cleaned using IPC principles. It identifies hospital cleaners as key support personnel for healthcare services delivery and recommends that they receive IPC training.[17] In 2018 Nwankwo[18] undertook a study to establish whether there is an association between training and the knowledge and practices of hospital cleaners with regards to waste management in a private hospital in Etosia, Nigeria. The study population demonstrated good practices, however there was a negative association between training and knowledge. Studies which explore the KAP of hospital cleaners regarding their cleaning role remain largely absent in the literature, particularly in low-to-middle income countries. One study, conducted during the COVID-19 pandemic in Lebanon in the Middle East, which assessed the knowledge, attitudes, and practices (KAP) of hospital cleaners towards COVID-19 and factors associated with good practices, showed that the cleaners had a good level of knowledge with regards to practices and had a positive attitude toward their work and working environment.[19] These results are similar to our findings.

In the study reported here many of the hospital cleaners reported working well with each other. However, they did not feel supported by other ward staff. It is worth noting that all cleaners agreed that it makes them happy if one of their co-workers told them when they were doing something wrong in their job, suggesting a willingness to receive feedback and to learn. They also reported that they often did not have the necessary equipment to do their work effectively, and that they often have to share equipment between wards highlighting resource limitation that is often encountered in poorly-resourced settings.

The findings of this study therefore highlight the importance of prioritising formal training. The REACH study, on which this study is based, showed that implementing a cleaning bundle (training focused on communication, staff training, improved cleaning technique, product use and audits of frequently touched areas) approach achieved cost savings of AUD $147 500.[20] The aforementioned study also suggested some revisions with regards to policies and guidelines related to hospital cleaners. Such an approach can be considered within the Namibian setting. Existing documents can be leveraged on when training. For example, the WHO and The United Nations International Children's Emergency Fund (UNICEF) have already developed many documents, including guidelines that focus on the individuals responsible for cleaning healthcare facilities.[11]

Limitations of the study

It is important to highlight that the REACH data collection tool for this study was not validated for the Namibian settings, although it is argued that the questions were general enough for the participants to understand. The sample size was small as the study focused on the two hospitals limiting the statistical approach used to identify associations between the study variables. Given the non-random selection of the districts, further generalization beyond the study population (e.g. to the whole region or country) is not possible. The results obtained regarding those cleaners who did not receive training appear to be counter-intuitive as in certain instances they tend to score better than the other categories of training, including those who have had formal training. This could suggest confounding that was not accounted for in the study. For example, those with no training may have had different characteristics than those who did not have training and this requires further investigation.

Conclusion

This research study highlights limited formal training for hospital cleaners at two large Namibian hospitals, and demonstrates the need for formal training of hospital cleaners who play a vital role in IPC and patient and healthcare worker safety. It also highlights the need to ensure that cleaners have access to the necessary materials and equipment to do their job.

Authors contributions

All the authors contributed to the study design and reviewed the manuscript. The primary researcher wrote the protocol, carried out data collection, data cleaning and statistical analysis. All authors read and approved the final manuscript.

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Appendices

APPENDIX 1: KAP questionnaire

The influence of hospital cleaner hygiene training on hospital cleaner knowledge, attitudes and practices, concerning their cleaning role in governmental hospitals in Namibia.

We are interested in finding out how to improve hospital cleaners' training and practices. However, before we can do that we need to establish what the current situation and challenges are. We are not here to evaluate you or to see whether you are doing your job. Nothing you say in this interview will have any effect on your current position.

1.1 Name and code	What is your name?	
	Insert respondent code	
1.2 Gender	*Insert the respondent's gender*	*Male* □ *Female* □
1.3 Age	How old are you?	*Age in years…….*
1.4 Hospital	Hospital where interviewed	*Swakopmund*□ *Walvis Bay* □
1.5 Educational level	What was the highest level of education that you passed?	*Primary school* □ *Secondary school* □ *Post School Certificate / Diploma*□ *Post School Degree / equivalent*□
1.6 Work Experience:	How many years have you been working in this cleaning job? ……. *years* Tell me about your cleaning job. What do you do most days? …… . …… . …… . …… . …… . *<u>Practice includes:</u>*	

	Cleaning practices □ *Hygiene* □ *Infection control* □ *Occupational health risks* □ Have you done previous cleaning jobs? Yes□ No□ Tell me about your different cleaning jobs and how long you have been at each job ……..... . …… . …… . …… .
1.7 Training	1. Please tell about any training you might have received for the cleaning job you are currently doing …… …… …… *<u>Format of training</u>*: *<u>Content of training</u>*: *Formal* □ *Cleaning practices* □ *Orientation* □ *Hygiene* □ *In-Service* □ *Infection control* □ *Job shadowing* □ *Occupational health risks* □ 2. Please tell me more about how you experienced the training process

	…… . …… . …… . …… . …… . …… . 3. Tell me about any training you might have received in the past, that is not related to your cleaning job …… . …… . …… . …… .

Knowledge

Statement	YES	NO	DO NOT KNOW
2.1 Health care workers and cleaners can carry germs without getting sick			
2.2 As a hospital cleaner I form part of the healthcare workforce			
2.3 I can infect other people with the germs that I carry			
2.4 Wearing gloves are enough to protect myself and patients against germs			
2.5 Latex gloves are as efficient as heavy-duty gloves			
2.6 Regularly washing hands can protect health care workers against germs			
2.7 Cleaning with soap alone is enough/efficient to kill germs			
2.8 I can use the same cleaning cloth for different surfaces			
2.9 I can use the same water to clean different surfaces			
2.10 I only need to change the wash water for floors once I can see the water is dirty i.e. brown			
2.11 Wet mops can carry germs			
2.12 I need to wash the mops with clean water after use			
2.13 I can protect myself against harmful situations, such as when working with strong chemicals etc.			
2.14 I only need to clean the visibly dirty areas in the patient room			
2.15 The bedrails, doorknobs, patient curtains can harbour germs			

