

Exploring the experiences of operating room nurses on the infection prevention and control programme at Intermediate Hospital, Katutura, Windhoek, Namibia.

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Page | 1

Abstract Background

Infection Prevention and Control (IPC) is essential for protecting patients and healthcare workers from healthcare-associated infections (HAIs), particularly in operating rooms where invasive procedures and exposure to biological materials increase infection risks. Operating room nurses play a central role in implementing IPC measures. However, effective implementation may be influenced by availability of resources, staffing, workload, training, supervision, and institutional support. This study explored the experiences of operating room nurses regarding the implementation of the IPC programme at Intermediate Hospital Katutura (IHK), Windhoek, Namibia.

Methods

A qualitative exploratory design was employed. Ten operating room nurses were purposively selected based on predefined eligibility criteria, including a minimum of two years of operating-room experience. Data were collected through face-to-face semi-structured interviews using an interview guide. Interviews were audio-recorded with participants' consent, transcribed verbatim, and analysed thematically using Braun and Clarke's six-phase approach, with support from MAXQDA version 24.

Results

Three major themes emerged: experiences with IPC programme implementation, challenges in adhering to IPC measures, and facilitators of effective IPC implementation. Participants demonstrated knowledge of IPC practices, including hand hygiene, use of personal protective equipment, sterilisation, environmental cleaning, and waste management. However, implementation was constrained by shortages of PPE and other supplies, staffing shortages, high workloads, emergency procedures, limited refresher training, and inadequate supervision. Facilitators included accessible IPC guidelines, teamwork and peer support, supportive leadership, supervision, and continuous professional development.

Conclusion

Operating room nurses understood the importance of IPC and demonstrated commitment to infection prevention practices. Nevertheless, organisational and resource-related barriers affected consistent implementation.

Recommendation

Hospital management and the Ministry of Health and Social Services should strengthen IPC resource availability, staffing, continuous professional development, supportive supervision, monitoring, and feedback mechanisms to promote sustained compliance and patient safety.

Keywords: *Infection Prevention and Control, Healthcare-Associated Infections, Operating Room Nurses, Patient Safety, Surgical Site Infections, Namibia*

Submitted: August 04, 2026 **Accepted:** August 14, 2026 **Published:** September 01, 2026

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Introduction

Healthcare-associated infections (HAIs) remain a significant challenge to patient safety worldwide, contributing to increased morbidity, mortality, prolonged

hospitalisation, and healthcare costs (WHO, 2022). Infection Prevention and Control (IPC) programmes are essential for reducing these infections through measures such as hand hygiene, sterilisation, environmental cleaning,

and the use of personal protective equipment (WHO, 2022; MoHSS, 2023a). Operating room nurses play a critical role in implementing these measures; however, challenges in IPC implementation persist within healthcare facilities. Therefore, this study explored the experiences of operating room nurses regarding the implementation of the Infection Prevention and Control Programme at Intermediate Hospital Katutura, Namibia, to identify factors influencing effective infection prevention practices.

Methods

Study Setting

The study was conducted in the operating rooms of Intermediate Hospital Katutura (IHK), a public tertiary-level referral hospital located in Windhoek, Khomas Region, Namibia. The hospital has a capacity of 843 beds and provides comprehensive healthcare services, including surgical care, maternity services, paediatric services, outpatient and inpatient care, radiology, laboratory services, pharmacy services, HIV/AIDS treatment, and mental health services. The hospital also serves as a teaching and training institution for healthcare professionals.

Research design

The study adopted a qualitative exploratory and descriptive design to obtain an in-depth understanding of operating room nurses' experiences regarding the implementation of the IPC programme. The design enabled participants to describe their experiences, perceptions, and challenges associated with infection prevention and control practices within the operating theatre environment.

Study Population and Sampling

The study population consisted of registered operating room nurses employed at Intermediate Hospital Katutura. Purposive sampling was used to recruit participants who had direct experience with IPC implementation. Inclusion criteria required participants to have at least two years of experience working in the operating theatre. A total of ten participants were interviewed, and data collection continued until data saturation was achieved. The study excluded nurses who were not currently assigned to the operating room at Intermediate Hospital Katutura, nurses with less than two years of operating-room experience, and nurses who were unavailable during the data-collection period. Nurses who did not provide informed consent to participate were also excluded.

