

## Original Article

# Association Between Nurses' Demographic Characteristics and Knowledge of Healthcare-Associated Infection Prevention: A Cross-Sectional Study



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### ABSTRACT

**Background:** Healthcare-Associated Infections (HAIs) significantly impact patient safety and healthcare costs. While general knowledge is often reported, evidence regarding how nurses' demographic characteristics influence HAI knowledge remains inconsistent, particularly in specialised psychiatric settings. This study aims to analyse the relationship between nurses' characteristics and their knowledge of HAI prevention and control.

**Methods:** This cross-sectional study followed STROBE guidelines. Data were collected from 125 nurses using a total sampling approach. Independent variables included age, gender, education, and length of service, while the dependent variable was knowledge of HAI prevention, measured by a validated 15-item Guttman-scale questionnaire. Data were collected using a validated and reliable structured questionnaire (Cronbach's alpha > 0.60). Data were analysed using the Contingency Coefficient.

**Results:** Most respondents were aged 30–50 years (84%), female (58.4%), held a Diploma in Nursing (71.2%), and had more than 5 years of service (86.4%). The majority demonstrated good knowledge (94.4%). There were significant relationships between age ( $p < 0.001$ ), education ( $p < 0.001$ ), and length of service ( $p < 0.001$ ) and knowledge of HAI prevention and control. However, no significant association was found between gender and knowledge ( $p > 0.001$ ).

**Conclusion:** Nurses' characteristics, specifically age, education, and length of service, are significantly associated with knowledge of HAIs prevention and control, while gender does not show a significant association. These findings emphasise the importance of infection prevention education strategies tailored to nurses' professional profiles.

**Keywords:** Hospitals, Psychiatric; Inpatients; Patient Safety.

### Implications for Practice:

- Training on the prevention of Healthcare-Associated Infections (HAIs) should be tailored to nurses' age, education level, and length of service, rather than delivered as a one-size-fits-all program that prioritises younger nurses and those with less experience.
- A structured senior-junior nurse mentorship system should be implemented, and nurse characteristics should be employed as the

### Implications for Practice:

- basis for assignments in high-risk infection areas.
- Hospital policies should establish minimum education standards and continuing education as requirements for practice, with a focus on competencies and experience.

## Introduction

Healthcare-Associated Infections (HAIs) are one of the global health challenges that have a significant impact on patients' safety, the quality of healthcare services, and the overall efficiency of the healthcare system ([Ministry of Health Regulation](#), 2017). HAIs have been shown to increase morbidity, mortality, length of hospital stays, and healthcare costs, thereby placing a double burden on both patients and the healthcare system ([Haque, M. et al.](#), 2018). HAIs are often difficult to treat, are a major force of antimicrobial resistance (AMR), and lead to premature death and disability ([WHO](#), 2024).

Centers for Disease Control and Prevention (CDC) classifies HAIs into four main categories based on the type of infections: Catheter Associated Urinary Tract Infection (CAUTI), or urinary tract infections resulting from the use of urinary catheters; Surgical Site Infection (SSI), or infections at the surgical site; Ventilator Associated Pneumonia (VAP), which is pneumonia due to the use of a ventilator; and Blood Stream Infection (BSI), or an infection occurring in the bloodstream ([Centers for Disease Control and Prevention](#), 2024). The global prevalence of HAIs was recorded at nearly 9%, meaning approximately 1.4 million hospitalized patients contracted nosocomial infections. According to a study conducted by the WHO, approximately 8.7% of 55 hospitals across 14 countries in Europe, the Middle East, and Southeast Asia reported high rates of HAIs, with one of the highest prevalences recorded in Southeast Asia at 10% ([Ministry of Health Regulation](#), 2017).

