Original Research Article

Determinants of Nurses' Compliance with Infection Prevention and Control Practices in Critical Care Units

SAGE Open Nursing
Volume 11: 1–8

DOI: 10.1177/23779608251339193
journals.sagepub.com/home/son
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Abstract

Introduction: It is widely recognized that critical care environments significantly increase the risk of infection for both patients and healthcare personnel.

Purpose: This study aimed to assess the determinants of nurses' compliance with infection prevention and control practices in critical care units.

Methods: A cross-sectional study was conducted with 155 nurses working in critical care units. Data were collected using a structured questionnaire that measured sociodemographic characteristics, compliance, knowledge, and perceptions of infection prevention and control (IPC) practices. Statistical analyses, including multiple linear regression, were performed to assess predictors of compliance with IPC practices. This study was conducted following the Strengthening the Reporting of Observational Studies in Epidemiology guidelines to ensure transparency and rigor in the reporting of the methodology and findings.

Results: A total of 155 nurses participated in the study, yielding a response rate of 91.1%. Seventy-one percent demonstrated good compliance with IPC practices, while only 39.4% exhibited moderate knowledge of IPC guidelines. Experience in critical care ($\beta = 3.542$, $p < .05$) and institutional support ($\beta = 0.246$, $p < .01$) were significant predictors of compliance, highlighting the importance of both factors in promoting adherence to IPC practices.

Conclusion: Although compliance with IPC practices was generally high, gaps in knowledge and perception suggest the need for enhanced educational initiatives and institutional support to further improve IPC adherence. Future research should focus on developing strategies that address these gaps to ensure sustainable compliance.

Keywords

critical care, compliance, healthcare-associated infections, infection prevention, perception

Received: September 3, 2024; revised: March 1, 2025; accepted: April 6, 2025

Introduction

Infection prevention and control (IPC) is a practical, evidence-based strategy aimed at protecting both patients and healthcare workers from preventable infections (World Health Organization [WHO], 2023). Its primary goal is to reduce infection rates through policies and practices that control and minimize the spread of illnesses (AlAnazy & Mwandenga, 2024). Infection prevention and control aims to mitigate the risk of microorganism transmission to healthcare providers, patients, and visitors (Link, 2019).

Healthcare workers' adherence to IPC protocols is often compromised by factors such as insufficient protective supplies, unclear instructions, high workload, and exhaustion (Houghton et al., 2020). Standard precautions (SPs) represent essential methods required to achieve optimal infection control across all patient treatments, regardless of diagnosis. These include guidelines and practices to prevent or reduce the spread of infectious diseases in healthcare environments

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(Beyamo et al., 2019; Kubde et al., 2023). Compliance with IPC measures is further influenced by individual, institutional, and environmental factors, which require attention to maintain high standards of patient care (Batran et al., 2022; Hussein et al., 2021; Karkhane et al., 2016).

The themes of IPC compliance, knowledge, attitudes, and practices are critical for reducing the prevalence of healthcare-associated infections (HAIs), particularly in critical care units (CCUs). This study introduces these themes by evaluating the factors contributing to nurses' compliance with IPC practices and identifying gaps in knowledge and attitudes.

Despite the acknowledged importance of IPC, adherence to these standards remains inadequate in many hospitals worldwide, including in Middle Eastern countries. Research shows that institutional challenges such as resource shortages, lack of management support, and inconsistent training programs also affect compliance (Amsalu & Kassaye, 2022; Edet et al., 2017; Feyisa et al., 2022). Recent studies in the region highlight some of these challenges. For example, Ayed and Zabn (2021) found that only 38.5% of Palestinian nursing students had high knowledge of COVID-19, and only 7.8% displayed a positive attitude toward the disease. This suggests significant gaps in knowledge and attitudes toward infection control among healthcare students, which may also be present among practicing nurses.

