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INFECTION PREVENTION AND CONTROL TRAINING AMONG HEALTHCARE WORKERS: A SURVEY OF GAPS AND IMPLICATIONS FOR PRACTICE AT A NAMIBIAN HOSPITAL

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Abstract: Infection prevention and control is crucial in preventing the spread of infections in hospital settings and healthcare workers play a vital role in preventing such healthcare associated infections. However, globally, hospitals in low- and middle-income countries experience challenges in infection prevention and control. Such challenges shown in private hospitals to be attributed to a "lack of trained staff", and insufficient information and technology support, which therefor necessitate research in public settings. A quantitative cross-sectional study was conducted at a hospital in Namibia using non-probability convenience sampling to recruit 118 healthcare workers as participants. The study looked to identify gaps in the training of healthcare workers in infection prevention and control at the hospital. A self-administered pre coded questionnaire with was used as the research instrument to collect data. Data collected was entered on a customised Microsoft excel spreadsheet before being exported to Statistical Package for Social Science version 28 for analysis. Notably, 23% of participants felt that they had not received enough training in infection prevention and control practices during their training as health professionals. A considerable 55.9% of participants did not receive training in infection prevention and control when they started working at the hospital. In addition, 53.4% of participants did not receive any training on proper selection and use of personal protective equipment. Significantly, 71.2% of participants did not receive any follow-up training in infection prevention and control at the hospital. The study findings highlight the need for improvement in programmes targeted at training of healthcare workers on infection prevention and control in hospitals. Such training remains critical during clinical practice whilst training to be healthcare professionals, at entry into healthcare service and continuously along the provision of healthcare service to curb and prevent the spread of infections amongst patients, healthcare workers themselves and visitors to the hospitals.

Keywords: infection control, healthcare workers, hospitals, infection prevention and control, hospital training, hospital infection control

Introduction

Globally, hospitals continue to experience challenges in infection prevention and control (IPC). The gaps in infection prevention and control programmes in healthcare settings were made evidently apparent by the Covid-19 pandemic. Several countries have been found to experience deficiency in IPC implementation (Baswa et al., 2022; Fu and Xu, 2020; Savul et al., 2020;). The recent publication of the first ever global report on infection control by the World Health Organisation (WHO) in 2022 is

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evidence of the increased recognition of the importance of infection control in preventing the spread of infections in healthcare settings. These healthcare-associated infections represent a global public health challenge and are associated with significant mortality and morbidity especially in healthcare facilities where IPC is a neglected area (Savul et al.,2020). Furthermore, low- and middle-income countries (LMICs) such as Namibia experience innumerable challenges in infection prevention and control than high income countries (WHO, 2022). Such challenges worsened by the fact that majority of the population in these countries relies on receiving healthcare from public health facilities. Underfunding of healthcare, limited human resources and poor governance among other issues are challenges that affect infection control in LMICs such as Namibia (Oleribe et al., 2019). Lowe et al, 2021 highlighted that "many hospitals in Africa suffer from challenges posed by staff shortages, a lack of IPC training for personnel and poor compliance with practices, such as hand hygiene". All these being aspects that hinder the execution of programmes for adequate IPC. The challenges faced by healthcare workers with regards to IPC, puts them at an increased risk of acquiring infections in the line of duty and similarly the patients in those healthcare facilities. Needless to say, healthcare providers at healthcare facilities, have a duty of care to their healthcare workers and patients to ensure that effective adherence to infection prevention and control practices is in place at their facilities For effective implementation of IPC, adequate knowledge in infection prevention and control and strict adherence to infection control guidelines by healthcare workers, is necessary to curb the spread of healthcare associated infections and protect healthcare workers while preventing the spread of infections among patients (Haifete et al., 2016). A study in Georgia in the United States of America showed that "IPC programmes for all hospitals were not comprehensive, with many lacking defined objectives, workplans, targets, and budget" (Deryabina et al., 2021). Hence it is imperative to identify gaps in training of healthcare workers, where the necessary knowledge on infection prevention and control is acquired, especially in LMIC such as Namibia which is under resourced. At the Windhoek Central Hospital, the IPC committee restarted in 2021 after being paused due to Covid-19 pandemic and in its absence, there was no induction for new employees at the hospital in IPC practices as the hospital also experienced shortages in supplies of materials and equipment needed to train staff in IPC (Mulonda, 2023).

