



**THE ROLE OF HOSPITAL MANAGEMENT INFORMATION SYSTEMS IN
ENHANCING COMPLIANCE WITH SURGICAL SITE INFECTION
PREVENTION PROTOCOLS: A SYSTEMATIC REVIEW**

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ABSTRACT

Surgical Site Infections (SSIs) remain a significant challenge in hospital settings, affecting patient safety and increasing healthcare costs. The implementation of Hospital Management Information Systems (HMIS) has been proposed as a strategy to enhance compliance with infection prevention protocols among healthcare professionals. However, variations in adherence and technological adoption remain a concern. Objective: This study aims to assess the impact of HMIS on nurses' compliance with infection prevention protocols in surgical settings by synthesizing existing research evidence. Method: A systematic literature review was conducted following PRISMA guidelines. Peer-reviewed studies published between 2019 and 2024 were analyzed, focusing on HMIS implementation, infection control compliance, and hospital-acquired infection (HAI) reduction. Results: The findings suggest that HMIS improves real-time monitoring, documentation accuracy, and adherence to infection control protocols. However, challenges such as workload, training gaps, and system integration issues hinder optimal compliance. Conclusion: HMIS plays a crucial role in enhancing infection prevention measures in hospitals. Future research should explore long-term effectiveness, cost-efficiency, and the integration of artificial intelligence to further optimize digital health interventions for infection control.

Keywords: clinical compliance; hospital surveillance; infection control; nosocomial infection; surgical safety

How to cite (in APA style)

Nurhadi, N., & Triyanto, E. (2025). The Role of Hospital Management Information Systems in Enhancing Compliance with Surgical Site Infection Prevention Protocols: A Systematic Review. *Indonesian Journal of Global Health Research*, 7(3), 785-792. Retrieved from <https://jurnal.globalhealthsciencegroup.com/index.php/IJGHR/article/view/5774>.

INTRODUCTION

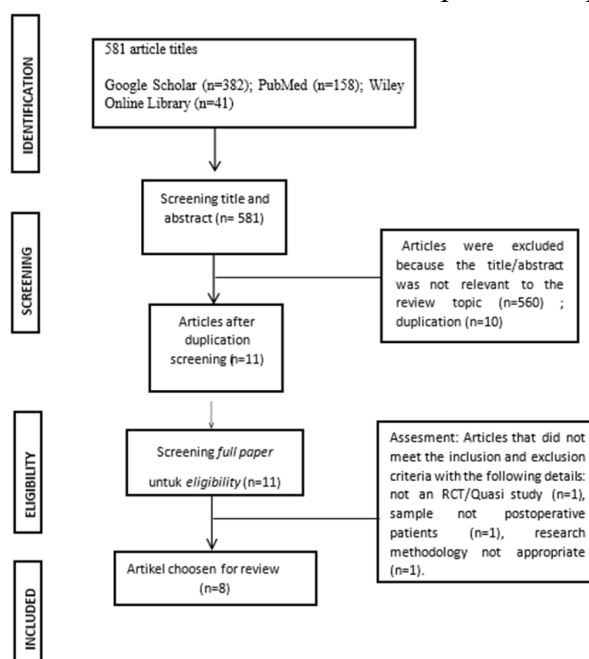
Infection control in surgical settings is a critical component of patient safety and quality healthcare. Surgical Site Infections (SSIs) are among the most common complications arising from surgical procedures, significantly affecting patient outcomes, healthcare costs, and hospital reputations (Calderwood et al. 2023). The World Health Organization (WHO) estimates that SSIs occur in 5% to 15% of surgical patients in developed countries, with even higher rates reported in low- and middle-income nations (World Health Organization, 2018). The prevention of these infections requires a multifaceted approach that includes adherence to strict hygiene protocols, appropriate use of prophylactic antibiotics, and effective surgical techniques (Sartelli et al., 2020). The role of healthcare professionals, particularly nurses, is paramount in implementing infection control measures. Compliance with established protocols is essential for minimizing the risk of SSIs. However, studies indicate that adherence to these protocols can be inconsistent among nursing staff due to various factors such as workload, lack of training, and insufficient access to information (Mohsen et al., 2020). Recent advancements in technology have introduced Hospital Management Information Systems (HMIS), which have the potential to enhance compliance with infection control practices. These systems can provide real-time access to guidelines, reminders for protocol adherence, and facilitate better documentation practices (Atifah et al., 2025). Despite

the promising benefits of HMIS, there remains a gap in the literature regarding their specific impact on nurses' compliance with infection control protocols in surgical settings.