Research instrument

A semi-structured interview guide was used as the primary data-collection instrument. The guide was developed in English from the relevant literature and aligned with the

study objectives. It contained demographic questions and open-ended questions addressing participants' experiences of the IPC programme, challenges in adhering to IPC measures, and recommendations for improving IPC implementation.

Pilot study

Before the main data-collection phase, the interview guide was pilot-tested with two operating-room nurses who met the same eligibility criteria as the main study participants. The pilot assessed the clarity, relevance, sequencing, and comprehensibility of the interview questions and allowed the researcher to evaluate the flow of the interview and the effectiveness of probing prompts. Feedback obtained during the pilot was used to refine the interview guide and probing strategies. The pilot participants were not included in the final study sample, and data generated during the pilot were excluded from the final analysis.

Transcript verification

The interview transcripts were not returned to participants for formal review or correction after transcription. However, member clarification was used during the interviews to confirm the researcher's understanding of participants' responses and minimise misinterpretation. Audio recordings and field notes were also used to support accurate transcription and interpretation of participants' views.

Data collection

Data were collected through face-to-face semi-structured interviews using an interview guide. Interviews were conducted in a private setting within the hospital and lasted approximately 15–20 minutes. All interviews were audio-recorded with participants' consent and later transcribed verbatim for analysis.

Data analysis

Data analysis was conducted concurrently with data collection. Following each interview, the audio recording was transcribed verbatim and reviewed repeatedly to ensure familiarity with the data. The researcher was the primary and sole data coder. A data-analysis expert was consulted to provide methodological support and to enhance the rigour of the analytical process.

The transcripts were imported into MAXQDA version 24 for organisation and coding. Thematic analysis was conducted using Braun and Clarke's six-phase framework: familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. Codes with similar meanings were grouped into categories and subsequently developed into overarching themes.

Participant quotations were used to support the findings and demonstrate the connection between the participants' accounts and the identified themes.

Ethical considerations

Ethical approval for the study was obtained from the Postgraduate Research Committee of Welwitchia Health Training Centre before commencement of data collection. Ethical clearance was granted on 10 June 2025, under ethical clearance number **WUREC/2025/030**. Permission to conduct the study was subsequently obtained from the Ministry of Health and Social Services (MoHSS), the medical superintendent and the administration of Intermediate Hospital Katutura, including the Operating Room department.

Written informed consent was obtained from all participants before participation. Participants were informed about the purpose and procedures of the study, their voluntary participation, their right to withdraw at any stage without penalty, and the measures taken to protect their confidentiality and anonymity. Participant names and identifying information were not recorded, and pseudonyms/codes were used in the transcripts and report. Research data were securely stored, and access was restricted to the researcher and supervisor.

Results

Three major themes emerged from the analysis: experiences with IPC programme implementation, challenges affecting IPC implementation, and factors facilitating effective IPC implementation.

Theme 1: Experiences with IPC Programme Implementation

Participants generally expressed positive perceptions regarding the IPC programme and recognised its importance in ensuring patient safety and preventing healthcare-associated infections. Most participants reported that IPC guidelines provided clear direction for safe clinical practice and helped minimise infection risks within the operating theatre.

One participant stated:

“IPC measures are very important because they protect both patients and healthcare workers from infections during surgical procedures.”

Participants demonstrated adequate knowledge of infection prevention principles and reported routine adherence to practices such as hand hygiene, use of personal protective equipment, waste segregation, and maintenance of sterile fields during surgical procedures.

Theme 2: Challenges affecting IPC programme implementation

Despite positive attitudes towards IPC, participants identified several challenges that hindered effective implementation.

Resource Constraints

Participants frequently reported shortages of personal protective equipment, disinfectants, and sterilisation materials. These shortages were perceived as barriers to maintaining optimal infection prevention standards.

One participant explained:

“Sometimes we do not have enough protective equipment, which makes it difficult to follow all infection prevention procedures consistently.”

Staffing Shortages and Increased Workload

Staff shortages and high patient volumes were reported as major challenges. Participants indicated that increased workloads reduced the time available to strictly adhere to all IPC procedures, particularly during emergency operations.

Limited Training Opportunities

Although participants possessed basic IPC knowledge, many highlighted the lack of regular refresher training programmes. Participants believed that continuous education would strengthen compliance with evolving IPC guidelines.