Attitudes

	Strongly Agree 1	Agree 2	Disagree 3	Strongly Disagree 4
3.1 In a hospital the patients are the most important people				
3.2 As a hospital cleaner I play a role in the well-being of the patients				
3.3 I am responsible for my own safety and protection when I am at work				
3.4 I don't need training, I feel equipped to do my job				
3.5 I am satisfied with my working environment				
3.6 I know what is expected of me at work				
3.7 I do not always feel supported at work by other staff on the wards				
3.8 The hospital cleaners usually work very well together				
3.9 Sometimes I feel overwhelmed by work demands				
3.10 I find it easy to ask my supervisor for help				
3.11 I feel motivated/happy to go to work each day				
3.12 It matters to patients and families that I do a good job cleaning				
3.13 I get regular feedback on my work				
3.14 I like getting feedback about my work				
3.15 I am happy if one of my co-workers tells me when I am doing something wrong in my job				

Practices

	Strongly Agree 1	Agree 2	Disagree 3	Strongly Disagree 4
4.1 I can help reduce infections by washing my hands before I touch patient surfaces				
4.2 I wash my hands at least 5 times per day				
4.3 I wear gloves when performing a cleaning task.				
4.4 Heavy duty gloves are always available				
4.5 I never wash out the mops before I use it				
4.6 I always wash the mop after I use it				
4.7 I only change the floor water when it looks brown				
4.8 I use the same cloth to clean different surfaces				
4.9 I know what to do when there are spills of bodily fluids or blood				
4.10 I always wear a facemask when working with strong chemicals				
4.11 I always wear facemask when I work in the TB wards.				
4.12 I know how to mix the detergents				
4.13 I only clean with soap water.				
4.14 I do not always have the equipment and supplies to clean well				
4.15 We often must share cleaning equipment such as mops and buckets between wards.				

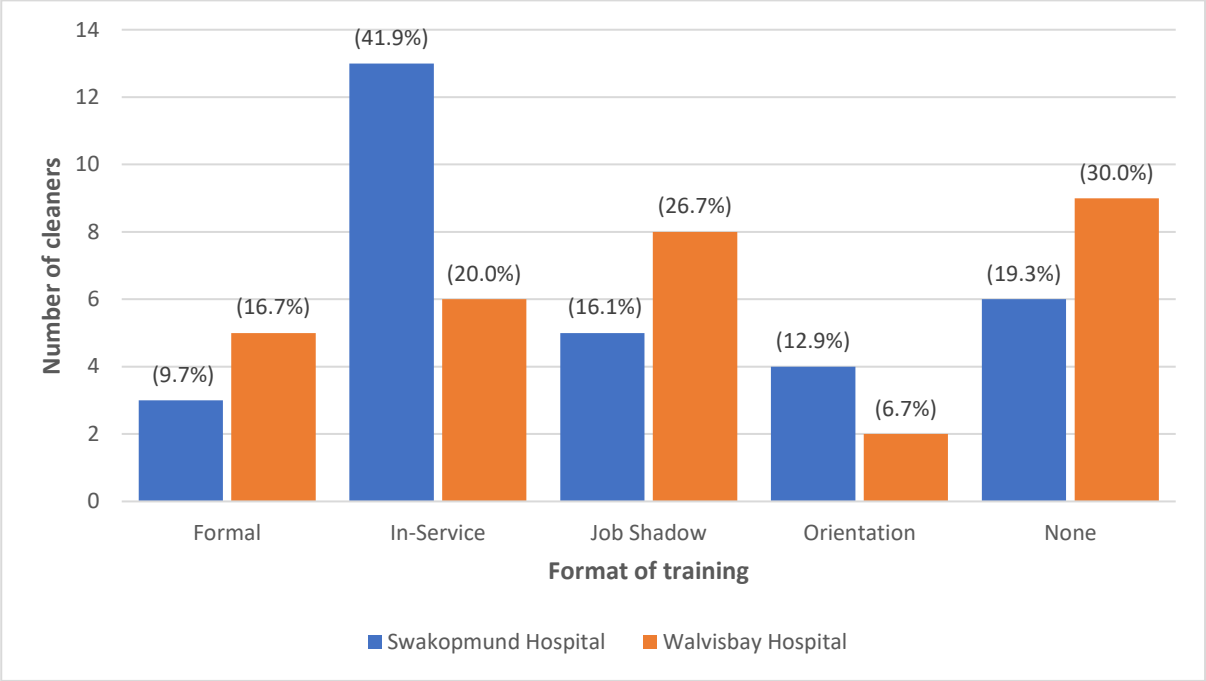
Appendix: Table I - Socio-demographic characteristics of the sample (n=61)

Table I: Socio-demographic characteristics of the sample, by hospital (n=61)

Variable	Category	Hospital		Total n (%)
		Swakopmund n (%)	Walvisbay n (%)	
Gender	Female	24 (77.4)	18 (60.0)	42 (68.9)
Educational Level	Primary	3 (9.7)	3 (10.0)	6 (9.8)
	Secondary	25 (80.6)	27 (90.0)	52 (85.2)
	Certificate	3 (9.7)	0 (0)	3 (4.9)
Previous Cleaning Jobs	No	15 (48.4)	19 (63.3)	34(55.7)
	Yes	16 (51.6)	11 (36.7)	27 (44.3)