The data analytics maturity model developed by Carvalho et al. (2019) provides a comprehensive framework for hospitals to assess and enhance their data analytics capabilities. By implementing this model, hospitals can improve operational efficiency, healthcare service quality, and data-driven decision-making. The application of this model is expected to serve as a guide for hospitals in their digital transformation journey, particularly in the area of health data analytics. This study aims to explore the influence of the implementation of an HMIS on nurses' compliance with infection control measures in operating rooms. By analyzing existing evidence-based research, this systematic review will identify the challenges faced by nurses in adhering to infection prevention protocols and evaluate how HMIS can support improved compliance.

METHOD

This study utilizes a systematic literature review to evaluate the impact of the Hospital Management Information System (HMIS) on nurses' compliance with surgical site infection (SSI) prevention protocols. Following PRISMA guidelines, articles were selected based on specific inclusion and exclusion criteria. Eligible studies were published in peer-reviewed Indonesian journals between 2019 and 2024, focusing on HMIS implementation and its role in infection control. The search was conducted in academic databases such as Garuda, Neliti, and Sinta, using Boolean operators to refine the results. Articles that were not peer-reviewed, unrelated to nurses' compliance, or literature reviews were excluded from the final selection. The study selection process involved screening titles and abstracts, removing duplicates, and conducting full-text evaluations. Relevant studies were assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist, categorizing them into high, moderate, or low-quality research based on methodological rigor. Data extraction focused on study design, sample population, HMIS usage, and key outcome measures such as compliance rates and infection reduction. A narrative synthesis was employed to summarize findings, while quantitative data, if available, were analysed using descriptive statistics to illustrate trends in HMIS implementation and nurses' adherence to infection prevention protocols.



RESULT

Table 1.
Article Analysis

No	Research Title and Authors	Research Design, Sample, and Sampling Technique	Research Findings	Research Limitations
1	Evaluation of the Implementation of Healthcare-Acquired Infections (HAIs) Surveillance System at RSU Haji Surabaya in 2020. Aulia Rosyida, Laura Navika Yamani, Dwiono Mudjianto (2021)	Descriptive evaluation research with an observational approach based on system components (input, process, and output)	The implementation of HAIs surveillance at RSU Haji Surabaya complies with the Minister of Health Regulation No. 27 of 2017 on Infection Prevention and Control Guidelines in Healthcare Facilities.	Some activities have not met the set targets, such as timeliness, report completeness, and improvements needed in the surveillance application.
2	Nurse Compliance in Implementing SSI Bundles and Surgical Site Infection Incidence. Yocia Retnawati, Niken Sukesi, Chandra Hadi (2024)	Quantitative research using a cross-sectional method with 67 respondents selected through purposive sampling	The study results show a calculated Z-score of -0.502 and a p-value = 0.000, indicating a moderate negative relationship between the dependent and independent variables.	The highest non-compliance was found in the intraoperative SSI bundle, though non-compliance was also observed in preoperative and postoperative bundles.
3	Nurse Compliance in Implementing the Surgical Safety Checklist and Patient Safety Incidents in Semarang Hospitals. Nurhayati, S., & Suwandi. (2019)	Quantitative research with 30 respondents. The instrument used was the WHO-adapted Surgery Safety Checklist at RSUD Tugurejo	Implementation of the Surgical Safety Checklist showed that 28 respondents (93.3%) were compliant, while 2 respondents (6.7%) were non-compliant.	No significant relationship was found between nurse compliance in implementing the Surgical Safety Checklist and patient safety incidents (p = 0.131).
4	Effectiveness of Nurse Compliance and Postoperative Infection Incidence in Mawar Ward, RSI Nasrul Ummah Lamongan, Ike Prafitasari (2019)	Cross-sectional study design with a sample of 24 nurses	Spearman correlation test results: $r = -0.530$, $\alpha = 0.008$ ($p < 0.05$), indicating a significant relationship between hand hygiene compliance and infection symptoms in the Mawar Ward, RSI Nasrul Ummah Lamongan.	34.8% of nurses did not comply with handwashing procedures, increasing the likelihood of postoperative infections.
5	Factors Influencing Nurse Compliance with Perioperative SOPs to Prevent Postoperative Wound Infection. Indrawati, Y. S. P., Sari, Y., & Sumeru, A. (2023)	Correlational analysis with a cross-sectional approach. Conducted at RSUD Dr. R. Goeteng Taroenadibrata Purbalingga (August 2022–February 2023) on 55 nurses in surgical and obstetric wards	Multivariate analysis showed that workload was the most dominant factor influencing compliance with perioperative SOPs (OR = 34.63). A positive B coefficient (3.54) indicates a direct correlation between workload and nurse compliance.	The study did not conduct comprehensive observations during perioperative nursing care implementation.
6	Characteristics and Compliance Levels of Nurses in Implementing SSI SOPs in the Surgical Unit of RSUP Cipto	Descriptive research with random sampling. The study population included 45 nurses from the integrated surgical ward at RSUP	Most nurses with 1–5 years of experience (31 out of 45) were compliant, while 6 were non-compliant. Nurses with more than	Factors such as older age, lower education levels, and non-compliance affected adherence to postoperative wound care SOPs.