Infection prevention and control (IPC) in healthcare facilities is an evidence-based strategy aimed at protecting patients and healthcare workers from preventable infections, and it is a top priority in ensuring the quality of care, patient safety, and the

overall efficiency of healthcare management ([WHO](#), 2023). Proper IPC practices have been proven to improve nurses' understanding and implementation of infection control measures, thereby directly reducing the risk of HAIs, lowering morbidity, increasing patient safety, and reducing healthcare costs ([Baturan et al.](#), 2025). In this context, nurses play a key role as the frontline of care, always interacting directly with patients. As the healthcare professionals most accessible to patients, nurses are often on the front lines of implementing infection control protocols, including strict hand hygiene practices and the proper use of personal protective equipment (PPE) ([Assiri, F. F. M. et al.](#), 2024). However, on the other hand, nurses also possess the potential to become a transmission pathway for infections to patients or themselves if adherence to IPC protocols is not properly maintained. Poor IPC practices expose patients to a higher risk of HAIs through contact with contaminated hands, equipment, and the surrounding environment ([Bahegwa et al.](#), 2022).

Although nurses serve a highly strategic role in the prevention of HAIs, the effectiveness of that role depends on the cognitive abilities and professional conduct of each individual. Various studies revealed that nurses' level of knowledge and adherence to IPC protocols vary significantly and are influenced by intrinsic factors inherent to their individual characteristics. Several factors influencing healthcare workers' adherence to IPC measures in healthcare facilities include knowledge, education and training, working experience, age, gender, and profession ([Zhu et al.](#), 2021). A recent study by [Al-Hussami, M., et al.](#) (2021) confirms that demographic characteristics and educational background are significant predictors of competency levels and professional commitment among

healthcare workers in hospitals. Several researchers argue that the level of education determines an individual's level of knowledge and that a higher level of knowledge positively influences attitudes and compliance toward IPC practices in hospitals. This is supported by findings from [Limon and Villafuerte \(2022\)](#), which indicate that higher levels of formal education are linearly associated with improved literacy of patient safety and awareness of the risks of nosocomial infections. Hence, healthcare workers with higher levels of education are expected to demonstrate better compliance than recent graduates, given that nurses with higher levels of education possess greater cognitive readiness and self-efficacy in applying complex infection prevention protocols ([Assefa et al., 2023](#)).

This integration of educationally acquired cognitive readiness with psychological maturity emphasizes that efforts to improve compliance with HAIs prevention protocols must consider the balance between nurses' age and work experience ([Hasanah et al., 2024](#)). Those with higher levels of education tend to possess a deeper understanding of infections, infection control strategies, and the prevention of HAIs. Undergraduate and graduate programs typically cover more comprehensive material on epidemiology, microbiology, and management of infection. Moreover, nurses with advanced education are generally more skilled at critical thinking, which is essential for understanding and properly implementing protocols. Conversely, nurses with lower levels of education may experience difficulty understanding the basic principles of infection control or following the latest guidelines, which could affect their effectiveness in preventing HAIs ([Ardina et al., 2021](#)).

On the other hand, such intellectual capacity will be further strengthened if

supported by sufficient clinical experience, as working experience has a significant impact on nurses' ability to prevent HAIs. Nurses with more experience generally possess a higher level of confidence in performing clinical procedures related to infection control, such as catheter insertion or blood sampling, and are more skilled at recognizing the early signs of infection. Extensive experience also helps them respond to high-risk situations more quickly and appropriately. However, if nurses do not regularly update their knowledge, there is a risk of resistance to the implementation of new procedures or stricter infection prevention guidelines ([Al-Radaideh & Al-Amir, 2025](#)). This phenomenon indicates the existence of complex dynamics between academic background and clinical maturity that can determine the quality of healthcare services in specialized units.

A deep understanding of the synergy between these demographic and cognitive variables is crucial so that hospital management can develop appropriate intervention strategies to reduce nosocomial infection rates. Based on the above description, this study aims to analyze the relationship between nurse characteristics (including age, gender, educational level, and length of service) and the knowledge of HAIs prevention and control.

## Methods

### Study Design

The present study employed a quantitative design with a descriptive correlational approach using a cross-sectional method. This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. This design was chosen to analyze the association between nurses' demographic characteristics

(independent variables) and their level of knowledge regarding the prevention and control of Healthcare-Associated Infections (HAIs) (dependent variable) at a single point in time

### Participants

The population for this study consisted of all nurses working in the inpatient unit at RSJD Dr. RM. Soedjarwadi, Klaten, totalling 135 individuals. A non-probability sampling technique was applied, specifically using a total sampling method.

