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Nurses' Knowledge and Compliance with Intravenous Insertion Standard Operating Procedures in Emergency Care Settings

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ABSTRACT

Background: *The emergency department is the main entry point for hospital services and plays a crucial role in providing immediate patient care. Intravenous insertion is a common invasive procedure that may contribute to nosocomial infections if standard operating procedures (SOPs) are not properly followed. Nurses' compliance with SOPs is therefore essential for infection prevention and patient safety.* ***Objective:*** *This study aimed to examine the relationship between nurses' knowledge levels and compliance with intravenous insertion standard operating procedures in emergency care settings.* ***Methods:*** *A correlational study with a cross-sectional design was conducted in January 2025. The study involved all nurses working in the emergency department, with a total of 18 participants selected using total sampling. Data were collected using structured questionnaires to assess knowledge and observational checklists to evaluate compliance. Statistical analysis was performed using Spearman's rho test with a significance level of 5% (α = 0.05).* ***Results****: The analysis revealed a statistically significant relationship between nurses' knowledge levels and compliance with intravenous insertion SOPs (p = 0.001), indicating that higher knowledge levels were associated with better compliance.* ***Conclusion****: Nurses' knowledge is a key determinant of compliance with intravenous insertion SOPs and plays an important role in preventing nosocomial infections in emergency care settings.*

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A. Introduction

The emergency department is the primary access point for hospital services and plays a crucial role in delivering rapid and life-saving care to patients (Lulie et al., 2021; Osei-Tutu et al., 2015). One of the most frequently performed nursing procedures in this setting is intravenous catheter insertion, an invasive intervention that requires strict adherence to aseptic principles due to direct contact with the vascular system (Miliani et al., 2017; Webster et al., 2019). Failure to comply with standard operating procedures during intravenous insertion increases the risk of healthcare-associated infections, particularly phlebitis and bloodstream infections (Zhang & Lv, 2020; Simin et al., 2019; Lulie et al., 2021; Osei-Tutu et al., 2015). Consequently, procedural safety in intravenous therapy is a fundamental component of patient safety in emergency care (Cicolini et al., 2014; Helm et al., 2015).

Healthcare-associated infections remain a global public health problem and contribute significantly to increased morbidity, prolonged hospitalization, and healthcare costs (Zhang & Lv, 2020; Miliani et al., 2017; O'Grady et al., 2011). Intravenous-related infections are among the most common preventable complications and are often associated with procedural errors rather than equipment failure (Miliani et al., 2017; Helm et al., 2015; Webster et al., 2015). Evidence indicates that healthcare workers may unintentionally transmit pathogens due to inadequate awareness and inconsistent adherence to infection-prevention standards (Simin et al., 2019; Lee et al., 2019; Tan et al., 2020). These findings highlight the central role of nurses' behavior in controlling nosocomial infections (Helm et al., 2015; Atay et al., 2018).

Emergency care environments are characterized by high patient turnover, unpredictable clinical conditions, and substantial time pressure (Cicolini et al., 2014; Miliani et al., 2017). Nurses in emergency departments often perform multiple intravenous insertions during a single shift, which may increase the likelihood of deviations from standard operating procedures (Lulie et al., 2021; Simin et al., 2019; Tan et al., 2020). Under such circumstances, routine or habitual practices may replace evidence-based techniques, potentially compromising patient safety (Helm et al., 2015; Webster et al., 2015). Therefore, consistent compliance with intravenous insertion protocols remains a persistent challenge in emergency nursing practice (Miliani et al., 2017; Atay et al., 2018).

Compliance with standard operating procedures is strongly influenced by nurses' knowledge and understanding of infection-prevention principles (Lee et al., 2019; Roca et al., 2012; Simin et al., 2019). Knowledge functions as a cognitive foundation that shapes attitudes, clinical judgment, and psychomotor performance in nursing practice (Lee et al., 2019; Tan et al., 2020).Nurses with adequate knowledge are more likely to recognize procedural risks, apply aseptic techniques correctly, and adhere to established standards (Helm et al., 2015; Lulie et al., 2021; Miliani et al., 2017). In contrast, insufficient knowledge may lead to unsafe practices that increase the risk of healthcare-associated infections (Atay et al., 2018; Roca et al., 2012; Simin et al., 2019).

Previous studies emphasize that the effectiveness of infection-control programs is determined not by sophisticated medical equipment, but by the consistent and correct implementation of care procedures by healthcare professionals (Helm et al., 2015; Miliani et al., 2017; O'Grady et al., 2011). In emergency care settings, where rapid decision-making is required, knowledge-based compliance becomes even more critical (Lulie et al., 2021; Tan et al., 2020; Zhang & Lv, 2020). Strengthening nurses' knowledge through structured education and training is therefore a strategic approach to improving adherence to standard operating procedures and enhancing patient safety outcomes (Helm et al., 2015; Lee et al., 2019; Tan et al., 2020).

