

Influence of Organizational Factors on ICU Nurses' Preventive Behaviors for Nosocomial Infections in Three Tertiary Hospitals in Botswana

Thatayotlhe Botsalano^{1*}, George Njoroge¹, Ramalingam Ramani²

¹Department of Nursing Education, Leadership, Management & Research, School of Nursing Sciences, Mount Kenya University, Kenya

²Department of Pharmaceutical Chemistry, School of Pharmacy, Mount Kenya University, Kenya

Abstract: **Background:** Nosocomial infections (NIs) are one of the leading causes of morbidity and mortality in hospital settings, particularly in the ICUs. In Botswana, their prevalence in the ICUs was estimated at 9.2% in 2023. They continue to remain a burning issue in healthcare facilities affecting not only patients but also causing financial burden to the healthcare institutions. Nurses play a vital part in the prevention of NIs. Several studies have been done to investigate NIs, however, the determinants of NIs preventive behaviors among ICU nurses have not been investigated by researchers in Botswana. The study aimed at assessing the organizational determinants of NIs preventive behaviors among ICU nurses in three tertiary hospitals in Botswana. **Methodology:** A cross-sectional study was conducted with a sample of 107 ICU nurses obtained from a target of 129 ICU nurses by purposive sampling. The study criteria included nurses in the adult ICU, PICU and NICU with more than 6 months' experience in the ICU settings from the three hospitals in Botswana. Data was collected from 95 respondents with a self-administered online questionnaire designed on Google Forms. Pre-testing of the tool was done to evaluate the validity of the tool on 10% of the sample size. All data was analyzed using SPSS version 27. A logistic regression analysis was done to assess the relationship between dependent and independent variables and, Chi-square tested the hypotheses. Additionally, tables and graphs were used to present data. **Results:** The study findings revealed significant gaps in organizational support for NIs prevention. A large proportion of respondents (93.7%) confirmed the availability of IPC policies and guidelines in their hospitals. Only 24.2% indicated that IPC training schedule was available, and a mere 17.9% reported routine IPC training was done highlighting a substantial training gap. **Significance & Implications:** In conclusion, the study clearly demonstrates that organizational support is a critical enabler of effective NIs preventive behaviors among ICU nurses in Botswana. While having IPC policies is a positive step, their practical implementation through resource provision, routine training, and infrastructure support is essential. Strengthening institutional capacity across these dimensions is vital for fostering a consistent, safe, and responsive infection control culture in critical care settings both in Botswana and globally. A customized framework should be developed and adopted for ICU settings, distinct from general IPC protocols to enhance relevance and address the unique challenges in critical care units.

Keywords: Nosocomial, infections, Botswana, ICU.

1. Introduction

A. Background

Nosocomial infections (NIs) also known as healthcare-associated infections (HAI), are infections acquired by patients throughout hospitalization while receiving care (Sikora & Zahra, 2023). They are usually not present during the patient's time of admission but occur in the hospital after the patient has been admitted and even after they have been discharged. NIs are one of the leading causes of morbidity and mortality in hospital settings, particularly in the ICUs. The prevalence of NIs exceeds 25% in ICUs worldwide (Webb *et al.*, 2016).

The WHO 2011 data reported the global burden of NIs in the Intensive care unit (ICU) in high-income countries to be around 30%, however, the incidence in low/middle-income countries was reported at least 2 to 3 times higher. Abubakar *et al.* (2022), states that the point prevalence of NIs in Africa is at least two times higher than in developed countries, and the rate was found to be higher in the ICU and neonatal Intensive care unit (NICU). African countries constantly face natural crises such as water shortages, drought, lack of resources, and low economic status which can influence the occurrence of NIs.

There is variation in the distribution of NIs in Sub-Saharan Africa (SSA) which points towards the need for implementation of better strategies and prevention measures. A systematic review of NIs in Sub-Saharan Africa (SSA) revealed that NIs rates range from 21.2% to 35.6% in the ICU (Mbim *et al.*, 2016). In Botswana, a study was carried out in one leading referral hospital to estimate the burden of NIs and describe their current trends. It was found out that the prevalence was 100% in the ICU, the nephrology unit prevalence was 50% followed by the NICU with 41.9% prevalence (Mpinda-Joseph *et al.*, 2019). According to the study, most infections were SSI, VAP, and decubitus ulcer infections. The majority of the infections were associated with ward overcrowding, non-adherence to aseptic techniques, and poor hygiene.