Olujong et al, 2013 study on health sciences students at the University of Namibia revealed differences in scores between students with regards to their knowledge in infection control. Students studying the programme of medicine had better overall scores (73%), in comparison to nursing students (66%) and radiology students at 61% (Olujong et al., 2013). Shitemo in a (2020) study focused on a private hospital in Namibia and found that majority of participants (80%) had adequate knowledge of IPC and 40% complied with the infection prevention and control practice". However, a survey by Coffey et al, 2023 revealed a "lack of trained staff, insufficient time devoted to frontline staff and insufficient information and technology support as the three main challenges faced by infection prevention and control programmes. This is particularly common in LMIC which continue to face challenges regarding adequate staff in hospitals let alone the training of such personnel on IPC. The Windhoek Central Hospital in Namibia already faces challenges relating to shortages of human resources to drive the IPC programme, lack of epidemiological surveillance of healthcare associated infections and instances where healthcare workers do not notify the IPC team of any incidences of healthcare associated infections (Mulonda, 2023). WHO (2016) highlights IPC education and training as one of the core components for infection prevention and control at facility level. Thus, the interest of our study to identify any existing gaps and facilitate improvement in the training of healthcare workers in infection

prevention and control at the hospital. The study also adds to existing body of literature in public hospitals for addressing infection prevention and control specifically in LMIC.

Materials and Methods

Study design and study setting

The study followed a descriptive cross sectional survey approach conducted at Windhoek Central Hospital, Namibia between January and March 2023. The hospital is the main referral hospital system in the public health sector in Namibia with over 80% of the population relying on the public health system, usually facing challenges such as overcrowding, long waiting times and shortages of healthcare workers (Christians, 2020). In the context of our study, the term healthcare worker referred to workers who have direct clinical involvement with patients and excluded clerical and maintenance staff. To be included in the study, participants had to be healthcare workers working at Windhoek Central Hospital at the time the study was conducted. Healthcare workers who were away on maternity leave, sick leave or study leave and thus away from the workstation during the time data was collected for this study, were excluded from the study. Non-consenting healthcare workers were also excluded from the study.

Study Population and Sampling Strategy

The study population consisted of healthcare workers from Windhoek Central Hospital including (social workers, doctors, nurses, radiographers, emergency medical practitioners, medical orthotists and prosthetists, dieticians, physiotherapists, occupational therapists, pharmacists, pharmacy assistants, medical physicists, clinical supplies assistant, audiological assistant and orthopaedic assistants). Convenience sampling was used to recruit the study participants who were purposefully sampled as healthcare workers to be potential participants in the study. The Centres for Diseases and Prevention Control (CDC) Epi Info 7 was used to calculate an appropriate sample size using a two-sided confidence interval of 95%, and a power of 80% for a cluster of 2. The targeted sample size was 196. Only 118 HCW completed the questionnaire (60% response rate).

Data Collection and Data Analysis

A structured close ended questionnaire was used as the research instrument. The construction of questions on the questionnaire was guided by current guidelines in infection prevention and control by the Centres for Diseases Prevention and Control (CDC, 2016; 2019 as updated to 2024). The set-up of the questionnaire is similar to relevant research done in South Africa by Moodley et al, 2021. The questionnaire was also constructed in consultation with a statistician at the University of Johannesburg. It was divided into sections answering biographical information and infection prevention and control training questions. The questionnaires were distributed in a convenient way by the researcher to the research participants after obtaining permission from the hospital. The estimated time to complete the questionnaire was 30 minutes. The researcher made initial visits to the various heads of department at the Windhoek Central Hospital to introduce herself and the research. The information letter and consent form were then put up on the noticeboards in all the departments at Windhoek Central Hospital. In the initial visit to the heads of department, a time for the researcher to introduce herself to the healthcare workers working in that department and the research, and distribute the questionnaires was agreed upon. During the follow up visit at the agreed time, the researcher distributed the information letter, consent

form and the questionnaire to the research participants. The researcher left a sealed box that was labelled with the research topic as well as the contact details of the researcher in the different workstations for the research participants to drop in the completed questionnaire after completion. Data entry for the study involved entering pre coded responses from each questionnaire into a customised data template. Thereafter, data editing commenced which encompassed checking the data entered for missing or inconsistent values and to detect any errors.