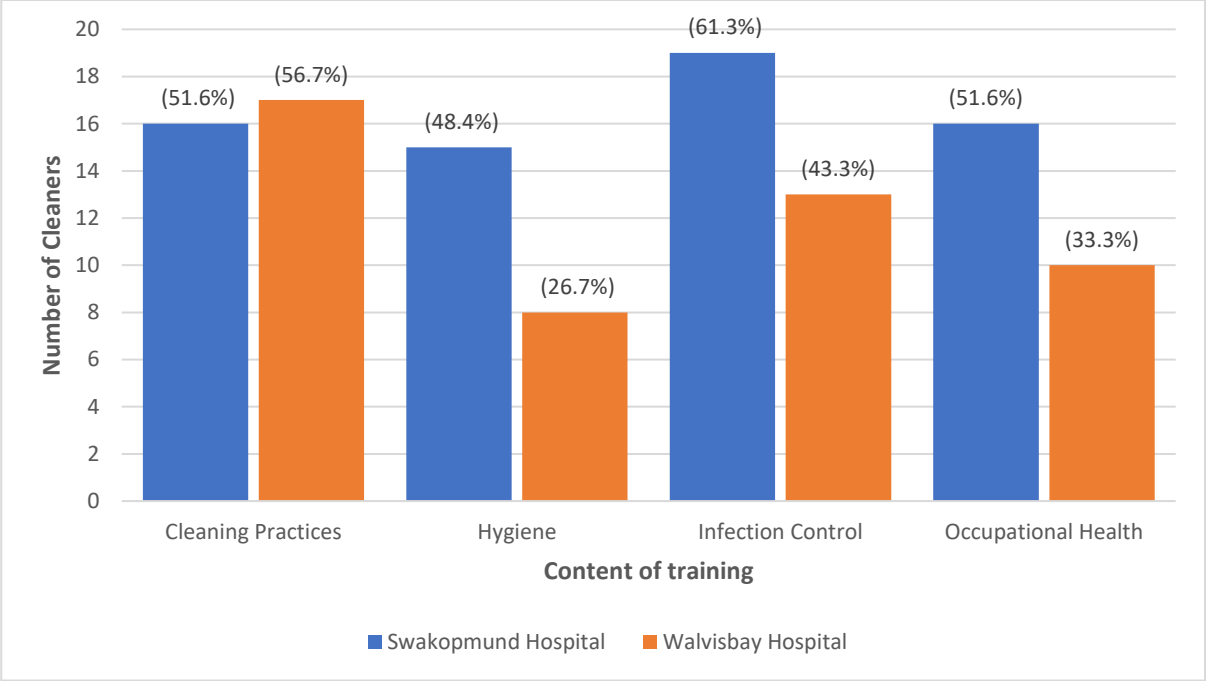
Appendix: Figure I - Format of training received

Figure I: Format of training received



Appendix: Figure II - Content categories

Figure II: Content categories



Appendix: Table II - Distribution of responses to knowledge statements (n=61)

Table II: Distribution of response to knowledge statements (n=61)

Statement	Categories	Hospital		
		Swakopmund	Walvisbay	Total
		n (%)	n (%)	n (%)
2.1. Health care workers and cleaners can carry germs without getting sick	Yes	21 (67.7)	21 (70)	42 (68.9)
	No	8 (25.8)	9 (30)	17 (27.9)
	Don't know	2 (6.5)	0 (0)	2 (3.3)
2.2. As a hospital cleaner I form part of the healthcare workforce	Yes	29 (93.5)	25 (83.3)	54 (88.5)
	No	1 (3.2)	3 (10)	4 (6.6)
	Don't know	1 (3.2)	2 (6.7)	3 (4.9)
2.3.I can infect other people with the germs that I carry	Yes	24 (77.4)	27 (90)	51 (83.6)
	No	6 (19.4)	3 (10)	9 (14.8)
	Don't know	1 (3.2)	0 (0)	1 (1.6)
2.4. Wearing gloves are enough to protect myself and patients against germs	Yes	18 (58.1)	16 (53.3)	34 (55.7)
	No	13 (41.9)	13 (43.3)	26 (42.6)
	Don't know	0 (0)	1 (3.3)	1 (1.6)
2.5. Latex gloves are as efficient as heavy-duty gloves	Yes	14 (45.2)	9 (30)	23 (37.7)
	No	16 (51.6)	19 (63.3)	35 (57.4)
	Don't know	1 (3.2)	2 (6.7)	3 (4.9)
2.6. Regularly washing hands can protect health care workers against germs	Yes	29 (93.5)	28 (93.3)	57 (93.4)
	No	2 (6.5)	2 (6.7)	4 (6.6)
2.7. Cleaning with soap alone is enough/efficient to kill germs	Yes	10 (32.3)	7 (23.3)	17 (27.9)
	No	21 (67.7)	23 (76.7)	44 (72.1)
2.8.I can use the same cleaning cloth for different surfaces	Yes	6 (19.4)	5 (16.7)	11 (18)
	No	25 (80.6)	25 (83.3)	50 (82)
2.9.I can use the same water to clean different surfaces	Yes	2 (6.5)	1 (3.3)	3 (4.9)
	No	29 (93.5)	29 (96.7)	58 (95.1)
	Yes	12 (38.7)	13 (43.3)	25 (41)
	No	19 (61.3)	16 (53.3)	35 (57.4)

2.10.I only need to change the wash water for floors once I can see the water is dirty i.e., brown	Don't know	0 (0)	1 (3.3)	1 (1.6)
2.11. Wet mops can carry germs	Yes	31 (100)	26 (86.7)	57 (93.4)
	No	0 (0)	4 (13.3)	4 (6.6)
2.12.I need to wash the mops with clean water after use	Yes	29 (93.5)	30 (100)	59 (96.7)
	No	2 (6.5)	0 (0)	2 (3.3)
2.13.I can protect myself against harmful situations, such as when working with strong chemicals etc.	Yes	31 (100)	27 (90)	58 (95.1)
	No	0 (0)	3 (10)	3 (4.9)
2.14.I only need to clean the visibly dirty areas in the patient room	Yes	2 (6.5)	4 (13.3)	6 (9.8)
	No	29 (93.5)	24 (80)	53 (86.9)
	Don't know	0 (0)	2 (6.7)	2 (3.3)
2.15. The bedrails, doorknobs, patient curtains can harbour germs	Yes	27 (87.1)	29 (96.7)	56 (91.8)
	No	3 (9.7)	1 (3.3)	4 (6.6)
	Don't know	1 (3.2)	0 (0)	1 (1.6)