According to Monegro *et al.* (2023), some of the risk factors associated with NIs include duration of stay in the hospital, invasive procedures, older age, immunosuppression and long stay in the ICU. Other factors include nurse's workload,

*Corresponding author: botsalanothesis2024@gmail.com

knowledge, training and experience. Although these infections are caused by poor health standards in hospitals, and poor hygiene practices by both patients as well as hospital staff, the main leading cause is non-compliance to health guidelines of hospitals (Raoofti *et al.*, 2023). NIs continue to remain a burning issue in healthcare facilities affecting not only patients but also causing financial burdens to the healthcare system. The effect of NIs is not just seen at an individual level, but also at the organizational level as they have been linked to multidrug-resistant infections (Monegro *et al.*, 2023).

Although it is difficult to get rid of NIs even in the most advanced hospitals, policies and procedures can be observed with the intention of minimizing or getting rid of them (Gazzarata *et al.*, 2020). NIs in the ICU can be controlled by compliance with infection control measures, antibiotic control policy and healthcare organizational support. The optimal approach to reducing NIs in critically ill patients remains unclear, however recent studies and major quality initiatives have shown that education –based strategies can decrease NIs rates in the ICU (Webb *et al.*, 2016).

B. Statement of Problem

The researcher has observed in the field that NIs appear to be a hidden cross-cutting problem in most hospitals in Botswana particularly in the ICU. In Botswana, the prevalence of NIs in ICU was estimated at 9.2% from January 2014 to December 2023 (Melariri *et al.*, 2024). The current retrospective data collected by the researcher has revealed high prevalence rates in the ICUs in the two tertiary hospitals in Botswana. Princess Marina hospital (PMH) has recorded about 28.1% prevalence in the adult ICU between July and December 2024. Nyangabgwe referral Hospital (NRH) recorded a prevalence of 30.5% in the adult ICU and 29% in the NICU between April and September 2024. In comparison, Sir Ketumile Masire teaching Hospital (SKMTH) lacked adequate statistical reporting particularly in the ICUs hence the burden could not be established. The current mortality NIs in the ICUs is unknown due to inadequate reporting in the three institutions. The risk is higher in ICU because of the patients' multiple underlying conditions, prolonged use of antimicrobial therapy, presence of invasive medical devices as well as mechanical ventilation.

Moreover, in PMH, NRH and SKMTH nurses in the ICU are short-staffed and most of the time the nurse-patient ratio is between 1:2 to 1:3 which influences their NIs preventive behaviors. Additionally, PMH had outdated Standard operating procedures (SOPs) that guides NIs prevention while in NRH most of the relevant SOPs for NIs handling in the ICUs are missing. Despite the efforts to prevent these infections they continue to cause negative impact globally; they remain a burning issue and no health institution can claim to have solved yet. Therefore, understanding the determinants influencing NIs preventive behaviors among ICU nurses is very vital. This research intends to address the knowledge gap in this topic by unveiling determinants of NIs preventive behaviors among ICU nurses to direct tailor-made interventions that address unique challenges faced by ICU nurses. The purpose of this study is to

assess the determinants of NIs preventive behaviors among ICU nurses in three tertiary hospitals in Botswana.

C. Specific Objective

To assess the organizational determinants of nosocomial infections preventive behaviors among ICU nurses in three tertiary hospitals in Botswana.

D. Research Question

1. What are the organizational determinants of NIs preventive behaviors among ICU nurses in the three tertiary hospitals in Botswana?

E. Hypothesis

H1: There is statistically significant relationship between organizational determinants and nosocomial infection (NIs) preventive behaviors among ICU nurses

2. Literature Review

A. IPC Training

Infection prevention and control training is another factor influencing adherence to infection control measures. According to Salu *et al.* (2023), in-service training directly influences the nurse's knowledge of NIs prevention. In the study done by Salu, nurses who had undergone in-service training or workshops in IPC were about 10 times more knowledgeable about IPC measures than those who had never attended the training. The same conclusions were made by Desta *et al.* (2018) study revealed that healthcare professionals who did not take IPC training were less knowledgeable about infection control measures than those who had taken the course. However, it is not clear as to whether having acquired knowledge positively affected their NIs preventive behaviors. A similar study assessed the practice of nurses in the NICU regarding NIs prevention showed that 55% of the nurses had never attended any training on NIs even though 60% of them showed good practice of preventive measures (Gulia *et al.*, 2022). Therefore, it can be concluded that training in IPC can be a predictor of NIs preventive behavior among ICU nurses.

Poor practice can also result from a lack of infection control workshops for nurses or simply nurses not attending these workshops for some other reasons. Training on IPC measures increases nurse's level of knowledge which will consequently improve their practice. Therefore, there is a need for policymakers to provide in-service training regularly for ICU nurses so that they are updated with current knowledge to practice effectively.