Data was then exported from the Microsoft excel spreadsheet to the IBM SPSS (Statistical Package for Social Science) version 28 which was the statistical software that was used for data analysis in this study. Missing values were recoded to 0 in IBM SPSS 28 and the variables were renamed with names corresponding to the questions asked in the questionnaire to ensure ease of data analysis. Data editing in IBM SPSS 28 also involved checking for any potential errors and thereafter data analysis continued. Frequencies, tables, charts, and percentages were used to summarise demographic data and outline of participants relating to infection prevention and control. Spearman's rank correlation was computed to assess the strength and direction of the relationship between the different variables, of which the majority of the variables in the study were measured on an ordinal Likert type of scale which made Spearman's correlation the most appropriate test. Furthermore, the Spearman's correlation was the appropriate test to use to measure the levels of association as it is a non-parametric test which is used to measure the direction and strength of association between two variables measured on at least an ordinal scale.

Ethical Considerations

The study protocol was approved by the Faculty of Health Sciences Higher Degree Committee (MPH HDC-01-70-2022) and Faculty Research Ethics Committee (approval number: REC-1870-2022) of the University of Johannesburg, South Africa. The participants were provided with an information letter to read and indicate agreement to participate by signing a consent form. The information letter highlighted the purpose of the research and what would be done with the data collected. They were informed of their right to withdraw any time without consequences. However, withdrawal was not possible once data was captured and submitted due to the anonymity of the study. Permission to conduct the study was also granted by the Biomedical Research Ethics Committee and Research Management Committee of the Ministry of Health and Social Services, Namibia and the Medical Superintendent's office at Windhoek Central Hospital, Namibia.

Results

Of the respondents, 52 were nurses (44.1%), 22 were medical officers (18.6%), 3 was Physiotherapist (2.5%), 6 were occupational therapist (5.1%), 4 were social workers (3.4%), and 9.3 % (n=8) were Radiographers. Othe job categories (17%) of healthcare workers that participated in the study included Audiological Assistant (n=1), Clinical supplies assistant (n=2), Dietician (n=2), Emergency Care Practitioner (n=3), Medical Orthotist Prosthetist (n=3), Medical Physicist (n=2), Orthopaedic Assistant (n=1), Pharmacist (n=3) and Pharmacy Assistant (n=3). Table 1 below shows the characteristics of participants.

Table 1: Participants characteristics of healthcare workers

Variables	**n (%)**
Gender	
Females	98 (83.1%)
Males	20 (16.9%)
Job Category	
Nurses	52 (44.1%)
Medical Officers	22 (18.6%)
Physiotherapist	3 (2.5%)
Occupational Therapist	6 (5.1%)
Social Workers	4 (3.4%)
Radiographers	8 (6.7%)
Other job categories	20 (16.9%)
missing	3 (2.5%)

Notably, 23% of participants as shown in table 2, felt that they had not received enough training in infection prevention and control practices as health professionals while 19.5% of participants neither agreed nor disagreed with the statement that they had received enough training as students in infection prevention and control.

Table 2: Participants indication of IPC training whilst as students health professionals

Question	**Responses**	**Frequency**	**Percentage**	**Valid percentage**	**Cumulative percentage**
I received enough training in infection prevention and control during my training to become a healthcare worker	Strongly disagree	10	8.5	8.5	8.5
	Disagree	17	14.4	14.4	22.9
	Neither agree nor disagree	23	19.5	19.5	42.4
	Agree	44	37.3	37.5	79.7
	Strongly agree	24	20.3	20.3	100

As illustrated in Figure 1, a significant, 55.9 % of participants did not receive training on infection prevention and control when they started working at Windhoek Central Hospital versus the 44.10% that did receive IPC training at entry into working at the hospital.