Additionally, a study by Ayed et al. (2024) assessed infection control knowledge, attitudes, and practices among nurses in Palestinian hospitals. The results indicated that 95.8% of nurses had good knowledge, 83.5% had positive attitudes, and 91.2% demonstrated good IPC practices. Therefore, the current study aimed to assess the determinants of nurses' compliance with infection prevention and control practices in critical care units.

Literature Review

Infection prevention and control measures are crucial for ensuring the safety and health of both patients and healthcare personnel, making them a vital aspect of all healthcare systems (Nofal et al., 2017). Proper IPC practices enhance nurses' understanding and application of infection control measures, thereby lowering the risk of HAIs (Edet et al., 2017.). Recent studies have linked IPC adherence with reduced morbidity, improved patient safety, and healthcare cost reduction (Ghabayen et al., 2023; Murphy et al., 2020; Ungar et al., 2024). Poor IPC practices expose patients to higher risks of HAIs through contact with contaminated hands, equipment, and environments (Bahegwa et al., 2022; Tolera et al., 2024).

Healthcare-associated infections contribute significantly to increased morbidity and mortality rates (Haque et al., 2018; Ripabelli et al., 2020). The economic and emotional burden of HAIs places immense pressure on healthcare facilities and affects patient outcomes (Ohannessian et al., 2018; Raoofi et al., 2023). Current data show that HAIs affect approximately 0.14% of patients, with an annual increase of 0.06%. Regions like the Western Pacific and the Americas have lower HAI prevalence, while the African region experiences the highest rates (Raoofi et al., 2023). In Europe, up to 80,000 individuals are affected by HAIs daily, impacting millions annually and placing a significant strain on economic and societal resources (Murphy et al., 2020). A WHO survey revealed that 8.7% of hospitalized patients in 14 countries had HAIs, with the prevalence being higher in the Eastern Mediterranean compared to the Western Pacific region (Raoofi et al., 2023; Rosenthal et al., 2023; Sax et al., 2020).

The critical care environment is particularly susceptible to infections, affecting both patients and healthcare personnel (Blot et al., 2022; Smith et al., 2017). Intensive care units (ICUs) often experience higher infection rates due to the increased use of invasive devices and procedures (Aiesh et al., 2023; Ohannessian et al., 2018). Addressing factors that influence nurses' compliance with IPC protocols in such environments is crucial, as high levels of noncompliance can lead to an increased risk of infection transmission. Compliance varies widely; for instance, research shows 64% compliance in China (Luo et al., 2010), 82.6% in the Philippines (Pasay et al., 2015), and only 12% in Ethiopia (Haile et al., 2017).

Nurses' adherence to IPC protocols is influenced by personal, organizational, and environmental factors. Individual attitudes toward IPC have been linked to compliance levels, with higher knowledge resulting in better practices (George et al., 2023; Kangoya et al., 2023). Institutional support also plays a pivotal role in maintaining adherence. Studies reveal that hospitals with adequate training programs, clear IPC guidelines, and consistent supervision report higher compliance rates (Amsalu & Kassaye, 2022; Wibonela et al., 2020).

Training and education are critical in enhancing IPC practices and knowledge among healthcare workers (Ayed et al., 2015; Hussein et al., 2021). A recent study found that over 64.9% of healthcare workers had adequate staff levels, but only 18.3% reported receiving supervision within the past year (Amsalu & Kassaye, 2022). This demonstrates the need for continuous education and institutional support to close compliance gaps.

Methods

Research Design

A cross-sectional study was carried out among nurses working in the ICU and critical care unit (CCU) departments of hospitals in the South West Bank, spanning from December 1, 2023, to June 1, 2024. This study was conducted following the Strengthening the Reporting of Observational Studies in Epidemiology guidelines to ensure transparency and rigor in the reporting of the methodology and findings.

Research Question

What are the determinants of nurses' compliance with infection prevention and control practices in critical care units?