Appendix: Table III - Distribution of responses to attitudes statements (n=61)

Table III: Distribution of responses to attitudes statements (n=61)

		Hospital		
		Swakopmund	Walvisbay	Total
Statement	**Categories**	**n (%)**	**n (%)**	**n (%)**
3.1. In a hospital the patients are the most important people	Strongly Agree	22 (71)	25 (83.3)	47 (77)
	Agree	6 (19.4)	4 (13.3)	10 (16.4)
	Disagree	2 (6.5)	0 (0)	2 (3.3)
	Strongly Disagree	1 (3.2)	1 (3.3)	2 (3.3)
3.2. As a hospital cleaner I play a role in the well-being of the patients	Strongly Agree	17 (54.8)	25 (83.3)	42 (68.9)
	Agree	14 (45.2)	4 (13.3)	18 (29.5)
	Disagree	0 (0)	1 (3.3)	1 (1.6)
3.3. I am responsible for my own safety and protection when I am at work	Strongly Agree	19 (61.3)	24 (80)	43 (70.5)
	Agree	9 (29)	5 (16.7)	14 (23)
	Disagree	3 (9.7)	1 (3.3)	4 (6.6)
3.4. I don't need training, I feel equipped to do my job	Strongly Agree	7 (22.6)	4 (13.3)	11 (18)
	Agree	5 (16.1)	4 (13.3)	9 (14.8)
	Disagree	14 (45.2)	15 (50)	29 (47.5)
	Strongly Disagree	5 (16.1)	7 (23.3)	12 (19.7)
3.5. I am satisfied with my working environment	Strongly Agree	12 (38.7)	16 (53.3)	28 (45.9)
	Agree	17 (54.8)	11 (36.7)	28 (45.9)
	Disagree	0 (0)	2 (6.7)	2 (3.3)
	Strongly Disagree	2 (6.5)	1 (3.3)	3 (4.9)
3.6. I know what is expected of me at work	Strongly Agree	19 (61.3)	23 (76.7)	42 (68.9)
	Agree	12 (38.7)	7 (23.3)	19 (31.1)
3.7. I do not always feel supported at work by other staff on the wards	Strongly Agree	2 (6.5)	9 (30)	11 (18)
	Agree	14 (45.2)	15 (50)	29 (47.5)
	Disagree	13 (41.9)	3 (10)	16 (26.2)
	Strongly Disagree	2 (6.5)	3 (10)	5 (8.2)
	Strongly Agree	16 (51.6)	15 (50)	31 (50.8)

3.8. The hospital cleaners usually work very well together	Agree	11 (35.5)	10 (33.3)	21 (34.4)
	Disagree	4 (12.9)	5 (16.7)	9 (14.8)
3.9. Sometimes I feel overwhelmed by work demands	Strongly Agree	4 (12.9)	12 (40)	16 (26.2)
	Agree	12 (38.7)	12 (40)	24 (39.3)
	Disagree	12 (38.7)	3 (10)	15 (24.6)
	Strongly Disagree	3 (9.7)	3 (10)	6 (9.8)
3.10. I find it easy to ask my supervisor for help	Strongly Agree	16 (51.6)	20 (66.7)	36 (59)
	Agree	13 (41.9)	7 (23.3)	20 (32.8)
	Disagree	1 (3.2)	2 (6.7)	3 (4.9)
	Strongly Disagree	1 (3.2)	1 (3.3)	2 (3.3)
3.11. I feel motivated/happy to go to work each day	Strongly Agree	19 (61.3)	24 (80)	43 (70.5)
	Agree	11 (35.5)	5 (16.7)	16 (26.2)
	Disagree	1 (3.2)	1 (3.3)	2 (3.3)
3.12. It matters to patients and families that I do a good job cleaning	Strongly Agree	21 (67.7)	26 (86.7)	47 (77)
	Agree	9 (29)	1 (3.3)	10 (16.4)
	Disagree	1 (3.2)	3 (10)	4 (6.6)
3.13.I get regular feedback on my work	Strongly Agree	7 (22.6)	10 (33.3)	17 (27.9)
	Agree	15 (48.4)	12 (40)	27 (44.3)
	Disagree	8 (25.8)	4 (13.3)	12 (19.7)
	Strongly Disagree	1 (3.2)	4 (13.3)	5 (8.2)
3.14. I like getting feedback about my work	Strongly Agree	21 (67.7)	21 (70)	42 (68.9)
	Agree	10 (32.3)	9 (30)	19 (31.1)
3.15. I am happy if one of my co-workers tells me when I am doing something wrong in my job	Strongly Agree	22 (71)	24 (80)	46 (75.4)
	Agree	9 (29)	6 (20)	15 (24.6)

Appendix: Table IV - Distribution of responses to practices statements (n=61)

Table IV: Distribution of responses to practices statements (n=61)