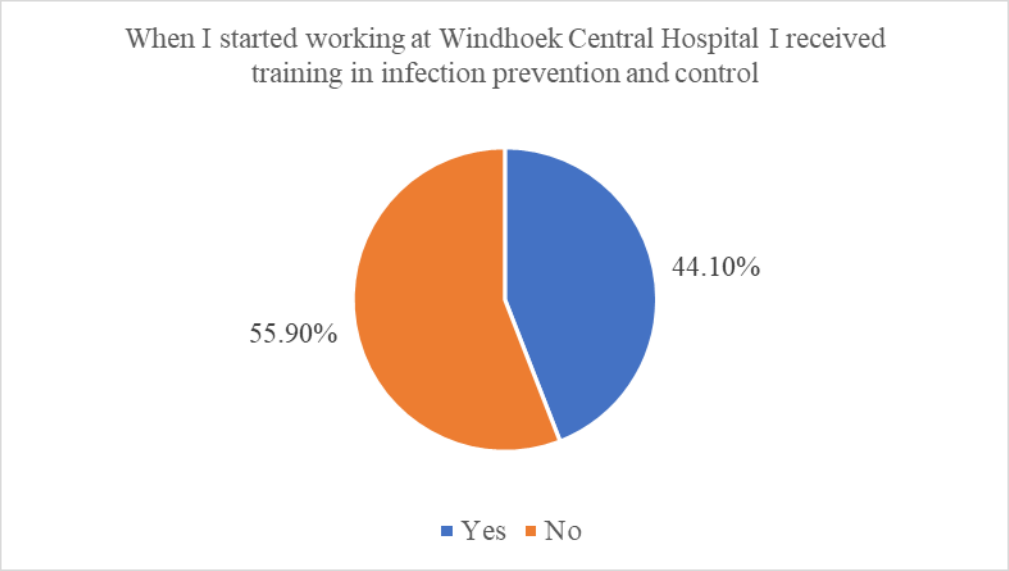

Figure 1: Participants indication of training received at entry to working at Windhoek Central Hospital

In addition, 53.4% of participants had not received any training on the proper selection, use and fit of personal protective equipment (PPE) as shown in Figure 2 versus the 46.6% of those who received some training in the proper selection, use and fit of PPE.

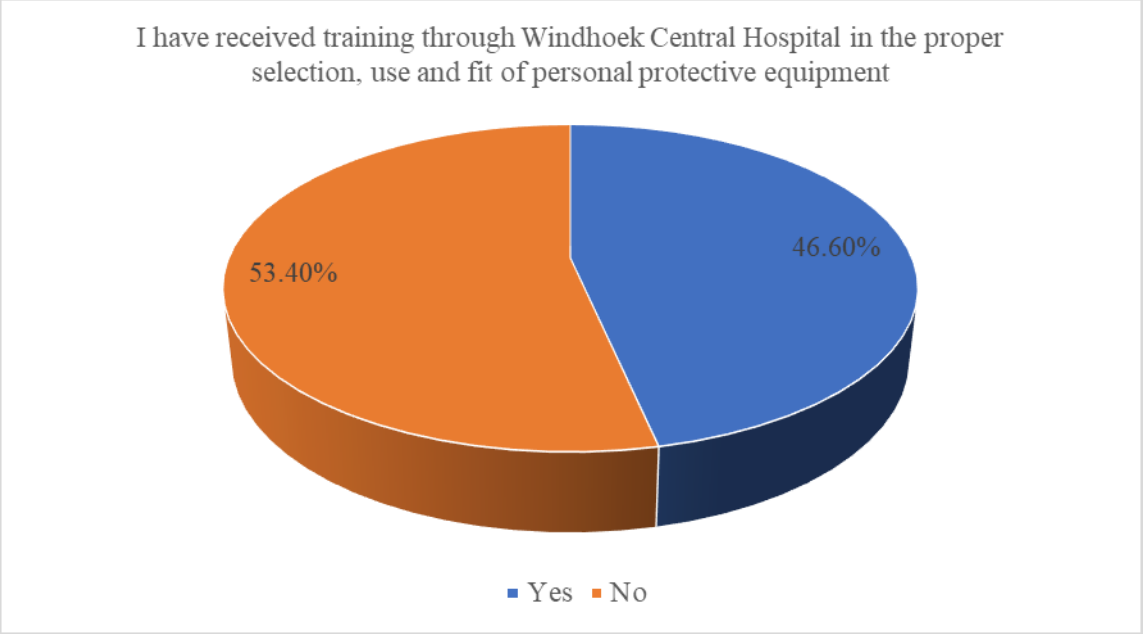

Figure 2: Participants indication of training in personal protective equipment

Significantly, 71.2% of participants had not received any follow-up training on infection prevention and control at Windhoek Central Hospital versus the 28.8% who did have some follow-up training on IPC as depicted in Figure 3.