Despite the availability of guidelines and protocols, variations in nurses' compliance with intravenous insertion procedures persist across clinical settings (Atay et al., 2018; Roca et al., 2012; Simin et al., 2019). These variations suggest that knowledge does not automatically translate into consistent practice, highlighting the need to examine the relationship between nurses' knowledge levels and procedural compliance (Lee et al., 2019; Lulie et al., 2021; Tan et al., 2020). Understanding this relationship is essential for developing effective interventions aimed at improving nursing performance and reducing healthcare-associated infections (Miliani et al., 2017; Osei-Tutu et al., 2015; Zhang & Lv, 2020). Therefore, this study focuses on analyzing the association between nurses' knowledge and compliance with intravenous insertion standard operating procedures in emergency care settings (Atay et al., 2018; Lulie et al., 2021; Simin et al., 2019).

B. Methods

This study employed a correlational research design with a cross-sectional approach to examine the relationship between nurses' knowledge levels and their compliance with standard operating procedures for intravenous insertion. The cross-sectional design allowed

simultaneous measurement of independent and dependent variables at a single point in time, enabling the assessment of associations without manipulating study conditions. This design was considered appropriate to capture real-world nursing practices in emergency care settings.

The study population consisted of all nurses working in the emergency department during the study period. Given the relatively small population size, a total sampling technique was applied, whereby all eligible nurses were included as study participants. This approach minimized sampling bias and ensured that the sample adequately represented the target population. A total of 16 nurses participated in the study.

Two variables were examined in this study: nurses' knowledge as the independent variable and nurses' compliance with intravenous insertion standard operating procedures as the dependent variable. Nurses' knowledge was defined as the cognitive understanding of intravenous insertion procedures, including the definition of standard operating procedures, preparation of equipment, insertion techniques, critical considerations during the procedure, and documentation requirements. Compliance was defined as the extent to which nurses performed intravenous insertion according to established procedural standards.

Data collection was conducted using two instruments. Nurses' knowledge was assessed using a structured questionnaire consisting of multiple items related to intravenous insertion procedures. Each correct response was scored as one point, while incorrect responses were scored as zero. Knowledge scores were converted into percentages and categorized as poor (≤55%), moderate (56–75%), or good (76–100%) (Wawan & Dewi, 2010). Nurses' compliance was measured through direct observation using a standardized checklist based on institutional standard operating procedures, covering preparation and procedural implementation criteria.

Prior to data collection, ethical approval and institutional permission were obtained. Participants were informed about the purpose of the study and provided written informed consent. To protect participants' rights, anonymity and confidentiality were strictly maintained throughout the research process. Data collection involved questionnaire administration followed by direct observation of intravenous insertion practices performed by participating nurses.

Data analysis was performed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics were used to summarize respondents' characteristics and variable distributions. The relationship between nurses' knowledge levels and compliance with intravenous insertion procedures was analyzed using Spearman's rho correlation test, as the data were ordinal in nature. Statistical significance was set at $\alpha = 0.05$, with a p-value less than 0.05 indicating a statistically significant association.

C. Results

A total of 16 nurses participated in this study. Most respondents were aged 31–40 years (74%), held a bachelor's degree in nursing (69%), and had more than five years of clinical experience (88%). These characteristics indicate that the majority of respondents were in a productive age group with sufficient educational and professional backgrounds.

Regarding knowledge related to intravenous insertion standard operating procedures, most nurses demonstrated a good level of knowledge (88%), while a small proportion showed moderate (6%) and poor knowledge (6%). In terms of compliance, 94% of nurses were classified as compliant with intravenous insertion SOPs, whereas 6% were non-compliant.

Table 1: Presents the association between nurses' knowledge levels and compliance with intravenous insertion SOPs.

Knowledge Level	Non-compliant n (%)	Compliant n (%)	Total n (%)
Poor	1 (6%)	0 (0%)	1 (6%)
Moderate	0 (0%)	1 (6%)	1 (6%)
Good	0 (0%)	14 (88%)	14 (88%)
Total	**1 (6%)**	**15 (94%)**	**16 (100%)**

Spearman's rho analysis revealed a statistically significant relationship between nurses' knowledge levels and compliance with intravenous insertion SOPs ($p = 0.001$, $\alpha \leq 0.05$), indicating that higher knowledge levels were associated with greater procedural compliance.

D. Discussion

The results of this study demonstrate that most nurses possessed good knowledge of intravenous insertion standard operating procedures. This finding is consistent with their educational background and work experience, both of which are known to contribute positively to clinical competence and procedural accuracy (Lee et al., 2019; Simin et al., 2019). Adequate knowledge provides a cognitive foundation for safe and effective nursing practice (Roca et al., 2012).

Despite the overall high level of knowledge, a small proportion of nurses still demonstrated insufficient knowledge. This suggests that clinical experience alone may not guarantee optimal understanding of procedural standards. Limited access to continuing education and infrequent refresher training may contribute to this gap (Lee et al., 2019; Tan et al., 2020). Therefore, ongoing professional development remains essential.