B. Resources

A study done by Desta *et al.* (2018) in Ethiopia has revealed that 33% of nurses do not use infection prevention supplies due to unavailability of prevention supplies, 25% of nurses in that study did not use the supplies because of carelessness whereas 30% were due to fact that they do not perceive exposure. Nurses who get an adequate supply of resources such as soap and PPE will easily meet the IPC standards (Gulia *et al.*, 2022). Moreover, nurses are more likely to comply with infection

control measures when they have sufficient resources. Some studies state that environmental causes such as lack of access to PPE, workload, and overcrowding in the ward can have a major impact on compliance with infection control measures (Mahdizadeh *et al.*, 2021). This may be because no matter how the nurses are aware of the policies and standards, resources can still limit their practice, as well as lack of knowledge.

C. Policies and Guidelines

Some studies have revealed that social support including organizational and managerial support had substantial effect on adherence to standard precautions such as hand hygiene (Mahdizadeh *et al.* 2021). Therefore, health institutions should offer support to nurses through policies and guidelines which makes the work easier for them to do. The presence of IPC policies and guidelines have been found to improve quality care as well as service delivery in hospitals. Adherence to IPC guidelines is another factor that can be associated with the NIs preventive behavior among ICU nurses. The availability of IPC guidelines in a facility will increase nurses' probability of adherence to NIs preventive behaviors. Desta *et al.* (2018) revealed that nurses who adhered to IPC guidelines were four times more likely to engage in infection prevention activities than their counterparts. At times nurses are not knowledgeable about IPC manual, either they do not know about it or it is not available in the facility and this can affect their practice.

3. Methodology

This study employed a quantitative method approach. An analytical Cross-sectional study was used to assess the determinants of NIs preventive behaviors among ICU nurses. This study area encompasses three tertiary hospitals in Botswana; Princess Marina Hospital (PMH), Nyangabwe Referral Hospital (NRH) and lastly Sir Ketumile Masire Teaching Hospital (SKMTH). The target population encompassed nurses in all ICUs; adult ICU, pediatric intensive care unit (PICU), and neonatal intensive care unit (NICU) in the three hospitals. The non-probability sampling method; purposive sampling was used. In total 129 ICU nurses were the target population for this study. The sample size was calculated using Cochran's formula of which a sample size of 129 nurses was obtained and 95 nurses responded to the questionnaires.

The structured survey questionnaire was designed on Google Forms and consisted of close-ended questions. The tool was pretested on 10% of the sample size prior to data collection to test the tool's reliability. A physical informed consent was sought from the respondents before it was administered. The collected data was coded, categorized, and entered into Epi-data software. Data was analyzed using Statistical Package for Social Science (SPSS) version 27.0. Descriptive findings were

analyzed to generate factual statistical parameters such as mean, percentages, standard deviations, and frequencies to examine relationships between variables. Approval and ethics clearance was obtained from the Mount Kenya University Ethical Committee. Research permit was granted by the Ministry of Health Research Development Committee (HDRC) in Botswana.

4. Results

Table 2
Demographic characteristics of ICU nurses in three hospitals

Demographic characteristics		F	%
Age cluster	21 - 30 years	27	28.4%
	31 - 40 years	37	38.9%
	41 - 50 years	23	24.2%
	51 - 60 years	7	7.4%
	Above 60years	1	1.1%
Gender	Female	70	73.7%
	Male	25	26.3%
Educational level	Diploma	59	62.1%
	Degree	30	31.6%
	Masters	6	6.3%
	PhD	0	0.0%
Specialty in ICU	Yes	25	26.3%
	No	70	73.7%
ICU work experience	7 months - 3 years	39	41.1%
	4 - 6 years	24	25.3%
	7 - 10 years	12	12.6%
	Above 10 years	20	21.1%
ICU sub-section	Adult ICU	49	51.6%
	Pediatric ICU	14	14.7%
	Neonatal ICU	32	33.7%
Type of facility	Public	61	64.2%
	Private	0	0.0%
	Parastatal	34	35.8%

Table 1 shows the demographic characteristics of respondents. A significant majority of respondents were females (73.7%) compared to males (26.3%). Most participants held diplomas (62.1%), followed by degrees (31.6%), and only a small number held master's degrees (6.3%). Notably, none of the respondents had a PhD. Out of 95 respondents 64.2% were from public hospitals; 34 of them from PMH and 27 were from NRH. The other proportion which is 35.8% were from a parastatal hospital (SKMTH). Majority of the respondents were based in the adult ICU (51.6%) followed by neonatal unit (33.7%) and pediatric unit recorded 14.7% responses. Moreover, out of all respondents only 26.3% (n= 25) had ICU specialty and majority (73.7%, n = 70) of the respondents based in the ICUs were not ICU trained. A substantial proportion (41.1%) had 7 months to 3 years of ICU experience, and 21.1% had over 10 years' experience.