To ensure the data quality, the researchers established the inclusion and exclusion criteria as follows:

- Inclusion Criteria: Staff nurses who were willing to participate as respondents (by completing informed consent) and were actively assigned to inpatient units during the study period.
- Exclusion Criteria: Nurses who were on leave (due to illness, maternity, or study), as well as those in structural/managerial positions who did not provide direct patient care.

Based on these criteria, the final sample size was 125 respondents.

### Instruments

Data were collected using a structured questionnaire consisting of two main sections. The first section (Instrument A) assessed respondents' characteristics, including initials, age, gender, education level, and length of service. The second section (Instrument B) measured nurses' knowledge regarding the prevention and control of Healthcare-Associated Infections (HAIs) using a 15-item questionnaire based on a Guttman scale. This instrument included 10 positive (favorable) and 5 negative (unfavorable) statements covering the definition, scope, modes of transmission, impact, and prevention and control of HAIs. Positive items were scored 1 for "True" and 0 for "False," whereas

negative items were scored 0 for "True" and 1 for "False," with a total score range of 0 to 15. Knowledge levels were categorized as good (10–15), fair (5–9), and poor (0–4). The instrument was adopted from a previously validated questionnaire with item validity ( $r = 0.35-0.80 > r$  table 0.316) and high reliability (Cronbach's alpha  $0.89-0.95 > 0.60$ ).

### Data Collection

Data collection for this study was conducted across all inpatient units, including general and psychiatric wards, at RSJD Dr. RM. Soedjarwadi, Klaten. The process was carried out in three stages: preparation, implementation, and completion. The core data collection took place over five days, covering both morning and afternoon shifts to optimize respondent participation. All primary data were collected directly by the principal investigator to ensure consistency of information provided to respondents. Data collection began with coordination and obtaining permission from ward supervisors in each inpatient unit. The researcher then identified nurses who met the inclusion and exclusion criteria until a total of 125 respondents was obtained. After the questionnaires were returned, an on-the-spot check was conducted to ensure completeness and accuracy of the data.

### Data Analysis

Data analysis was conducted quantitatively using SPSS statistical software. The analysis process included univariate and bivariate analyses. Univariate analysis was used to describe the frequency distribution and percentages of each study variable, including nurses' characteristics (age, gender, education, and length of service) measured on a nominal scale, as well as their level of knowledge regarding the prevention and control of HAIs measured on an ordinal scale.

Bivariate analysis was performed to examine the relationship between nurses' characteristics (independent variables) and their knowledge of HAIs prevention and control (dependent variable). Given the categorical nature of the data, the Contingency Coefficient test was used as the statistical method.

### Ethical Considerations

This study was reviewed and approved by the Research Ethics Committee of RSJD Dr. RM. Soedjarwadi under approval number 500.6.24/4382. All participants received a written information sheet and provided written informed consent prior to data collection. Participation was entirely voluntary, with no coercion or penalties for refusal or withdrawal. Anonymity was ensured by assigning each participant an identification code; no names or personal identifiers were included in the dataset. Consent forms were stored separately from the questionnaires to prevent linkage.

### Results

The present study involved 125 nurses at RSJD Dr. RM. Soedjarwadi, Klaten, who met the inclusion and exclusion criteria. The data collected through a questionnaire were then analyzed to provide an overview of the respondents' individual characteristics and level of knowledge, which will subsequently be tested for statistical correlation.

Table 1. Characteristics of Respondents (n = 125)

Characteristics	Category	n (%)
Age	Young Adults (<30)	6 (4.8)
	Middle-aged Adults (30–50)	105 (84.0)
	Older Adults (>50)	14 (11.2)
Gender	Male	52 (41.6)
	Female	73 (58.4)
Education	Diploma III in Nursing	89 (71.2)

Characteristics	Category	n (%)
	Bachelor's Degree in Nursing	2 (1.6)
	Professional Nurse (Ners)	34 (27.2)
Length of Service	0–2 years	4 (3.2)
	2–5 years	13 (10.4)
	>5 years	108 (86.4)
Level of Knowledge	Good	118 (94.4)
	Fair	7 (5.6)
	Poor	0 (0.0)

**Table 1** illustrates that the majority of respondents were in the middle-aged adult group (30-50 years), totaling 105 nurses (84.0%). In terms of gender, most respondents were female, with 73 individuals (58.4%). Regarding educational background, the majority held a Diploma III in Nursing (89 individuals; 71.2%), followed by a Professional Nurse (Ners) qualification (27.2%), and a Bachelor's Degree in Nursing (1.6%). Furthermore, the respondents' professional profile reflects a high level of seniority, as most nurses had more than five years of length of service, reaching 108 respondents (86.4%). The findings suggest that only 7 inpatient ward nurses (5.6%) had fair knowledge about the prevention and control of HAIs.