No	Research Title and Authors	Research Design, Sample, and Sampling Technique	Research Findings	Research Limitations
	Mangunkusumo, Jakarta. Akhiryani et al. (2019)	Cipto Mangunkusumo	five years of experience showed higher compliance.	
7	The Relationship Between Motivation and Nurse Compliance in Hand Hygiene Practices in the Surgical Ward of RSUD Indramayu. Saefulloh et al. (2018)	Analytical survey research with a cross-sectional approach to examine correlations between risk factors and effects. The population consisted of 30 nurses in the surgical ward of RSUD Indramayu	27 respondents (90%) were compliant with hand hygiene practices, though some nurses still failed to adhere fully.	Observations revealed that 6 out of 10 nurses followed the five moments of hand hygiene, while 3 did not wash hands before patient contact, and 1 did not wash hands after patient contact. Reasons for non-compliance included perceived cleanliness and urgency in attending to patients.
8	Factors Related to Compliance with Surgical Patient Safety Implementation in the IBS Unit of RSUD Karawang 2021. Lismayanti & Septiani, (2021).	The study included 35 surgical nurses, analyzed using the Chi-Square formula	Higher education levels were associated with increased compliance. Bivariate analysis results: P-value (0.001) < 0.05, indicating a significant relationship between education level and compliance.	Compliance with the Patient Safety Checklist was influenced by age, gender, work experience, education, and motivation. Other unexplored variables include attitudes, group characteristics, environmental factors, supervision, policy enforcement, and marital status.

This systematic review synthesizes various empirical studies examining nurses' compliance with infection prevention protocols, particularly within surgical settings in Indonesian hospitals. The studies collectively highlight the critical role of surveillance systems, standardized protocols, and behavioral factors influencing adherence to infection control guidelines. Rosyida et al. (2021) conducted an observational descriptive evaluation of the Healthcare-Associated Infections (HAIs) surveillance system at RSU Haji Surabaya. Their findings indicate that while the surveillance system aligns with Regulation of the Minister of Health No. 27 of 2017, specific implementation gaps remain, particularly in timeliness, completeness of reporting, and system usability. Similarly, Retnawati et al. (2024) employed a cross-sectional quantitative approach to assess nurses' adherence to Surgical Site Infection (SSI) prevention bundles, revealing a moderate negative correlation (Z-score: -0.502, p = 0.000) between compliance and SSI occurrence. Notably, intraoperative bundle adherence was the weakest, while preoperative and postoperative compliance also showed variability, underscoring the need for targeted interventions.

Further investigations into surgical safety protocols offer mixed insights. A study in Semarang hospitals using the WHO-adapted Surgical Safety Checklist found that 93.3% of nurses adhered to checklist protocols, though no statistically significant relationship (p = 0.131) was observed between adherence and patient safety incidents. Contrastingly, Sari (2019) employed a Spearman correlation analysis (r = -0.530, p = 0.008) to assess the relationship between hand hygiene compliance and post-surgical infection rates at RSI Nasrul Ummah, demonstrating a significant inverse correlation, where 34.8% of nurses failed to follow proper hand hygiene procedures. In the perioperative context, Indrawati, Sari & Sumeru (2023) identified workload (OR = 34.63, B = 3.54) as the most influential factor affecting compliance with Standard Operating Procedures (SOPs) for infection prevention, suggesting that high workload correlates with reduced adherence. Furthermore, Akhiryani et al. (2019) study at RSUP Cipto Mangunkusumo found that nurses with more than five years

of experience exhibited higher adherence levels, reinforcing the link between work experience and procedural compliance.