Study Population and Sampling

The study involved 155 nurses working in ICU and CCU departments in South West Bank hospitals. Participants were selected using stratified random sampling based on their experience, gender, and educational background. A structured self-administered questionnaire was used to collect data on sociodemographic characteristics, compliance, knowledge, and perceptions related to IPC practices.

Inclusion Criteria

The inclusion criteria were all practical and staff nurses currently working in ICUs and CCUs. Nurse with at least one year of experience in the ICUs and willing to participate in the study are included.

Exclusion Criteria

The study implemented specific exclusion criteria to ensure the validity and relevance of its findings. Nurses with less than one year of experience were excluded, as their brief tenure made it challenging to accurately assess their compliance and their perception of individual and institutional factors of infection prevention and control, particularly during their adjustment period. Additionally, nurses who were on extended leave, such as career breaks or maternity leave, were excluded to maintain consistency in the sample of actively practicing nurses. Part-time nurses and nursing students were excluded as well, to ensure that the study focused solely on full-time, experienced nursing professionals.

Instrumentation

A self-administered questionnaire composed of five parts was utilized to gather data on various factors influencing nurses' compliance with IPC practices.

The first part examined the sociodemographic traits of nurses, including age, gender, marital status, education, work department, experience in ICU/CCU, hospital category, and participation in infection control practice training. This demographic information is essential for understanding the context and diversity of the study participants.

The second part assessed nurses' compliance with SP practices, developed by Hussein et al. (2021), and contained 22 items rated on a scale from 1 (Never) to 5 (Always). The components used to measure nurses' compliance demonstrated high reliability, with a Cronbach's alpha of 0.86. The total score was calculated using Bloom's cutoff point (Bloom, 1956), categorizing adherence into three levels: poor compliance (less than 60%), fair compliance (60–79%), and good compliance (80–100%). The current study yielded a Cronbach's alpha of 0.90 for this section.

The third part focused on knowledge factors, also developed by Hussein et al. (2021), and consisted of 20 true/false questions. Responses were coded as 1 for correct and 0 for incorrect. The total score was similarly calculated using Bloom's cutoff point (Bloom, 1956), and knowledge levels were categorized as: low knowledge level (less than 60%), moderate knowledge level (60–79%), and high knowledge level (80–100%). The reliability of this section was strong, with a Cronbach's alpha of 0.88, and the current study yielded a Cronbach's alpha of 0.82.

The fourth part assessed individual factors influencing compliance, consisting of 18 items rated on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree). This section showed reliability with a Cronbach's alpha of 0.80. The total score was calculated using Bloom's cutoff point (Bloom, 1956), categorizing perceptions into three levels: low perception level (less than 60%), moderate perception level (60–79%), and high perception level (80–100%). The current study reported a Cronbach's alpha of 0.92.

The fifth part evaluated institutional factors, consisting of 18 items rated similarly from 1 (Strongly Disagree) to 5 (Strongly Agree). This section had an interitem reliability of $\alpha = 0.84$. The total score was also calculated using Bloom's cutoff point (Bloom, 1956), with perceptions categorized into low perception level (less than 60%), moderate perception level (60–79%), and high perception level (80–100%). The current study revealed a Cronbach's alpha of 0.88.

Validity and Reliability

The validity of the questionnaire was ensured through expert review by five professionals specializing in ICU and critical care nursing. These experts included senior ICU nursing educators, ICU nurse specialists, and critical care nurses, all with extensive experience in critical care nursing education and patient care in ICU settings. A pilot study involving 20 nurses was conducted to test the reliability of the instrument. Cronbach's alpha values indicated high internal consistency across the various sections: compliance with SPs (0.86), individual factors influencing compliance (0.88), knowledge factors (0.80), and institutional factors (0.84). Participants in the pilot study were excluded from the main study, and the questionnaire was designed to be completed in a reasonable timeframe of 15–20 min.