**Table 2.** The Relationship between Age, Gender, Education, Length of Service and Knowledge Regarding the Prevention and Control of HAIs (n-125)

Variable	Category	Good n (%)	Fair n (%)	Poor n (%)	P value
Age	Young Adults	4 (66.7)	2 (33.3)	0 (0.0)	0.009
	Middle-aged Adults	101 (96.2)	4 (3.8)	0 (0.0)	
	Older Adults	13 (92.9)	1 (7.1)	0 (0.0)	
Gender	Male	49 (94.2)	3 (5.8)	0 (0.0)	0.945
	Female	69 (94.5)	4 (5.5)	0 (0.0)	
Education	Diploma III in Nursing	84 (94.4)	5 (5.6)	0 (0.0)	0.019
	Bachelor’s Degree in Nursing	1 (50.0)	1 (50.0)	0 (0.0)	
	Professional Nurse (Ners)	33 (97.1)	1 (2.9)	0 (0.0)	
Length of Service	0-2 years	2 (50.0)	2 (50.0)	0 (0.0)	0
	2-5 years	10 (76.9)	3 (23.1)	0 (0.0)	
	>5 years	106 (98.1)	2 (1.9)	0 (0.0)	

**Table 2** illustrates that the bivariate analysis on the relationship between age and the level of knowledge about the prevention and control of HAIs. Based on these data, middle-aged nurses (30–50 years) demonstrated a highly dominant level of mastery, with 101 respondents (96.2%) classified as possessing a “good” level of knowledge. In contrast, respondents in other age groups showed a more varied distribution of knowledge levels. The statistical test employing the Contingency Coefficient exhibited a p-value of 0.945 ( $p < 0,001$ ). These findings indicate that there is no significant association between gender and nurses’ knowledge levels regarding the prevention and control of HAIs at RSJD Dr. RM. Soedjarwadi.

Statistically, gender is not a predictor influencing nurses’ cognitive capacity to comprehend nosocomial infection protocols at this institution. The results of the statistical test using the Contingency Coefficient yielded a p-value of 0.019 ( $p > 0,001$ ). These findings indicate a statistically significant association between the level of formal education and nurses’

knowledge regarding the prevention and control of HAIs at RSJD Dr. RM. Soedjarwadi.

A statistical test using the Contingency Coefficient obtained a p-value of  $< 0.001$ . These findings confirm the existence of a highly significant association between length of service and nurses’ knowledge of HAIs at RSJD Dr. RM. Soedjarwadi.

## Discussion

The research findings, which reveal the predominance of middle-aged adult nurses (30-50 years old) with more than five years of service at RSJD Dr. RM. Soedjarwadi, suggest a stable organizational structure; however, without proper management, this stability may pose a risk of cognitive stagnation. From a sociological perspective of the profession, middle adulthood is a phase of “clinical maturity” in which nurses no longer rely solely on procedural memory but have reached the expert level or, at the very least, the proficient level. This finding supports the study hypothesis that age is associated with nurses’ knowledge of HAIs prevention and control, as indicated by the significant statistical result ( $p < 0.001$ ). In the context of nursing practice, this phase



indirectly offers advantages such as greater work experience, emotional maturity, as well as stability in thinking and acting, all of which contribute to a deeper understanding of the prevention and control of HAIs. This is in line with the findings of [Ardina et al. \(2021\)](#), who noted that individuals aged 20 to 35 tend to demonstrate a higher level of knowledge, as they are generally more capable of recalling learned materials or applying them effectively. This maturity provides a more solid psychological foundation for coping with workplace stress in psychiatric hospitals, which have different risk dynamics compared to general hospitals. Patients with severe mental illnesses (SMI) often exhibit cognitive deficits, psychomotor agitation, or poor personal hygiene awareness, making standard infection protocols (such as hand hygiene compliance and social distancing) exceptionally difficult to enforce among patients. The emotional stability that comes with middle adulthood contributes to greater diligence in implementing infection prevention protocols (HAIs), which are frequently viewed as routine tasks despite their high-risk nature ([Al-Mugheed, K. & Bayraktar, 2021](#)).