Inadequate Supervision

Participants reported limited monitoring and feedback regarding IPC compliance. They indicated that regular supervision and audits could improve accountability and adherence to infection prevention standards.

Theme 3: Factors Facilitating Effective IPC Implementation

Participants identified several factors that promoted effective IPC implementation.

Continuous Professional Development

Regular training programmes enhanced knowledge and confidence in implementing infection prevention practices.

Availability of Resources

Adequate provision of PPE, sterilisation equipment, and hand hygiene facilities supported compliance with IPC guidelines.

Teamwork and Collaboration

Strong collaboration among healthcare workers encouraged shared responsibility for infection prevention and improved adherence to IPC protocols.

Supportive Leadership

Participants reported that supportive supervisors and managers contributed positively to compliance by providing guidance, resources, and encouragement.

Participant Quotations Supporting the Themes

The findings were supported by quotations from all ten participants, identified as OR1 to OR10 to maintain confidentiality. Participants described IPC as an important component of routine operating-room practice, while also identifying resource, workload, training, and institutional challenges.

OR1 explained that, although nurses were trained in IPC procedures, updates were not always communicated: *"We are trained in all the steps of sterilisation and hand hygiene, but sometimes we are not sure if the updates have reached us yet."*

OR2 highlighted the effect of staffing and workload: *"Sometimes we have two nurses for three surgeries in a row. Following every step properly is almost impossible."*

OR3 described limited refresher training: *"We rarely get formal updates. Most of what we do is from initial training or learning from colleagues."*

OR4 emphasised the effect of resource shortages: *"Even when you know the steps, without the right materials, it's impossible to follow them fully."*

OR5 described the pressure experienced during emergencies: *"In emergencies, the priority is patient survival. Some IPC steps may get shortened, which is stressful."*

OR6 emphasised the safety implications of inadequate supplies: *"It's not safe for the patient or us when there isn't enough PPE or disinfectant."*

OR7 described routine IPC practices: *"We start with proper handwashing, wear gloves and gowns, and ensure all instruments are sterilised before any surgery."*

OR8 explained the role of environmental cleaning: *"Environmental cleaning is done before and after each procedure, and we check everything twice to be sure it's safe."*

OR9 described the effect of workload and fatigue: *"Long hours and many patients make it hard to keep up with strict IPC, even if we know it's important."*

OR10 highlighted the importance of continuous training: *"Regular workshops would help us feel confident and avoid mistakes."*

Collectively, these accounts demonstrate that the nurses possessed knowledge of IPC practices and recognised their importance, but their ability to implement IPC consistently was influenced by resource availability, staffing, workload, training, teamwork, guidelines, and supervisory support.

Discussion

Knowledge and Understanding of Infection Prevention and Control

The findings indicate that operating room nurses at Intermediate Hospital Katutura generally have a good

understanding of Infection Prevention and Control (IPC) principles and recognise IPC as an essential component of safe surgical care. This suggests that the nurses are aware of the importance of measures such as appropriate use of personal protective equipment (PPE), hand hygiene, environmental cleaning, sterilisation, disinfection, and adherence to standard precautions in preventing healthcare-associated infections. The findings therefore demonstrate that IPC knowledge is present among the participants and provides an important foundation for safe operating-room practice.

However, the findings also demonstrate that having adequate knowledge does not necessarily result in consistent implementation of IPC practices. Participants described situations in which they knew the appropriate procedures but experienced difficulties in applying them consistently during emergencies, periods of increased workload, and when essential IPC resources were unavailable. This indicates a gap between knowledge and practice. In other words, nurses may understand what should be done to prevent infection, but the conditions in which care is provided may limit their ability to translate this knowledge into consistent practice.

This finding is consistent with previous research showing that healthcare workers may demonstrate positive attitudes and adequate knowledge of infection prevention while still experiencing difficulties in maintaining consistent IPC practices because of workplace constraints (Pittet et al., 2021). Similarly, Kangoya et al. (2023) reported that resource limitations and challenging working conditions can negatively affect the implementation of IPC measures in healthcare settings.