Data Collection Procedure

Following approval from Palestine Ahliya University and the Ministry of Health, the researcher initiated the data collection process by visiting selected hospitals to meet with the chiefs of nurses and head nurses in the ICU and CCU departments. During these meetings, the researcher thoroughly explained the study's objectives, emphasizing the importance of understanding IPC practices among nurses in critical care settings. To facilitate participation, the researcher requested lists of nurses' names and their duty schedules, ensuring a systematic approach to engaging potential participants. Nurses were

approached during their scheduled duty breaks, which allowed the researcher to maximize participation while minimizing disruption to the nurses' responsibilities. Those who expressed interest in participating were provided with detailed information about the study, including its purpose, procedures, and the voluntary nature of participation. Before completing the questionnaire, all participating nurses signed an informed consent form, affirming their willingness to contribute to the research.

The questionnaire was administered in paper form, allowing participants to complete it at their convenience during breaks. To accommodate varying levels of English proficiency among the nurses, the questionnaire was designed to be clear and straightforward, ensuring that all items were easily understandable. Additionally, the researcher was available to provide clarification on any questions if needed, thereby enhancing the accuracy of the data collected.

Data Analysis

Descriptive statistics such as mean, standard deviation, and percentages were used to summarize participant characteristics and levels of compliance. Multiple linear regression analysis was conducted to assess the effect of predictors (e.g., age, gender, education, experience, work department, institutional factors, and training) on IPC compliance.

Ethical Considerations

Ethical approval was obtained from Palestine Ahliya University, and permission was granted by the Ministry of Health. Participants were informed about the study's goals and objectives prior to completing the questionnaires, which included a written explanation. Participation was voluntary, and participants were assured that they could choose not to participate without any consequences. To ensure anonymity, no identifying information such as names or hospital details was collected, and unique codes were assigned to participants to maintain confidentiality.

Results

Participants' Characteristics

One hundred and fifty-five nurses out of 170 participated in the study (91.1% response rate). The analysis revealed that more than half of the participants, 93 (60.0%), were younger than 30 years old, and 93 (60.0%) were males. Most participants, 107 (69.0%), have a bachelor's degree in nursing, and 92 (59.4%) have 1–5 years' experience in critical care units. Furthermore, 92 (59.4%) reported training on infection prevention courses, as seen in Table 1.

The analysis of the critical care nurses' compliance with IPC practices in critical care units revealed that 110 (71.0%) participants had a good level of compliance, while 43 (27.7%) participants had a fair level of compliance, as shown in Table 2.

Table 1. Demographic Characteristics of the Participants ($N = 155$).

Variable		*N*	%
Age	Less than 30 years	93	60.0
	30–39 years	39	25.2
	More than 40 years	23	14.8
Gender	Male	93	60.0
	Female	62	40.0
Educational level	Diploma	33	21.3
	Bachelor	107	69.0
	Master and above	15	9.7
Working experience in the critical care units	1–5 years	92	59.4
	6–10 years	38	24.5
	More than 10 years	25	16.1
Training on infection prevention	Yes	92	59.4
	No	63	40.6

Table 2. Description of the Critical Care Nurses' Compliance with Infection Prevention and Control Practices in Critical Care Unit ($N = 155$).

Variable		*N*	(%)
Compliance	Poor compliance	2	1.3
	Fair compliance	43	27.7
	Good compliance	110	71.0

The analysis of the critical care nurses' knowledge of IPC practices in critical care units revealed that 61 (39.4%) participants had a moderate knowledge level, while 52 (33.5%) participants had a high level of knowledge. Also, the analysis of critical care nurses' perceptions of their factors in IPC practices in critical care units revealed that 86 (55.5%) participants had a moderate perception level, while 40 (25.8%) participants had a low perception level. According to nurses' perceptions of the institutional factors in IPC practices in critical care units the analysis revealed that 75 (48.4%) participants had a moderate perception level, while 51 (32.9%) participants had a high perception level, as shown in Tables 3.