A critical finding of this study was the respondents' low level of understanding regarding the definition of HAIs, with an average score of only 0.296. This finding partially contradicts the overall quantitative result showing a high proportion of "good" knowledge (94.4%), indicating the presence of inconsistency between general knowledge scores and specific conceptual understanding. An in-depth analysis revealed the existence of a knowledge-practice gap. Although overall knowledge was generally classified as "Good", the inability to understand basic definitions suggests that prevention practices carried out to date were likely mechanical and ritualistic in nature, rather than based on a strong conceptual

understanding. This inconsistency may be explained by the dominance of routine-based learning and repetitive clinical exposure, which emphasize procedural compliance over theoretical comprehension.

This conceptual gap poses an even greater threat within a psychiatric hospital ecosystem. In general hospitals, HAIs are often signaled by clear clinical markers (e.g., surgical site redness, ventilator parameters, or urinary catheter presentation). Conversely, in psychiatric wards, patients are rarely bedridden and mostly interact in communal spaces, shifting the primary infection risks to skin-to-skin contact, scabies outbreaks, respiratory tract infections through close wandering, or physical aggression-related wound contamination. If nurses perform procedures ritualistically without gripping the fundamental concept of what constitutes an HAIs, they are prone to overlooking these non-ventilator or non-surgical infection pathways. Consequently, the inability to accurately define the scope of HAIs heavily poses a risk of underreporting infection cases. If nurses do not understand when an infection begins to be categorized as an HAI in a mobile, communal patient population, infection surveillance at RSJD Dr. RM. Soedjarwadi may lose the accuracy of its primary data.

The inability to accurately define the scope of HAIs poses a risk of underreporting infection cases. If nurses do not understand when an infection begins to be categorized as an HAIs, infection surveillance at RSJD Dr. RM. Soedjarwadi may lose the accuracy of its primary data. This finding partially contradicts the overall results indicating a high proportion of "good" knowledge, suggesting a discrepancy between general knowledge scores and specific conceptual understanding. While formal education does establish an initial cognitive framework, continuous reinforcement

through Clinical Privileges and periodic recredentialing is essential to ensure that foundational knowledge is not eroded by routine practice. This inconsistency may be explained by routine-based learning, where nurses perform procedures correctly but lack deep theoretical comprehension.

The results of the statistical test confirmed that age is not merely a chronological variable, but rather a variable that accumulates information. This finding supports the study hypothesis that age is significantly associated with knowledge of HAIs prevention and control. Middle-aged nurses have an advantage in terms of crystallized intelligence, or the ability to apply knowledge gained from past experiences. This aligns with a study by [Hampton & Smith, 2022](#), which revealed that senior nurses possess “clinical intuition” that helps them understand the urgency of infection control as part of patient protection ethics. Although study by [Li & Wang, 2024](#) highlights the advantages of youth in terms of fluid intelligence (the speed of processing new information), in the context of HAIs prevention, consistency and experience are far more decisive than speed. Differences between these findings and previous studies may be influenced by variations in training exposure and institutional learning systems.

The significant relationship between education level and knowledge emphasizes that the curriculum transformation from vocational (D3) to professional (Ners) has a tangible impact on how nurses implement health protocols. This finding supports the study hypothesis that education level is significantly associated with knowledge of HAIs prevention and control. Nurses trained in the Ners Program are educated with an Evidence-Based Practice (EBP) orientation, which enables them not only to understand “what” should be done but also “why” it should be done ([Damayanti & Sofyan, 2022](#)). This structural knowledge is critical

for RSJD Dr. RM. Soedjarwadi, as professional nurses are expected to modify standard infection guidelines into psychiatric-safe interventions (e.g., managing isolation protocols without triggering patient trauma or exacerbating psychotic episodes). This supports the argument that improving educational levels is a strategic investment for psychiatric facilities to bridge patient safety with complex psychiatric therapeutic communication. This study supports the argument put forward by [Pratiwi et al., 2021](#) that improving educational levels is a strategic investment for hospitals to reduce infection rates by enhancing literacy on patient safety.