The high level of compliance observed in this study indicates that most nurses were able to translate knowledge into appropriate clinical behavior. However, even minimal non-compliance is clinically relevant given the invasive nature of intravenous therapy and its association with healthcare-associated infections (Miliani et al., 2017; Zhang & Lv, 2020). This highlights the importance of zero-tolerance approaches to procedural deviation in emergency care settings.

Emergency departments are characterized by high workload, time pressure, and unpredictable clinical demands(Sholehah, 2025). These conditions may occasionally lead to deviations from standard operating procedures, even among knowledgeable nurses. Thus, compliance should be viewed not only as an individual responsibility but also as an organizational issue requiring adequate staffing, supervision, and institutional support (Helm et al., 2015; WHO, 2023).

The significant association between nurses' knowledge and compliance found in this study supports behavioral theories suggesting that knowledge is a key determinant of professional practice (Hasan & Sholehah, 2023). Nurses with better knowledge are more likely to adhere to established standards and perform procedures safely and consistently (Lee et al., 2019; Simin et al., 2019). Knowledge-based behavior is also more sustainable over time compared to behavior driven solely by routine.

These findings are consistent with previous studies showing that adherence to intravenous insertion SOPs is associated with reduced incidence of complications such as phlebitis and nosocomial infections. Proper technique and strict compliance with aseptic procedures remain central to infection prevention strategies (Miliani et al., 2017; Zhang & Lv, 2020).

Educational level and work experience may further reinforce compliance by enhancing nurses' critical thinking and decision-making abilities. Nurses with higher education tend to be more receptive to evidence-based practice and clinical guidelines (Lee et al., 2019). Similarly, longer work experience allows for better integration of theoretical knowledge and practical skills (Simin et al., 2019).

From a nursing management perspective, these results emphasize the need for structured training programs, regular competency evaluations, and clear enforcement of standard operating procedures. Hospitals should facilitate continuous education and provide sufficient resources to support nurses in maintaining procedural compliance (Tan et al., 2020). Such measures contribute to improved patient safety and quality of care (WHO, 2023).

This study has limitations, including a small sample size and a single-setting design, which may limit generalizability. In addition, observational assessment of compliance may be influenced by the presence of the researcher. Future studies involving larger samples and multiple clinical settings are recommended (Lulie et al., 2021).

Overall, this study confirms that nurses' knowledge is a critical factor influencing compliance with intravenous insertion standard operating procedures. Strengthening knowledge through continuous education and institutional support is essential to enhance compliance and reduce the risk of healthcare-associated infections in emergency care settings (Miliani et al., 2017; Zhang & Lv, 2020).

Implication and limitation

The findings of this study highlight that nurses' knowledge is a critical determinant of compliance with intravenous insertion standard operating procedures in emergency care settings. The strong association observed indicates that improving knowledge through structured education, continuous training, and competency-based evaluation can significantly enhance adherence to clinical standards and reduce the risk of healthcare-associated infections. These findings also emphasize the need for institutional support, including supervision, monitoring, and reinforcement of SOP implementation, particularly in high-pressure emergency environments. However, this study has several limitations. The small sample size and single-center setting limit the generalizability of the findings. The cross-sectional design does not allow causal inference, and observational assessment may be subject to observer bias. Future studies involving larger samples and multi-center designs are recommended to strengthen the evidence base.

Relevance for Practice

This study provides important practical implications for improving patient safety in emergency care by emphasizing the role of nurses' knowledge in ensuring compliance with intravenous insertion procedures. Healthcare institutions should implement regular training programs, competency assessments, and continuous supervision to maintain high standards of clinical practice. Strengthening knowledge and reinforcing adherence to SOPs can reduce procedural errors, prevent nosocomial infections, and enhance the overall quality of nursing care in emergency settings.

E. Conclusion

This study demonstrates a statistically significant association between nurses' knowledge levels and compliance with intravenous insertion standard operating procedures in emergency care settings. Nurses with higher levels of knowledge showed greater adherence to established procedures, highlighting the critical role of cognitive understanding in ensuring safe and consistent clinical practice. Although most nurses demonstrated good knowledge and high compliance, the presence of non-compliance, even in a small proportion, remains clinically important due to the invasive nature of intravenous therapy. Overall, strengthening nurses' knowledge is essential for improving procedural compliance and reducing the risk of healthcare-associated infections.

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Author Contribution

Abdur Rahman contributed to the study conceptualization, data collection, and initial manuscript drafting. Ahmad Kholid Fauzi contributed to the study design, data analysis, interpretation of the results, and critical revision of the manuscript. Both authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Declaration of Conflicting Interest

The authors declare no conflict of interest.

Declaration of Use of AI in Scientific Writing

The authors declare that generative AI and AI-assisted technologies were used to support language editing and grammatical refinement of the manuscript.

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