		Hospital		
		Swakopmund	**Walvisbay**	**Total**
Statement	**Categories**	**n (%)**	**n (%)**	**n (%)**
4.1. I can help reduce infections by washing my hands before I touch patient surfaces	Strongly Agree	23 (74.2)	28 (93.3)	51 (83.6)
	Agree	7 (22.6)	2 (6.7)	9 (14.8)
	Disagree	1 (3.2)	0 (0)	1 (1.6)
4.2. I wash my hands at least 5 times per day	Strongly Agree	21 (67.7)	24 (80)	45 (73.8)
	Agree	8 (25.8)	5 (16.7)	13 (21.3)
	Disagree	2 (6.5)	1 (3.3)	3 (4.9)
4.3. I wear gloves when performing a cleaning task.	Strongly Agree	22 (71)	25 (83.3)	47 (77)
	Agree	8 (25.8)	5 (16.7)	13 (21.3)
4.4. Heavy duty gloves are always available	Strongly Agree	8 (25.8)	4 (13.3)	12 (19.7)
	Agree	8 (25.8)	8 (26.7)	16 (26.2)
	Disagree	14 (45.2)	8 (26.7)	22 (36.1)
	Strongly Disagree	1 (3.2)	10 (33.3)	11 (18)
4.5. I never wash out the mops before I use it	Strongly Agree	2 (6.5)	5 (16.7)	7 (11.5)
	Agree	2 (6.5)	6 (20)	8 (13.1)
	Disagree	16 (51.6)	6 (20)	22 (36.1)
	Strongly Disagree	11 (35.5)	13 (43.3)	24 (39.3)
4.6. I always wash the mop after I use it	Strongly Agree	20 (64.5)	26 (86.7)	46 (75.4)
	Agree	10 (32.3)	3 (10)	13 (21.3)
	Disagree	1 (3.2)	1 (3.3)	2 (3.3)
4.7. I only change the floor water when it looks brown	Strongly Agree	8 (25.8)	13 (43.3)	21 (34.4)
	Agree	5 (16.1)	3 (10)	8 (13.1)
	Disagree	13 (41.9)	5 (16.7)	18 (29.5)
	Strongly Disagree	5 (16.1)	9 (30)	14 (23)

4.8. I use the same cloth to clean different surfaces	Strongly Agree	2 (6.5)	6 (20)	8 (13.1)
	Agree	3 (9.7)	2 (6.7)	5 (8.2)
	Disagree	14 (45.2)	4 (13.3)	18 (29.5)
	Strongly Disagree	12 (38.7)	18 (60)	30 (49.2)
4.9. I know what to do when there are spills of bodily fluids or blood	Strongly Agree	20 (64.5)	26 (86.7)	46 (75.4)
	Agree	10 (32.3)	4 (13.3)	14 (23)
	Strongly Disagree	1 (3.2)	0 (0)	1 (1.6)
4 .10. I always wear a facemask when working with strong chemicals	Strongly Agree	25 (80.6)	27 (90)	52 (85.2)
	Agree	6 (19.4)	2 (6.7)	8 (13.1)
	Disagree	0 (0)	1 (3.3)	1 (1.6)
4.11. I always wear facemask when I work in the TB wards	Strongly Agree	22 (71)	26 (86.7)	48 (78.7)
	Agree	9 (29)	3 (10)	12 (19.7)
	Disagree	0 (0)	1 (3.3)	1 (1.6)
4.12. I know how to mix the detergents	Strongly Agree	16 (51.6)	16 (53.3)	32 (52.5)
	Agree	10 (32.3)	7 (23.3)	17 (27.9)
	Disagree	4 (12.9)	4 (13.3)	8 (13.1)
	Strongly Disagree	1 (3.2)	3 (10)	4 (6.6)
4.13. I only clean with soap water.	Strongly Agree	3 (9.7)	10 (33.3)	13 (21.3)
	Agree	9 (29)	5 (16.7)	14 (23)
	Disagree	17 (54.8)	11 (36.7)	28 (45.9)
	Strongly Disagree	2 (6.5)	4 (13.3)	6 (9.8)
4.14. I do not always have the equipment and supplies to clean well	Strongly Agree	6 (19.4)	15 (50)	21 (34.4)
	Agree	17 (54.8)	12 (40)	29 (47.5)
	Disagree	7 (22.6)	3 (10)	10 (16.4)
	Strongly Disagree	1 (3.2)	0 (0)	1 (1.6)
4.15. We often must share cleaning equipment such as	Strongly Agree	8 (25.8)	14 (46.7)	22 (36.1)
	Agree	8 (25.8)	7 (23.3)	15 (24.6)

mops and buckets between wards.	Disagree	10 (32.3)	5 (16.7)	15 (24.6)
	Strongly Disagree	5 (16.1)	4 (13.3)	9 (14.8)

Appendix: Table V - Association between type of training and knowledge

Table V: Association between type of training and knowledge

Training format	Adjusted proportions of responses [%] *			p-value**
	Yes	No	Don't know	
Health care workers and cleaners can carry germs without getting sick				
Formal	73.0	27.0	0.0	0.01
In-Service	59.7	30.5	9.8	
Job-shadow	60.1	39.9	0.0	
Orientation	84.6	15.4	0.0	
None	79.7	20.3	0.0	
As a hospital cleaner I form part of the healthcare workforce				
Formal	73.0	13.5	13.5	0.01
In-Service	95.1	0.0	4.9	
Job-shadow	83.4	16.6	0.0	
Orientation	100.0	0.0	0.0	
None	86.9	5.8	7.2	
I can infect other people with the germs that I carry				
Formal	100.0	0.0	0.0	<0.01
In-Service	84.1	15.9	0.0	
Job-shadow	86.6	6.7	6.7	
Orientation	65.4	34.6	0.0	
None	81.1	18.9	0.0	
Wearing gloves are enough to protect myself and patients against germs				
Formal	51.3	48.7	0.0	0.02
In-Service	58.5	41.5	0.0	
Job-shadow	53.4	46.6	0.0	
Orientation	30.9	69.1	0.0	
None	65.3	27.5	7.2	
Latex gloves are as efficient as heavy-duty gloves				
Formal	37.8	48.7	13.5	0.13
In-Service	35.4	58.5	6.1	
Job-shadow	43.4	56.6	0.0	
Orientation	15.4	84.6	0.0	
None	40.6	53.6	5.8	
Regularly washing hands can protect health care workers against germs				
Formal	89.1	10.9	0.0	0.04
In-Service	93.9	6.1	0.0	
Job-shadow	85.0	15.0	0.0	
Orientation	100.0	0.0	0.0	