Regarding the length of service variable, a very strong (coherent) relationship was observed. This finding strongly supports the study hypothesis that length of service is significantly associated with knowledge of HAIs prevention and control. Long tenure fosters a process of experiential learning, in which nurses learn from past failures and successes in infection control procedures. A long tenure allows the patient safety values to be internalized until they become an ingrained part of the work culture ([Borg & Nilsson, 2024](#)). This accumulation of experience builds muscle memory in technical procedures; however, this study reminds us that without updates to theoretical knowledge, long tenure may contribute to resistance toward new procedural innovations ([Li & Wang, 2024](#)). This finding also highlights a potential contradiction, where experience improves practice but may reduce adaptability to updated guidelines if not supported by continuous education.

The non-significant results for the gender variable convey a strong message about competency equality at RSJD Dr. RM. Soedjarwadi. This finding does not support the study hypothesis, as gender was not significantly associated with knowledge of

HAIs prevention and control. The absence of this association demonstrates that knowledge of HAIs is a gender-neutral technical competency. The hospital work environment, with its strict standard operating procedures (SOPs), has eliminated gender bias in knowledge acquisition. This supports the theory that, in professional bureaucratic organizations, access to training and information is influenced more by functional roles than by biological identity ([Al-Radaideh & Al-Amir, 2025](#)).

As a final synthesis, this study confirms that mastery of knowledge on the prevention and control of Healthcare-Associated Infection (HAIs) at RSJD Dr. RM. Soedjarwadi is not merely a product of chronological age or length of service, but rather the result of the internalization of structured clinical experience. The findings regarding significant association in the variables of age, education, and length of service confirm the theory of Mastery Learning, in which competence is developed through repeated exposure to cases and continuous academic reinforcement ([Hasanah et al., 2024](#)). This is in line with global criticism of Evidence-Based Practice (EBP), which states that healthcare workers often adhere to (psychomotor) procedures without fully deconstructing the theoretical rationale behind them ([Damayanti & Sofyan, 2022](#)). The non-significance of the gender factor in this study also offers an important sociological contribution that the psychiatric hospital ecosystem in Indonesia has successfully mitigated gender bias through inclusive operational standardization, consistent with international findings that professionalism transcends biological dichotomies ([Al-Radaideh & Al-Amir, 2025](#)). This finding is consistent with previous studies that report no significant gender differences in infection prevention knowledge among healthcare workers.

Therefore, future transformation in nosocomial infection management within psychiatric hospitals can no longer rely solely on generic, repetitive training. Intervention strategies must be tailored based on both nurses' characteristics and the specific behavioral landscapes of psychiatric wards. It requires repositioning the role of senior nurses through a specialized "Psychiatric Clinical Mentorship" system to facilitate the transfer of tacit risk-mitigation knowledge to junior nurses, along with the revitalization of internal surveillance tools that emphasize early diagnostic acuity in detecting behavioral-led infections. The present study provides an empirical basis for healthcare facility administrators that investment in Professional Nurse (Ners) is a key determinant in strengthening the patient safety architecture in hospitals ([Pratiwi et al., 2021](#)).

### Implications and limitations

Theoretically, this study contributes to patient safety literacy by revealing the phenomenon of the "cognitive paradox", in which professional maturity, shaped by age, education, and length of service, does not automatically guarantee mastery of fundamental concepts such as the boundaries of HAIs. These findings reinforce the theoretical framework of Mastery Learning, in which the internalization of health protocols requires synergy between clinical experience and continuous academic updates. The scientific impact of this study challenges conventional training models that tend to be repetitive and calls for a reorientation of hospital human resource development policies, with greater emphasis on strengthening the Professional Nurse (Ners) pathway to enhance nurses' critical thinking skills in infection risk management.