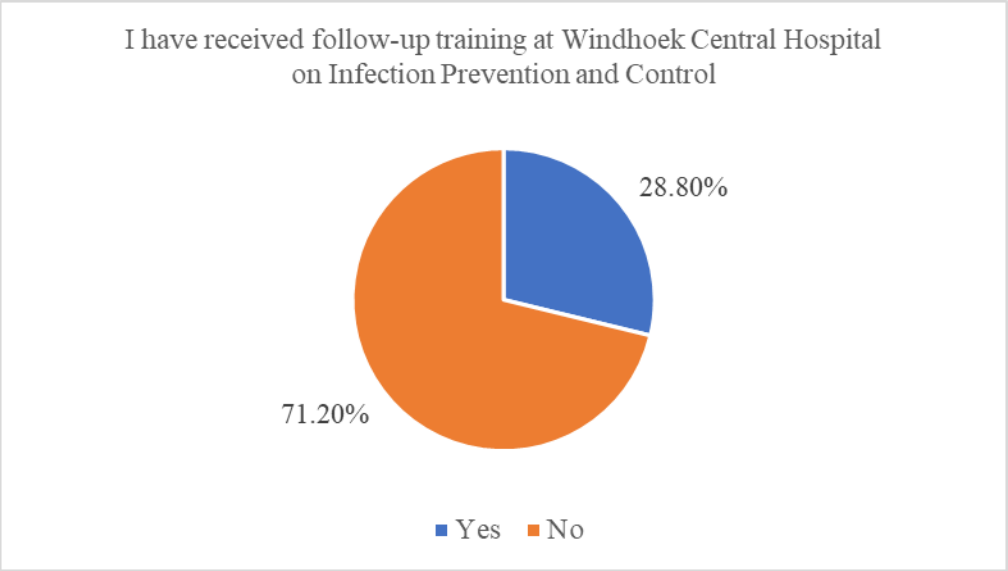

Figure 3: Participants indication of follow-up training on IPC at Windhoek Central Hospital

After running the Spearman's rank order correlation, the results revealed a negative correlation between gender and job category, n=118, r=-0.256, p-0.005. There was a negative correlation between job category and receiving enough training in infection prevention and control whilst training as a healthcare professional, n=118, r=-1.85, p= 0.046. The results revealed a positive correlation between receiving training in infection prevention and control when a healthcare worker starts working at the Windhoek Central Hospital and receiving training through the hospital on the proper selection and use of personal protective equipment, n=118, r=0.505, p= <0.01. There was a positive correlation between job category and having gone for follow-up training sessions in infection prevention and control, n=118, r=0.187, p=0.042. Mostly it was the nurses that are trained in IPC measures at the Windhoek Central Hospital.

Discussion

According to WHO, (2022), only 34% of countries reported having an IPC programme established nationally. This state of poor implementation of infection prevention and control globally is a public health concern considering that the world is grappling with emerging pathogens and antimicrobial resistance. Healthcare facilities such as the Windhoek Central Hospital, can unintentionally facilitate the transmission of infections in the hospital, increasing the risk of morbidity and mortality unless proper evidence-based and effective infection prevention strategies are put in place (Gebregiorgis et al., 2020).Thus, preliminary survey investigations such as this study on existing healthcare situations can certainly help to identify existing problems at the institutional and facility level such as hospitals. Lowe et al, 2021 indicate that little work has been done to understand the challenges faced in these settings and what works to improve IPC at the facility level. This study highlight the need for improvement in training of healthcare workers on infection prevention and control in these hospital. Such training remains critical for health care professionals during their training in clinical practice; at entry into healthcare service depending on the setting of their facilities and the challenges experienced by the community they serve. Furthermore, the training is necessary to continue along the provision of the service to curb and prevent the spread of infections amongst patients, healthcare workers themselves