A multivariable regression analysis was conducted to determine the factors influencing nurse compliance with IPC practices in critical care units. The independent variables included age, gender, marital status, education, work department, experience, hospital type, training, knowledge, and individual and institutional factors. These variables were entered into the predictive model. The overall model was statistically significant ($p < .001$, $R = 0.487$, $R^2 = 0.238$, adjusted $R^2 = 0.179$), indicating that these factors could explain 23.8% of the variance in nurse compliance with IPC practices in critical care units.

The results showed that experience in critical care units are significantly predicted compliance with IPC practices ($\beta = 3.542$, $p < .05$). This suggests that each additional year of experience was associated with a 3.542-point increase in

compliance. Additionally, the institutional factor was a significant predictor ($\beta = 0.246$, $p < .01$), indicating that a one-point increase in institutional perception was associated with a 24.6-point increase in compliance, as detailed in Table 4.

Discussion

This study highlights strong compliance with IPC practices among critical care nurses in Palestinian healthcare settings. Despite systemic challenges, adherence is driven by professional ethics, collective responsibility, and teamwork. However, resource constraints, inconsistent management support, and workload stress remain barriers (Feyisa et al., 2022; George et al., 2023). Ongoing education and institutional support are crucial for maintaining and improving IPC standards, as studies in Ethiopia, Namibia, and Jordan show that regular training enhances compliance (Hussein et al., 2021; Kangoya et al., 2023; Nofal et al., 2017).

Compared to other regions, Palestinian nurses demonstrate higher IPC adherence. Studies in Ethiopia report adherence rates ranging from 12% to 64% (Angaw et al., 2019; Babore et al., 2024; Bekele et al., 2018; Yemane, 2014), while international comparisons reveal variability, with China at 64%, the Philippines at 82.6%, and Saudi Arabia reporting knowledge levels between 44.4% and 55.1% (Batran et al., 2018; Luo et al., 2010; Pasay et al., 2015).

Nurses exhibited moderate IPC knowledge, suggesting awareness but some inconsistencies. Limited access to updated training and variable institutional support may hinder deeper understanding (Nofal et al., 2017; Tolera et al., 2024). In Saudi Arabia, 63.8% reported good knowledge (Althiyabi et al., 2024), while Nigeria showed only 50% (Abdulraheem et al., 2012). Similarly, 53.9% of Palestinian nurses had fair knowledge (Ayed et al., 2015).

Nurses' perceptions of IPC-related individual factors were moderate, influenced by workload, beliefs, and training effectiveness. Studies indicate attitudes impact adherence, with factors such as stress, gender, and education playing a role (George et al., 2023; Hussein et al., 2021). Ethiopian research found 65.7% had positive attitudes, and 63.7% supported SPs (Feyisa et al., 2022; Yohannes et al., 2019). Namibian findings suggest a 10% increase in IPC practice factors led to a 3.1% rise in adherence (Kangoya et al., 2023), while Tanzanian studies link IPC training to better sharps handling and hand hygiene (Wibonela et al., 2020).

Institutional support for IPC was perceived as moderate, reflecting concerns about resources, policy implementation, and supervision. Strengthening hospital infrastructure, access to personal protective equipment (PPE), and IPC committee activities is essential (Amsalu & Kassaye, 2022; Hussein et al., 2021). Ethiopian studies show only 37.4% of healthcare providers received supervision, yet 73.8% emphasized the need for IPC training (Feyisa et al., 2022). Alarmingly, only 4.6% of hospitals had active IPC committees (Amsalu & Kassaye, 2022).

Table 3. Description of the Critical Care Nurses' Knowledge, Individual, and Institutional Factors of Infection Prevention and Control Practices in Critical Care Unit ($N = 155$).

Variable		*N*	(%)
Knowledge	Low knowledge level	42	27.1
	Moderate knowledge level	61	39.4
	High knowledge level	52	33.5
Perception of individual factors	Low perception level	40	25.8
	Moderate perception level	86	55.5
	High perception level	29	18.7
Perception of institutional factors	Low perception level	29	18.7
	Moderate perception level	75	48.4
	High perception level	51	32.9

Table 4. Predictors of Compliance with Infection Prevention and Control Practices: Multiple Linear Regression.