None	100.0	0.0	0.0	
Cleaning with soap alone is enough/efficient to kill germs				
Formal	13.5	86.5	0.0	<0.01
In-Service	30.5	69.5	0.0	
Job-shadow	23.3	76.7	0.0	
Orientation	0.0	100.0	0.0	
None	45.0	55.0	0.0	
I can use the same cleaning cloth for different surfaces				
Formal	0.0	100.0	0.0	<0.01
In-Service	21.9	78.1	0.0	
Job-shadow	8.3	91.7	0.0	
Orientation	15.4	84.6	0.0	
None	31.9	68.1	0.0	
I can use the same water to clean different surfaces				
Formal	0.0	100.0	0.0	0.05
In-Service	6.1	93.9	0.0	
Job-shadow	0.0	100.0	0.0	
Orientation	0.0	100.0	0.0	
None	11.7	88.3	0.0	
I only need to change the wash water for floors once I can see the water is dirty i.e. brown				
Formal	64.8	35.2	0.0	<0.01
In-Service	21.9	72.0	6.1	
Job-shadow	38.3	61.7	0.0	
Orientation	15.4	84.6	0.0	
None	63.9	36.1	0.0	
Wet mops can carry germs				
Formal	100.0	0.0	0.0	<0.01
In-Service	100.0	0.0	0.0	
Job-shadow	83.4	16.6	0.0	
Orientation	100.0	0.0	0.0	
None	85.5	14.5	0.0	
I need to wash the mops with clean water after use				
Formal	100.0	0.0	0.0	<0.01
In-Service	100.0	0.0	0.0	
Job-shadow	100.0	0.0	0.0	
Orientation	100.0	0.0	0.0	
None	88.3	11.7	0.0	
I can protect myself against harmful situations, such as when working with strong chemicals etc.				
Formal	100.0	0.0	0.0	0.57
In-Service	93.9	6.1	0.0	

Job-shadow	91.7	8.3	0.0	
Orientation	100.0	0.0	0.0	
None	92.8	7.2	0.0	
I only need to clean the visibly dirty areas in the patient room				
Formal	0.0	86.5	13.5	
In-Service	6.1	93.9	0.0	
Job-shadow	16.6	83.4	0.0	0.02
Orientation	15.4	84.6	0.0	
None	13.1	79.7	7.2	
The bedrails, doorknobs, patient curtains can harbour germs				
Formal	100.0	0.0	0.0	
In-Service	95.1	4.9	0.0	
Job-shadow	85.0	15.0	0.0	<0.01
Orientation	84.6	0.0	15.4	
None	94.2	5.8	0.0	

* = Proportions are adjusted by weighing to take into account the different response rates in the two districts

** = Pearson χ^2 test, with Rao and Scott second-order correction for sampling design (stratification, unequal response rate and finite population)

Appendix: Table VI - Association between type of training and attitudes

Table VI: Association between type of training and attitudes

	Adjusted proportions of responses [%] *				
	Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**	**p-value****
In a hospital the patients are the most important people					
Formal	62.2	37.8	0	0	
In-Service	69.5	15.9	9.8	4.9	
Job-shadow	76.7	15	0	8.3	<0.01
Orientation	84.6	15.4	0	0	
None	94.2	5.8	0	0	
As a hospital cleaner I play a role in the well-being of the patients					
Formal	89.1	10.9	0	0	
In-Service	49.9	50.1	0	0	
Job-shadow	85	6.7	8.3	0	<0.01
Orientation	65.4	34.6	0	0	
None	73.9	26.1	0	0	
I am responsible for my own safety and protection when I am at work					
Formal	48.7	51.3	0	0	
In-Service	58.5	26.8	14.7	0	
Job-shadow	93.3	6.7	0	0	<0.01
Orientation	69.1	30.9	0	0	
None	81.1	11.7	7.2	0	
I don't need training, I feel equipped to do my job					
Formal	10.9	24.3	51.3	13.5	
In-Service	20.7	11	41.5	26.8	
Job-shadow	23.3	0	60.1	16.6	<0.01
Orientation	0	15.4	34.6	50	
None	18.9	26.1	47.8	7.2	
I am satisfied with my working environment					
Formal	51.3	48.7	0	0	
In-Service	41.5	52.4	6.1	0	
Job-shadow	46.6	30	8.3	15	<0.01
Orientation	19.1	65.4	0	15.4	
None	60.8	39.2	0	0	
I know what is expected of me at work					
Formal	75.7	24.3	0	0	
In-Service	52.4	47.6	0	0	<0.01
Job-shadow	85	15	0	0	