and visitors to the hospitals. Emerging infectious diseases are always a reality in healthcare requiring healthcare workers who are the engines that drive health systems globally, to attend to such diseases. Never before was this heightened than during the Covid-19 pandemic, where healthcare workers were prominent at the frontline of efforts to curb the spread of the infectious disease. During this period the crucial role healthcare workers play in preventing the spread of infections including healthcare associated infections, was very evident. Additionally, strict compliance by healthcare workers to infection prevention and control precautions, approaches and strategies is vital to curb the spread of healthcare associated infections in hospitals (Alhumaid et al., 2021). For such effective measures to ensure IPC, healthcare workers need to be properly trained and competent (Qureshi et al., 2022). This needs to happen whilst they are being trained as healthcare professionals. Nalunkuma et al, 2021 mentioned the importance of training all students in health sciences in IPC and thus ensuring that all health sciences students have adequate knowledge in infection prevention and control to reduce the risk of infection transmission between them and patients during their clinical attachments in health facilities. Olujong et al, 2013 also supported mandatory training of all students in health sciences in IPC due to the fact they are exposed early to activities that increase their risk of acquiring healthcare associated infections during their clinical training in health care facilities. Ensuring that the training is mandatory will enforce training of all healthcare workers at Windhoek Central Hospital and other similar health care settings and improve approaches towards IPC. Improved infection prevention and control has been shown to be "effective and cost saving while also ensuring that healthcare workers and patients are protected and receive high-quality care" (WHO, 2022). Ensuring mandatory training in infection prevention and control for all healthcare workers in all job categories is key to ensuring adherence to IPC guidelines. Although the study did not assess whether the participants knowledge in infection prevention and control was due to other factors such as on the job learning, continual professional development courses, future studies are recommended to include this aspect. According to Khan et al, 2022 "training of all healthcare workers in infection control is important and can bring about improvement in knowledge and practice of infection prevention and control".

Conclusion

For proper infection control to be practised in the hospitals, correct knowledge is imperative thus necessitating continuous training of healthcare workers, especially in the era of emerging diseases and their infectious strains. Alhumaid et al, 2021 emphasised how knowledge of IPC procedures among healthcare workers is crucial for effective IPC and compliance with IPC measures has critical implications for healthcare workers safety and patient protection in the hospital environment. Moreover that the participants remain a frontline cohort for responses to future pandemics. Namibia's health system, already understaffed in terms of healthcare workers with reports in 2003 of an average 947 patients per registered nurse and 7,000 patients per registered doctor, would be severely strained by a depletion in available staff due to factors such as absenteeism from work as a result of acquiring infections in the hospitals (Brockmeyer and Ebert-Stiftung, 2012). Similarly with many other health systems in low- and middle-income countries in the same situation of not affording low staff turnout due to challenges with infection prevention and control. The study offered an opportunity to assess the aspect of IPC training of healthcare workers in a developing country of Namibia and present results that serve as a reference point for authorities to develop future public health approaches towards training of healthcare workers in IPC. Regular and continuous education and training of healthcare workers in IPC is recommended similarly by the WHO. Such trainings are ought to be mandatory as improved infection

prevention and control has been shown to be "effective and cost saving as well as ensuring that healthcare workers and patients are protected and receive high-quality care" (WHO, 2022).

The study was a cross-sectional study which relied only on self-reported measures thus for future research, direct observational studies of participants, to see their practical application of their knowledge from such trainings, while observing their practices in infection prevention and control is recommended. Future research may also include institutional, cultural, or resource-based barriers preventing healthcare workers from receiving proper IPC training, which was not part of our study. Additionally, longitudinal studies to assess the long-term impact of IPC training on healthcare outcomes and exploring how IPC training is integrated into healthcare curricula and its impact on healthcare practice can be incorporated into future studies. Although noting the small sample size as a limitation, the study added to the existing body of literature in infection prevention and control in hospitals crucial to global public health in addressing the spread of infections in public hospital settings.

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Declaration of Interest Statement

The authors declare that they have no conflict of interests.

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