					95.0% confidence interval	
Predictor	*B*	Beta	*t*	*p* value	Lower bound	Upper bound
Age	.922	.069	.627	.532	−1.985	3.828
Gender	−.054	−.003	−.033	.974	−3.276	3.168
Marital status	.498	.027	.330	.742	−2.489	3.486
Education	−1.127	−.062	−.772	.442	−4.012	1.759
Work department	2.128	.105	1.373	.172	−.936	5.192
Work experience (more than 10 years)	3.542	.270	2.615	.010[a]	.864	6.221
Hospital type	1.883	.093	1.091	.277	−1.528	5.293
Training	.391	.019	.251	.802	−2.687	3.469
Knowledge factor	.001	.003	.035	.972	−.074	.077
Individuals factor	.006	.011	.122	.903	−.095	.107
Institutional factor	.246	.362	4.749	.001[b]	.144	.349

CI = confidence interval; b = unstandardized beta; B = standardized beta.
[a]Significant at $p < .05$.
[b]Significant at $p < .01$.

Findings underscore the need for targeted training and institutional improvements to bridge knowledge gaps and enhance IPC adherence. Promoting a culture of safety and accountability within healthcare institutions can strengthen IPC practices. Policymakers should invest in infrastructure, staffing, and PPE to align Palestinian healthcare with international IPC standards (Murphy et al., 2020; Raoofi et al., 2023). Future research should explore the long-term impact of educational interventions and address compliance barriers to improve infection control outcomes.

Strength and Limitations

The strength of this study lies in its ability to measure the impact of variables at both the individual and institutional levels on compliance with SPs. This dual focus aims to address and potentially close the gap identified in previous research, offering a more comprehensive understanding of the factors influencing IPC compliance. However, the study also has certain limitations. Firstly, it was conducted within a specific geographic area, which may limit the generalizability of its findings to other healthcare settings. Additionally, the use of self-reported data to assess compliance, knowledge, individual, and institutional perception presents inherent challenges, as such data may be subject to biases such as social desirability or recall bias, potentially affecting the accuracy of the results.

Recommendations and Implications

Based on the study findings, several recommendations can enhance IPC practices among critical care nurses. Regular, tailored training sessions should be implemented, incorporating updates on current guidelines and best practices. Healthcare institutions must foster a culture that supports IPC adherence through open communication, resource allocation, and administrative backing.

Periodic assessments of nurses' IPC knowledge and attitudes can identify areas for improvement and track training effectiveness. Engaging frontline staff in developing and reviewing IPC policies ensures relevance and compliance. Technology, such as e-learning platforms and mobile applications, should be leveraged for continuous education and easy access to IPC resources.

Further research on IPC practices in Palestine is essential to establish evidence-based strategies suited to local needs. Evaluating the impact of implemented changes will guide future improvements and policy adjustments. Strengthening IPC frameworks will enhance patient safety, improve nurse job satisfaction, and contribute to better healthcare outcomes.

Conclusion

The study found that nurses in critical care units generally exhibit good compliance with IPC practices, although their knowledge about IPC is only moderate. Additionally, the study revealed that nurses' perceptions of both individual and institutional factors were also moderate. Notably, the findings indicated that both experience and institutional factors significantly predict adherence to IPC practices.

Acknowledgments

The author would like to express their thanks to the nurses who participated in the study.

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Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from Palestine Ahliya University (CAMS/CCNA/29/524). Written informed consent was obtained from all subjects before the study.

Consent for Publication

I affirm that this work is original and has not been published elsewhere, except as noted in the manuscript.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Use of AI Software

I affirm that the integrity and originality of this work are entirely my own and are not influenced by any AI technology.

Supplemental Material

Supplemental material for this article is available online.

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