Orientation	84.6	15.4	0	0	
None	68.1	31.9	0	0	
I do not always feel supported at work by other staff on the wards					
Formal	13.5	40.4	32.6	13.5	
In-Service	6.1	53.6	35.4	4.9	
Job-shadow	24.9	30	36.7	8.3	<0.01
Orientation	15.4	84.6	0	0	
None	34.7	46.4	5.8	13.1	
The hospital cleaners usually work very well together					
Formal	51.3	48.7	0	0	
In-Service	46.4	26.8	26.8	0	
Job-shadow	48.3	36.7	15	0	0.04
Orientation	50	50	0	0	
None	58	27.5	14.5	0	
Sometimes I feel overwhelmed by work demands					
Formal	0	64.8	35.2	0	
In-Service	29.2	36.6	24.5	9.8	
Job-shadow	16.6	45	15	23.3	<0.01
Orientation	53.7	30.9	15.4	0	
None	40.6	27.5	24.7	7.2	
I find it easy to ask my supervisor for help					
Formal	37.8	62.2	0	0	
In-Service	57.3	30.5	6.1	6.1	
Job-shadow	71.6	28.4	0	0	<0.01
Orientation	53.7	30.9	0	15.4	
None	66.7	20.3	13.1	0	
I feel motivated/happy to go to work each day					
Formal	75.7	24.3	0	0	
In-Service	58.5	35.4	6.1	0	
Job-shadow	70	23.3	6.7	0	0.07
Orientation	69.1	30.9	0	0	
None	86.9	13.1	0	0	
It matters to patients and families that I do a good job cleaning					
Formal	89.1	10.9	0	0	
In-Service	74.4	20.7	4.9	0	
Job-shadow	76.7	6.7	16.6	0	0.02
Orientation	69.1	30.9	0	0	
None	81.1	11.7	7.2	0	
I get regular feedback on my work					
Formal	35.2	64.8	0	0	<0.01

In-Service	28	40.3	20.7	11	
Job-shadow	23.3	43.4	16.6	16.6	
Orientation	0	69.1	30.9	0	
None	40.6	27.5	24.7	7.2	
I like getting feedback about my work					
Formal	75.7	24.3	0	0	
In-Service	63.4	36.6	0	0	
Job-shadow	61.7	38.3	0	0	0.3
Orientation	65.4	34.6	0	0	
None	79.7	20.3	0	0	
I am happy if one of my co-workers tells me when I am doing something wrong in my job					
Formal	75.7	24.3	0	0	
In-Service	62.2	37.8	0	0	
Job-shadow	78.3	21.7	0	0	<0.01
Orientation	65.4	34.6	0	0	
None	94.2	5.8	0	0	

* = Proportions are adjusted by weighing to take into account the different response rates in the two districts

** = Pearson χ^2 test, with Rao and Scott second-order correction for sampling design (stratification, unequal response rate and finite population)

Appendix: Table VII - Association between type of training and practices

Table VII: Association between type of training and practices

	Adjusted proportions of responses [%] *				
	Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**	**p-value****
I can help reduce infections by washing my hands before I touch patient surfaces					
Formal	100	0	0	0	
In-Service	73.2	26.8	0	0	
Job-shadow	93.3	6.7	0	0	<0.01
Orientation	84.6	15.4	0	0	
None	82.5	11.7	5.8	0	
I wash my hands at least 5 times per day					
Formal	86.5	13.5	0	0	
In-Service	73.2	21.9	4.9	0	
Job-shadow	63.3	30	6.7	0	0.23
Orientation	69.1	30.9	0	0	
None	81.1	11.7	7.2	0	
I wear gloves when performing a cleaning task.					
Formal	86.5	13.5	0	0	
In-Service	73.2	26.8	0	0	
Job-shadow	86.6	13.4	0	0	<0.01
Orientation	40.9	59.1	0	0	
None	86.9	13.1	0	0	
Heavy duty gloves are always available					
Formal	13.5	75.7	10.9	0	
In-Service	19.6	15.9	46.4	18.2	
Job-shadow	21.7	15	30	33.2	<0.01
Orientation	0	30.9	34.6	34.6	
None	26.1	20.3	39.2	14.5	
I never wash out the mops before I use it					
Formal	27	13.5	46.1	13.5	
In-Service	17	6.1	39.1	37.8	
Job-shadow	0	8.3	45	46.6	<0.01
Orientation	0	0	50	50	
None	13.1	33.3	7.2	46.4	
I always wash the mop after I use it					
Formal	64.8	35.2	0	0	
In-Service	74.4	25.6	0	0	<0.01
Job-shadow	86.6	13.4	0	0	

Orientation	84.6	15.4	0	0	
None	73.9	13.1	13.1	0	
I only change the floor water when it looks brown					
Formal	53.9	13.5	32.6	0	
In-Service	21.9	4.9	36.6	36.6	
Job-shadow	31.6	23.3	20.1	24.9	<0.01
Orientation	15.4	30.9	15.4	38.3	
None	52.2	5.8	27.5	14.5	
I use the same cloth to clean different surfaces					
Formal	13.5	0	32.6	53.9	
In-Service	17	4.9	30.5	47.6	
Job-shadow	0	0	36.7	63.3	<0.01
Orientation	0	50	15.4	34.6	
None	27.5	7.2	18.9	46.4	
I know what to do when there are spills of bodily fluids or blood					
Formal	89.1	10.9	0	0	
In-Service	58.5	36.6	0	4.9	
Job-shadow	85	15	0	0	<0.01
Orientation	69.1	30.9	0	0	
None	86.9	13.1	0	0	
I always wear a facemask when working with strong chemicals					
Formal	89.1	10.9	0	0	
In-Service	78.1	15.9	6.1	0	
Job-shadow	93.3	6.7	0	0	<0.01
Orientation	84.6	15.4	0	0	
None	86.9	13.1	0	0	
I always wear facemask when I work in the TB wards					
Formal	75.7	24.3	0	0	
In-Service	74.4	19.6	6.1	0	
Job-shadow	85	15	0	0	0.31
Orientation	84.6	15.4	0	0	
None	81.1	18.9	0	0	
I know how to mix the detergents					
Formal	75.7	24.3	0	0	
In-Service	57.3	31.7	11	0	
Job-shadow	39.9	28.4	15	16.6	<0.01
Orientation	50	34.6	0	15.4	
None	46.4	20.3	26.1	7.2	
I only clean with soap water					
Formal	27	0	59.6	13.5	0.03
In-Service	21.9	26.8	40.3	11	