Several studies emphasize behavioral and demographic influences on compliance. A study at RSUD Indramayu (Saefulloh et al. 2018) found that 90% of nurses adhered to hand hygiene protocols, though observational assessments revealed gaps in compliance during critical patient interactions. The study highlighted perceived cleanliness and urgency as primary justifications for non-compliance, indicating the necessity for behavioral reinforcement and real-time monitoring. Additionally, a study at RSUD Karawang ((Lismayanti & Septiani, 2021)) employing Chi-square analysis ($p = 0.001$) identified a strong association between education level and adherence to the Surgical Patient Safety Checklist, though other unexamined variables, such as group dynamics, environmental factors, and policy enforcement, remain influential determinants. Collectively, these findings suggest that nurses' compliance with infection control measures is multifactorial, influenced by institutional policies, workload, experience, education, and behavioral attitudes. Addressing these challenges requires comprehensive interventions, including structured training programs, enhanced surveillance systems, workload optimization, and targeted behavioral change strategies to ensure consistent adherence to infection prevention protocols in surgical settings.

DISCUSSION

The synthesis of eight analyzed articles reveals various factors influencing the implementation and effectiveness of the Hospital Management Information System (SIMRS) in preventing hospital-acquired infections (HAIs), particularly surgical site infections (SSIs). Several studies, including those by Rosyida et al. (2021) and Allegranzi et al. (2016), highlight the significance of surveillance systems in infection control, which help in early identification and prevention of HAIs. However, despite these benefits, Retnawati et al. (2024) and Braun et al. (2020) emphasize that compliance with infection prevention protocols varies significantly among healthcare workers, affecting the overall effectiveness of infection control measures. Studies by Haynes et al. (2009) indicate that while adherence to surgical safety checklists is high in some hospitals, this does not always correlate with better patient outcomes due to variations in implementation quality and institutional commitment. One of the major challenges in infection prevention is nurse compliance with standard protocols, which is influenced by factors such as workload, education, and motivation. Research by Indrawati, Sari & Sumeru (2023) and Babore et al. (2024) demonstrates that excessive workload negatively impacts adherence to infection prevention guidelines, leading to increased risk of HAIs. Conversely, Akhiryani et al. (2019) and Storesund et al. (2020) suggest that extensive clinical experience positively correlates with higher compliance levels. However, the gap in compliance rates underscores the necessity for continuous education, structured training programs, and reinforcement strategies to improve infection prevention practices.

The implementation of SIMRS has shown potential in enhancing compliance with infection control measures through digital surveillance, real-time data monitoring, and automated reminders. According to Xu et al. (2023), clinical decision support systems (CDSS) integrated within hospital information management frameworks have been instrumental in reducing HAIs by assisting healthcare providers in adhering to best practices. Despite these advantages, issues such as inconsistent technology adoption, user resistance, and lack of interoperability with existing hospital workflows have been reported as significant barriers to SIMRS efficacy. Study by Mohsen et al. (2020) further suggest that effective integration of digital tools into clinical practice requires institutional support, comprehensive training, and user-friendly interfaces to encourage widespread acceptance among healthcare workers. Future research should focus on evaluating the long-term effectiveness of SIMRS in preventing HAIs

through large-scale, multi-center studies. While previous research has demonstrated promising results in isolated settings, limited longitudinal studies and meta-analyses hinder a comprehensive understanding of SIMRS's impact on infection control. Moreover, investigations into the cost-effectiveness, user adaptability, and scalability of such digital interventions in diverse healthcare settings are crucial. Addressing these research gaps can provide stronger evidence for policy recommendations and encourage broader adoption of digital infection control strategies in hospitals worldwide.

CONCLUSION

This systematic review highlights the significant role of the Hospital Management Information System (SIMRS) in enhancing compliance with infection prevention protocols in surgical settings. While SIMRS offers benefits such as real-time monitoring, automated reminders, and improved documentation, challenges persist, including workload, inadequate training, and inconsistent adherence. Factors such as work experience, education, and institutional support influence nurses' compliance levels. Despite the system's potential, variability in adherence suggests that additional interventions are necessary to maximize its impact on hospital-acquired infection (HAI) prevention. A comprehensive approach integrating SIMRS with continuous education, surveillance systems, and decision-support tools is essential for improving infection control. Strengthening hospital policies, optimizing staff workload, and implementing real-time alerts can mitigate surgical site infections (SSIs) and enhance patient safety. However, limitations in infrastructure and training hinder widespread adoption, requiring further refinement in system usability and institutional commitment. Improving knowledge, positive attitudes, adequate training, and the provision of adequate facilities and infrastructure can enhance compliance with the implementation of surgical patient safety. The recommendation from this study is for hospitals to enhance training programs, improve facilities and equipment, and build a strong patient safety culture within the hospital environment based on IT. Future research should evaluate the long-term effectiveness of SIMRS in infection control through large-scale, multi-center studies. Investigations into cost-effectiveness, behavioral influences on compliance, and integration of artificial intelligence (AI) for predictive infection control analytics could enhance hospital management.

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