The main limitation of this study lies in the sample scope, which involved only one

specific institution; therefore, the generalization of the findings to nurse population in general hospitals with different service dynamics should be carried out with caution. Furthermore, the use of a cross-sectional design limits the study's ability to explain longitudinal causal relationships between individual characteristics and the development of nurses' knowledge over time. Employing a self-report instrument also has the potential to introduce social desirability bias, in which respondents may answer based on professional expectations rather than their actual knowledge. Therefore, future research is advised to incorporate a direct observational method to validate the relationship between cognitive capacity and clinical behavior in the field.

### Relevance to Practice

The current study provides an empirical basis for hospital management to restructure staff development programs by prioritizing the "Clinical Mentorship" method, in which senior nurses with extensive length of service serve as agents for the transfer of practical knowledge to junior nurses to mitigate competency gaps. Healthcare practitioners and policymakers at RSJD RM. Soedjarwadi is advised to revitalize the internal training curriculum so that it focuses not only on technical (psychomotor) procedures but also on periodically reinforcing the fundamental concepts of nosocomial infections to ensure the accuracy of HAIs surveillance. Additionally, institutions need to provide managerial support for nurses with a diploma to pursue further education toward a Professional Nurse (Ners), considering the strong correlation between higher education and critical thinking skills in ensuring patient safety. The implementation of this policy will directly strengthen the culture of patient safety, reduce morbidity rates due to cross-

infection, and improve the cost-effectiveness of care through higher-quality and standardized nursing practices.

### Conclusion

This study concluded that age, educational level, and length of service are the primary determinants significantly associated with nurses' knowledge of HAIs prevention and control, while gender was not significantly linked. These findings emphasize that clinical maturity and professional education level Professional Nurse (Ners) are crucial in strengthening nurses' cognitive capacity regarding patient safety standards. As a strategic implication, it is necessary for the hospital management to integrate formal education development with periodic updates to theoretical concepts to close fundamental knowledge gaps and ensure the effectiveness of infection prevention practices in healthcare settings.

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### CrediT Authorship Contributions Statement

**Arlina Dhian Sulistiyawati:** Conceptualization, Methodology, Supervision, Writing -Original Draft  
**Eka Rahmawati:** Validation, Formal Analysis, Writing -Review & Editing  
**Nur Wulan Agustina:** Investigation, Resources, Data Curation  
**Sri Handayani:** Writing -Original Draft, Review & Editing, Visualization

### Conflicts of Interest

There is no conflict of interest.

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### Supplementary Materials

Supplementary File S1: Research Instrument contains the full questionnaire used for data collection.

### References

- Al-Mugheed, K., & Bayraktar, N. (2021). Knowledge and practice of infection prevention and control among nurses: A cross-sectional study. *Journal of Nursing Management*, 29(4), 780–787. <https://doi.org/10.1111/jonm.13219>
- Al-Radaideh, M., & Al-Amir, S. (2025). Gender differences in nurses' knowledge, practice, and attitudes towards contact isolation precautions: A measurement invariance study. *Shiraz E-Medical Journal*, 26(11), Article e148167. <https://doi.org/10.5812/semj-148167>
- Al-Hussami, M., Hayajneh, F., Abdalrahim, M. S., Maharmeh, M., & Al-Hamdan, Z. M. (2021). The relationship between nurses' characteristics, organizational commitment, and job performance. *Journal of Nursing Management*, 29(4), 798–809. <https://doi.org/10.1111/jonm.13219>
- Ardina, R., Yusnita, Y., & Ariansyah, J. (2021). Faktor - faktor yang Mempengaruhi Perilaku Perawat Dalam Pencegahan Infeksi Nosocomial Oleh Perawat Di RSUD Kota Agung. *Nursing News: Jurnal Ilmiah Keperawatan*, 5(2), 86–101. <https://doi.org/10.33366/nn.v5i2.2311>
- Assefa, D., Melese, T., Gomora, S. T., & Alemu, S. (2023). Healthcare workers' compliance with infection prevention and control guidelines and associated factors: A systematic review and meta-analysis. *PLOS ONE*, 18(3), e0283301. <https://doi.org/10.1371/journal.pone.0283301>
- Assiri, F. F. M., Alanazi, M. M. D., Alanazi, N. T. M., Alruwaili, W. I. N., Alruwaili, S. S. Q., Asiri, N. F. M., & Alanazi, A. M. O. (2024). The role of nurses in preventing hospital-acquired infections. *International Journal of Computational and Experimental Science and Engineering*, 10(4). <https://doi.org/10.22399/ijcesen.4059>
- Bahegwa, R. P., Hussein, A. K., Kishimba, R., Hokororo, J., German, C., Ngowi, R., Eliakimu, E., & Ngasala, B. (2022). Factors affecting compliance with infection prevention and control standard precautions among healthcare workers in Songwe region, Tanzania. *Infection Prevention in Practice*, 4(4), 100236. <https://doi.org/10.1016/j.infpip.2022.100236>
- Batran, R., Ayed, A., Batran, A., Abu Ejheisheh, M., Alassoud, B., Hayek, M. F., & Batran, A. (2025). Determinants of nurses' compliance with infection prevention and control practices in critical care units. *SAGE Open Nursing*, 11. <https://doi.org/10.1177/23779608251339193>
- Borg, J., & Nilsson, K. (2024). Experiential learning in clinical practice: How years of nursing experience shape infection control habits. *Nordic Journal of Nursing Research*, 44(2), 88–97. <https://doi.org/10.1177/2057158523121045>