Job-shadow	16.6	23.3	51.7	8.3	
Orientation	0	46.3	34.6	19.1	
None	34.7	18.9	40.6	5.8	
I do not always have the equipment and supplies to clean well					
Formal	27	73	0	0	
In-Service	29.2	41.5	24.5	4.9	
Job-shadow	31.6	45	23.3	0	<0.01
Orientation	53.7	30.9	15.4	0	
None	46.4	46.4	7.2	0	
We often must share cleaning equipment such as mops and buckets between wards.					
Formal	27	62.2	10.9	0	
In-Service	32.9	19.6	26.8	20.7	
Job-shadow	39.9	21.7	21.7	16.6	0.01
Orientation	34.6	19.1	30.9	15.4	
None	46.4	14.5	26.1	13.1	

* = Proportions are adjusted by weighing to take into account the different response rates in the two districts

** = Pearson χ^2 test, with Rao and Scott second-order correction for sampling design (stratification, unequal response rate and finite population)

References

[1] World Health Organization. About infection prevention and control [Internet]. Geneva, Switzerland. WHO. Available from: https://www.who.int/teams/integrated-health-services/infection-prevention-control

[2] Hicks D, 2016.Time to turn Cleaning Staff into Certified Technicians. [Internet]. Infection Control Tips. February 2016. Available from: https://infectioncontrol.tips/

[3] World Health Organization. Prevention of hospital-acquired infections. A practical guide. Second Edition Geneva, Switzerland. WHO. 2002. Available from: https://apps.who.int/iris/bitstream/handle/10665/67350/WHO_CDS_CSR_EPH_2002.12.pdf

[4] Doll M, Stevens M, Bearman G. Environmental cleaning and disinfection of patient areas. *Int J Infect Dis.*2018; 67: 52-57.

[5] CDC and ICAN. Best Practices for Environmental Cleaning in Healthcare Facilities in Resource-Limited Settings. Infection Control Africa Network 2019. Atlanta, GA: US Department of Health and Human Services, CDC; Cape Town, South Africa

[6] World Health Organization. Essential environmental health standards in health care. Geneva. Switzerland. WHO Available fromhttps://www.who.int/water_sanitation_health/publications/ehs_hc/en/

[7] Alfa MJ, Lo E, Olson N, MacRae M, Buelow-Smith L. Use of a daily disinfectant cleaner instead of a daily cleaner reduced hospital-acquired infection rate. *Am J Infect Control.* 2015; 43(2): 141-146.

[8] Peters A, Otter J, Moldovan A, Parneix P, Voss A, Pittet D. Keeping hospitals clean and safe without breaking the bank; summary of the Healthcare Cleaning Forum 2018. *Antimicrob Resist Infect Control. [*Internet]. 2018*;* 7:132. Available from: https://doi.org/10.1186/s13756-018-0420-3.

[9] Mugivhisa LL, Dlamini N, Olowoyo JO. Adherence to safety practices and risks associated with health care waste management at an academic hospital, Pretoria, South Africa. *Afri Health Sci*.2020; 20(1): 453-68. Available from: https://dx.doi.org/10.4314/ahs.v20i1.52

[10] Salerna S, Kolman V, Livigni L, Magrini A, Bosco MG, Talmanca IF. Women's working conditions in hospital cleaning: a case study. *Work*. 2012*;* 41(1): 4315 – 4319. Available from: DOI: 10.3233/WOR-2012-0726-4315.

[11] Storr J, Kilpatrick C, Lee K. Time for a renewed focus on the role of cleaners in achieving safe health care in low- and middle-income countries. *Antimicrob Resist Infect Control.* [Internet]. 2021*;* 10:59. Available from: doi.org/10.1186/s13756-021-00922. (accessed 26 June 2022)

[12] Hall L, White NM, Allen M et al. Effectiveness of a structured, framework-based approach to implementation: The Researching Effective Approaches to Cleaning in Hospitals (REACH) Trial. *Antimicrob Resist Infect Control*. [Internet].2020*;* 9:35. Available from: https://doi.org/10.1186/s13756-020-0694-0. (accessed 25 April 2021).

[13] Mitchell BG, White NM, Farrington A. Changes in knowledge and attitudes of hospital environmental services staff: The Researching Effective Approaches to Cleaning in Hospitals (REACH) study. *Am J Infect Control*. 2018; 46: 980-5.

[14] Haifete AN, Amukugo HJ, Iita H. Knowledge, attitude and practice of healthcare workers on waste segregation at two public training hospitals. *Eur J Pharm Med Res*. 2016; 3(5): 674-689.

[15] Mitchell BG, Shaban RZ, MacBeth D, Wood CJ, Russo P.L. The burden of healthcare-associated infection in Australian hospitals: A systematic review of the literature*. Infect Dis Health* [Internet]**.**2017;22(3):117-128.Available from: https://doi.org/10.1016/j.idh.2017.07.001.

[16] Cross S, Gon G, Morrison E, Afsana K, Ali SM, Manjang T, Manneh L, Rahman A, Saxena D, Vora K, Graham WJ. An invisible workforce: the neglected role of cleaners in patient safety on maternity units. Glob Health Action. 2019;12(1):1480085. .

[17] WHO. Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Geneva; 2016

[18] Nwankwo C. Knowledge and practice of waste management among hospital cleaners. *Occup Med* (Lond) [Internet]. 9 June2018; 68(6): 360 – 363. Available from: http://doi:10.1093/occmed/kqy078

[19] Youssef D, Abass Abou L, Hassan H. Knowledge, attitudes and practices of hospital cleaning services staff towards Coronavirus Disease-2019 (COVID-19) in a Middle Eastern country: A web-based cross-sectional study. *Research Square*. 21 June 2021. Available from: https://doi.org/10.21203/rs.3.rs-576799/v1.

[20] White NM, Barnett AG, Hall L et al. Cost-effectiveness of an Environmental Cleaning Bundle for Reducing Healthcare-associated Infections. Clin Infect Dis.2020;70: 2461-2468.