Organisational and Resource-Related Barriers to IPC Implementation

The findings further indicate that IPC implementation among operating room nurses is influenced not only by individual knowledge but also by organisational and working conditions. Participants identified shortages of PPE, disinfectants and sterilisation materials as important barriers to compliance with recommended IPC procedures. The meaning of this finding is that nurses cannot always implement prescribed IPC measures effectively when the necessary resources are unavailable. Therefore, IPC compliance should not be considered solely an individual responsibility, as nurses' ability to comply is partly dependent on the availability and accessibility of appropriate resources.

Staff shortages and consecutive surgical procedures were also identified as factors that create increased workload and time pressure. These conditions may make it difficult for nurses to complete all IPC procedures consistently,

particularly during emergencies or periods of high patient and surgical activity. The findings therefore suggest that the working environment can either facilitate or hinder effective IPC implementation. Adequate staffing, sufficient supplies and realistic workloads are consequently important organisational requirements for maintaining IPC standards in the operating room.

These findings correspond with evidence from other healthcare settings, particularly in low- and middle-income countries, where shortages of resources, staffing constraints and increased workloads have been identified as important barriers to effective IPC implementation (Kangoya et al., 2023). In the Namibian context, the Ministry of Health and Social Services has similarly emphasised the importance of adequate resources, institutional support, monitoring and continuous improvement in strengthening IPC practices (MoHSS, 2023a; MoHSS, 2023b).

Continuous Training and Updating of IPC Knowledge

The findings also indicate that continuous IPC training is necessary to maintain and strengthen nurses' knowledge and practice. Participants reported that they sometimes relied on information obtained during their initial training or from colleagues when updated IPC guidance was not formally communicated. This suggests that although nurses may possess basic IPC knowledge, the absence of regular refresher training can create uncertainty regarding changes in procedures, guidelines and recommended practices.

The finding is important because IPC guidelines and recommended practices may change as new evidence, technologies and institutional requirements emerge. Without regular opportunities for professional development, nurses may continue using previously learned practices even when updated procedures are available. The findings therefore suggest that IPC training should not be viewed as a once-off activity undertaken during initial professional preparation. Instead, it should be treated as a continuous process involving refresher training, dissemination of updated guidelines, practical demonstrations and opportunities for staff to clarify uncertainties.

This interpretation is supported by previous evidence emphasising continuous professional development as an important strategy for maintaining healthcare workers' competencies and improving adherence to IPC practices (WHO, 2023). The Namibian IPC framework also highlights the importance of continuous capacity building and strengthening healthcare workers' competencies (MoHSS, 2023a; MoHSS, 2023b).

Leadership, Teamwork and Monitoring

The findings further show that supportive leadership, teamwork and regular monitoring are important facilitators of effective IPC implementation. Participants' experiences suggest that IPC is more likely to be consistently practised when nurses work collaboratively, receive support from supervisors and operate within an environment where compliance is regularly monitored. This indicates that effective IPC implementation requires an organisational culture in which infection prevention is regarded as a shared responsibility rather than an obligation of individual nurses alone.

Supportive leadership is particularly important because managers and supervisors influence the availability of resources, staff training, enforcement of IPC policies and monitoring of compliance. Regular monitoring can also help identify gaps in practice and provide opportunities for corrective action and reinforcement of good practices. Teamwork, meanwhile, promotes shared responsibility and may help nurses remind and support one another in maintaining IPC standards, particularly during busy surgical periods.

These findings are consistent with WHO recommendations that effective IPC programmes require strong leadership commitment, adequate institutional support, monitoring and continuous quality improvement (WHO, 2022). They also support evidence from the Namibian context highlighting leadership engagement, monitoring and continuous professional development as important components of effective IPC programmes (MoHSS, 2023a; MoHSS, 2023b).

Overall Interpretation of the Findings

Overall, the findings demonstrate that operating room nurses at Intermediate Hospital Katutura have a generally good understanding of IPC principles, but the consistent application of this knowledge is influenced by the conditions in which nursing care is delivered. The central issue identified by the study is therefore not simply a lack of knowledge, but the interaction between nurses' knowledge and the organisational environment. Resource shortages, staff shortages, workload pressures and limited access to refresher training can prevent nurses from consistently translating their knowledge into practice.