The findings from Table 2 reveal significant gaps in organizational support for nosocomial infections prevention. While a large proportion of respondents (93.7%) confirmed the

Table 1
Nurses rating on the organizational determinants of nosocomial infections preventive behaviors among ICU nurses

Organizational Determinants	Yes		No	
	F	%	F	%
Is there availability of IPC policy and guidelines in your hospital?	89	93.7%	6	6.3%
Is there an availability of risk assessment tools in the unit?	59	62.1%	36	37.9%
Is there availability of an IPC training schedule for the unit?	23	24.2%	72	75.8%
Is there availability of PPE in the work area at all times?	40	42.1%	55	57.9%
Does the hospital do routine IPC training for all ICU nurses?	17	17.9%	78	82.1%

Table 3

Chi Square Test on the on the organizational determinants of nosocomial infections preventive behaviors among ICU nurses

Chi-Square Tests			
	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.504 ^a	3	.001
Likelihood Ratio	18.643	3	.000
Linear-by-Linear Association	8.904	1	.003
N of Valid Cases	95		

availability of IPC policies and guidelines in their hospitals, this alone is not sufficient without reinforcement through actionable resources and programs. To further examine the association between organizational determinants and nosocomial infections preventive behaviors among ICU nurses, a Chi-square test was conducted. The purpose of this test was to determine whether there is a statistically significant relationship between institutional-level factors (such as availability of IPC guidelines, PPE, training schedules, and infrastructure) and the observed behaviors of ICU nurses regarding infection prevention. Table 3 presents the Chi-square test results, including Pearson Chi-Square, Likelihood Ratio, and Linear-by-Linear Association statistics.

The Pearson Chi-Square value is 17.504, with 3 degrees of freedom (df) and a p-value of .001, indicating a statistically significant association between organizational determinants and NIs preventive behaviors. This finding confirms that the organizational context in which nurses operate such as the presence or absence of necessary resources, policies, and training has a direct impact on whether or not they comply with infection control protocols. The Likelihood Ratio test (18.643, $p = .000$) reinforces this significance, providing additional statistical strength to the association. Moreover, the Linear-by-Linear Association test yielded a value of 8.904 with a p-value of .003, suggesting a linear trend: as organizational support increases (e.g., more access to PPE, better training, availability of water), preventive behaviors also improve.

Based on the Chi-square analysis presented in Table 3, we accepted the alternative hypothesis, which posited that there is statistically significant relationship between organizational determinants and nosocomial infection (NIs) preventive behaviors among ICU nurses. The Pearson Chi-Square value of 17.504 with a p-value of .001, along with corroborating results from the Likelihood Ratio test ($p = .000$) and the Linear-by-Linear Association test ($p = .003$), provides compelling statistical evidence of a significant association. These findings clearly indicate that organizational factors such as training availability, institutional policies, access to infection prevention resources like PPE and hand hygiene infrastructure play a crucial role in shaping nurses' infection prevention behaviors.

In conclusion, the Chi-square test confirms that organizational determinants are significantly associated with nosocomial infection preventive behaviors among ICU nurses. These results reinforce the need for health facility administrators and policymakers to not only develop IPC guidelines but also ensure they are actionable through regular training, adequate staffing, PPE provision, and infrastructure reliability. The Botswana case reflects similar patterns observed globally, underscoring the universal importance of strong institutional support in promoting safe clinical practices.

5. Discussion

The availability of risk assessment tools was confirmed by only 62.1% of nurses, indicating that a significant portion of ICU units lack structured mechanisms for identifying and managing infection risks. This is in contrast to studies such as Mere *et al.* (2023) in South Africa, which emphasized that the presence and regular use of risk assessment tools are critical for proactive infection control, especially in high-risk units like ICUs.

Alarming, only 24.2% of nurses reported that their units had an IPC training schedule, and an even lower percentage (17.9%) stated that routine IPC training was conducted for all ICU nurses. These findings suggest that although policies may exist, the lack of scheduled and consistent training undermines their implementation. This supports earlier conclusions by Zhang *et al.* (2021), who found that in the absence of structured refresher training, nurses' knowledge and compliance with infection prevention protocols significantly decline over time. Moreover, Assefa *et al.* (2022) noted that continuous training is essential to reinforcing behavior change and updating knowledge, particularly when protocols evolve in response to emerging pathogens.