- Centers for Disease Control and Prevention. (2024). *Healthcare-associated infections (HAIs)*. <https://www.cdc.gov/healthcare-associated-infections/about/index.html>
- Damayanti, M., & Sofyan, O. (2022). Hubungan Tingkat Pendidikan Terhadap Tingkat Pengetahuan Masyarakat di Dusun Sumberan Sedayu Bantul Tentang Pencegahan Covid-19 Bulan Januari 2021. *Majalah Farmasetik*, 18(22), 220–226. <https://doi.org/10.22146/farmaseuti.k.v18i2.70171>
- Hampton, K. B., & Smith, T. J. (2022). The role of clinical expertise in infection prevention: Moving beyond rote compliance to ethical professional intuition. *Journal of Clinical Nursing*, 31(15–16), 2189–2201. <https://doi.org/10.1111/jocn.15982>
- Haque, M., Sartelli, M., McKimm, J., & Abu Bakar, M. (2018). Health care-associated infections: An overview. *Infection and Drug Resistance*, 11, 2321–2333. PMC6245375
- Hasanah, S., Sarwili, I., & Rizal., A. (2024). Hubungan Pengetahuan Pencegahan Infeksi Dan Masa Kerja Perawat Dengan Perilaku Pencegahan Infeksi Luka Operasi Di RS Gatot Soebroto Tahun 2023. *Jurnal Riset Rumpun Ilmu Kesehatan*, 3(1), 159–175. <https://doi.org/10.55606/jurrikes.v3i1.2744>
- Li, Y., & Wang, H. (2024). Cognitive aging in healthcare: How crystallized knowledge compensates for fluid intelligence declines in nursing tasks. *International Journal of Nursing Studies*, 148. <https://doi.org/10.1016/j.ijnurstu.2023.104615>
- Limon, I., & Villafuerte, R. (2022). Educational attainment and its impact on patient safety competencies among nursing professionals. *International Journal of Healthcare Management*, 15(2), 143–151. <https://doi.org/10.1080/20479700.2020.1836734>
- Pedoman Pencegahan Dan Pengendalian Infeksi Di Fasilitas Pelayanan Kesehatan, 11 (2017).
- Pratiwi, A., Sari, R., & Nugroho, A. (2021). Faktor-Faktor yang Mempengaruhi Pengetahuan Tenaga Kesehatan. *Jurnal Kesehatan Masyarakat*, 15(2), 123–130.
- World Health Organization (WHO). (2023). *Infection prevention and control*.
- World Health Organization (WHO). (2024). *Global Report on Infection Prevention and Control 2024*. <https://www.who.int/publications/i/item/9789240103986>
- Zhu, N., Zhang, D., & Chen, W. (2021). Knowledge of infection prevention and control among healthcare workers and factors influencing compliance: A systematic review. *BMC Infectious Diseases*, 21(545). <https://doi.org/10.1186/s12879-021-06219-3>