The findings consequently suggest that improving IPC compliance requires a multifaceted approach. Strengthening nurses' knowledge through continuous training is important, but it should be accompanied by adequate provision of PPE and other IPC materials, appropriate staffing levels, supportive leadership, effective teamwork and regular monitoring. IPC should therefore be understood as both an individual professional responsibility and an institutional

responsibility. Sustainable improvement in IPC practices at Intermediate Hospital Katutura will require both competent and knowledgeable nurses and an organisational environment that enables them to consistently apply recommended IPC practices.

Page | 6 Generalisability and Transferability

The findings of this qualitative study are not statistically generalisable to all operating room nurses in Namibia because the study was conducted at a single public tertiary hospital and involved a purposively selected sample of ten nurses. However, the findings may be transferable to operating-room environments with similar organisational, staffing and resource conditions. Transferability is supported by the detailed description of the study setting, participant characteristics, operating-room environment and contextual factors influencing IPC implementation. Readers and healthcare managers in similar settings may therefore assess the relevance of the findings to their own institutions. The findings may be particularly useful to other public hospitals in Namibia that experience comparable challenges relating to IPC resources, staffing, workload, training and supervision.

Limitations

This study had several limitations. First, it was conducted at a single tertiary hospital in Windhoek, Namibia, which limits the transferability of the findings to other healthcare institutions with different organisational and resource contexts. Second, the sample consisted of only ten operating room nurses selected purposively, and their experiences may not represent the views of all nurses working in operating rooms in Namibia. Third, data were based primarily on participants' self-reported experiences, which may have been influenced by recall or social desirability bias. Finally, the study focused on nurses' perspectives and did not include other healthcare professionals, hospital managers, or direct observational assessment of IPC practices. Nevertheless, the use of semi-structured interviews, participant quotations, purposive sampling, and thematic analysis provided in-depth insight into the experiences of operating room nurses at Intermediate Hospital Katutura.

Recommendations

The Ministry of Health and Social Services and hospital management should ensure consistent availability of infection prevention resources, including personal protective equipment and sterilisation supplies. Regular refresher training programmes should be implemented to strengthen staff competencies and maintain compliance with evolving IPC guidelines. Furthermore, healthcare facilities should strengthen staffing levels, supportive supervision,

and routine IPC audits to enhance accountability and improve patient safety outcomes.

Acknowledgement

The author acknowledges Welwitchia University/Welwitchia Health Training Centre for academic and institutional support. Sincere appreciation is extended to Dr. Teopolina Enkono for her guidance and supervision throughout the study. The author also acknowledges the management and staff of Intermediate Hospital Katutura for granting permission to conduct the study and thanks all operating room nurses who participated and shared their experiences. Appreciation is further extended to colleagues, friends, and family for their encouragement and support throughout the research process.

List of Abbreviations

Abbreviation Full Term

COVID-19	Coronavirus Disease 2019
HAI	Healthcare-Associated Infection
IHK	Intermediate Hospital Katutura
IPC	Infection Prevention and Control
MoHSS	Ministry of Health and Social Services
OR	Operating Room
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment
WHO	World Health Organization

Source of Funding

The study did not receive any external funding. The research was self-funded by the author.

Conflict of Interest

The author declares that there are no conflicts of interest associated with this study, its authorship, or publication.

Author contributions

Hortensia Ndeumona Ndeshihafela Kamati: Conceptualisation, study design, literature review, methodology, data collection, data analysis, interpretation of findings, manuscript preparation, revision and final approval of the manuscript.

Dr. Teopolina Enkono: Research supervision, methodological guidance, critical review of the research work, revision of the manuscript, and final approval of the manuscript.

Data availability

The qualitative data generated and analysed during this study are not publicly available because they contain potentially identifiable information relating to healthcare professionals and were collected under conditions of confidentiality. The data are securely stored, and access is

restricted to the researcher and supervisor in accordance with the ethical requirements of the study. Reasonable requests for access to anonymised data may be considered by the corresponding author, subject to ethical and institutional approval.

Page | 7

Author biography

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PUBLISHER DETAILS:

Student's Journal of Health Research (SJHR)

(ISSN 2709-9997) Online

(ISSN 3006-1059) Print

Category: Non-Governmental & Non-profit Organization

Email: studentsjournal2020@gmail.com

WhatsApp: +256 775 434 261

Location: Scholar's Summit Nakigalala, P. O. Box 701432,
Entebbe Uganda, East Africa