One of the most critical barriers identified was the lack of consistent PPE availability, reported by only 42.1% of nurses. A majority (57.9%) indicated that PPE is not always available in their work areas, which poses a serious threat to both nurse and patient safety. This is consistent with findings by Adegboye *et al.* (2021) in Nigeria, where PPE shortages were linked to low compliance with standard precautions and increased infection rates. Resource availability is a fundamental organizational responsibility, and without access to protective equipment, even well-trained and knowledgeable nurses may be forced to compromise safe practices.

The findings clearly indicate that organizational factors such as training availability, institutional policies, access to infection prevention resources like PPE play a crucial role in shaping nurses' infection prevention behaviors. These findings are strongly aligned with prior studies. For instance, Assefa *et al.* (2022) also used Chi-square tests and found a significant association between hospital-level support (especially IPC training and supervision) and adherence to infection prevention measures among ICU staff in Ethiopia. Similarly, Mere *et al.* (2023) demonstrated that organizational readiness especially the presence of risk assessment tools and training schedules was statistically associated with compliance in South African ICUs. In contrast, settings where such resources were lacking experienced lapses in compliance, leading to a higher risk of healthcare-associated infections.

This study's results also mirror findings by Adegboye *et al.*

(2021) in Nigeria, where hospitals that provided regular IPC training and ensured constant availability of PPE reported significantly higher compliance rates. Moreover, Zhang *et al.* (2021) emphasized that institutional factors, more than individual knowledge alone, played a crucial role in determining actual practice in infection control. The current findings from Botswana add to this body of evidence, highlighting that organizational infrastructure and systems are not just supportive but foundational to effective infection prevention behaviors.

In summary, while the presence of IPC policies in Botswana's tertiary hospitals is encouraging, the broader organizational environment reveals critical weaknesses. Infrequent training, lack of scheduled education sessions, inconsistent availability of PPE, and partial access to risk assessment tools point to systemic gaps that hinder effective infection prevention. Comparisons with similar studies suggest that hospitals must move beyond policy formulation to actively create environments that are well-resourced, regularly audited, and staff-supported. Addressing these organizational barriers is vital for ensuring that ICU nurses can fully implement the infection prevention behaviors required to reduce nosocomial infections.

6. Conclusion

In conclusion, the study clearly demonstrates that organizational support is a critical enabler of effective nosocomial infection prevention behaviors among ICU nurses. While having IPC policies is a positive step, their practical implementation through resource provision, routine training, and infrastructure support is essential. Strengthening institutional capacity across these dimensions is vital for fostering a consistent, safe, and responsive infection control culture in critical care settings both in Botswana and globally.

A. Recommendations

- i. The management of all the three hospitals (PMH, NRH and SKMTH) to implement quarterly workshops to educate and train nurses on IPC measures. The basic IPC five days' course is mandatory for all healthcare workers according to the Botswana national IPC guideline (2023). The WHO recommends IPC education and training as one of the core IPC components.
- ii. The IPC committee of the hospitals to implement IPC risk assessment to identify high risk areas and focus interventions according to the Botswana national IPC guideline.
- iii. NRH and PMH to develop and implement NIs surveillance tools and bundles in the ICUs. These tools should be standardized and used to assess patient risk for NI upon admission, forming the basis for tailored preventive strategies.
- iv. The IPC committee at NRH and PMH to revise and make available the Standard Operating Procedures (SOPs) guiding NIs prevention in the ICU units. Nurses should have access to updated SOPs for;

prevention of VAP, CAUTs, SSI, UTI, hand hygiene, surface disinfection and PPE in the ICU units.

- v. The hospital management of the three hospitals to ensure 24/7 availability of PPE, disinfectants, and hand hygiene stations in ICUs.
- vi. Hospitals to introduce regular compliance audits and reporting mechanisms to monitor adherence to IPC protocols. Integration with the hospital quality assurance department is recommended.

B. Recommendations for Further Study

The researcher recommends a longitudinal study designs to assess the long-term impact of training programs on NIs rates. Experimental studies can also be done testing specific IPC training programs to quantify their impact on behavioral change. Additionally, the study recommends future studies employing a qualitative approach to explore nurses' perceived barriers to compliance through interviews Understanding cultural, emotional, or psychological barriers influencing nurse's preventive behaviors may offer richer insight.

C. Limitations of the Study

A cross-sectional study design approach does not show a causal association among variables. The nurse's actual practice towards prevention of nosocomial infection was not be observed, rather information was collected by a self-reported online questionnaire. Lastly, the questionnaire is prone to bias because nurses may withhold some information because they do not want to expose their malpractice behaviors.

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