Jurnal Keperawatan Global
Vol. 9, No. 1, June 2024
https://doi.org/10.37341/jkg.v9i1.943

Original Research

Management of Surgical Wound Care Using the Bundles Principle as an Infection Control Strategy in Post-operative Patients

Sri Lestari[1] , Arum Pratiwi[2]*, Noor Alis Setiyadi[3]

[1] Master of Nursing Program, Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, Indonesia
[2] Nursing Department, Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, Indonesia
[3] Public Health Department, Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, Indonesia

ABSTRACT

Background: *Infection prevention strategies, such as applying the bundle's principle, play a vital role in surgical wound care. However, limited studies assess nurse compliance with these standards. Investigating compliance is crucial to understanding its impact on post-operative wound infection. This study examines how nurse adherence to the bundle's principle influences wound infection during the healing process.*

Methods: *A before-and-after study was conducted at a second-level hospital in Indonesia over three months. Using total sampling, 100 nurses meeting inclusion criteria (adults with over one year of experience and training in bundle strategies) participated. Patients were selected through accidental sampling and included adults with non-infectious surgical wounds and no complications. The bundle's principle was implemented from the third to the sixth postoperative day, with infection signs assessed afterward. Instruments included demographic data, compliance checklists, and wound infection assessments. Data were analyzed using logistic regression.*

Results: *Gender did not significantly affect wound infection occurrence (OR 0.39, *P* = 0.092). Nurse compliance and work length showed a significant association with infection prevention (OR 4.47, *P* = 0.006). Educational background was not significantly associated with compliance (OR 2.11, *P* = 0.409).*

Conclusion: *Nurses' compliance with the bundle's principle significantly reduces post-operative wound infections, promoting effective healing. Factors like gender, work length, and educational background contribute equally to post-operative wound care outcomes.*

ARTICLE HISTORY
Received: May 27th, 2024
Received: December 5th, 2024

KEYWORDS
bundles, nurses, patients, surgical, standards, wounds;

CONTACT
Arum Pratiwi
✉
ap140@umns.ac.id
Nursing Department, Faculty of Health Science, Universitas Muhammadiyah Surakarta. Jl. A. Yani, Mendungan, Pabelan, Kartasura District, Sukoharjo Regency, Central Java, Indonesia 57162.

Cite this as: Lestari, S., Pratiwi, A., & Alis Setiyadi, N. (2024). Management of Surgical Wound Care Using the Bundles Principle as an Infection Control Strategy in Post-operative Patients. *JKG (JURNAL KEPERAWATAN GLOBAL)*, *9*(1), 62–70. https://doi.org/10.37341/jkg.v9i1.943

INTRODUCTION

Healthcare-associated infections (HAIs) are one of the health problems in various countries in the world, including Indonesia (Al-Tawfiq and Tambyah 2014). Infectious

diseases related to health services are an agenda that must be discussed to solve the problem because infections such as HAIs can have a direct impact as a burden on the country's economy (Gidey et al. 2023). HAIs are infections that occur in patients during hospitalization for example, on postoperative patients. HAIs can be prevented if health services consistently implement infection control programs. Infection Prevention and Control is an effort made to protect everyone from harmful things such as the possibility of contracting infections from public or environmental sources and during the healthcare process in various health settings (Lowe et al., 2021).

HAIs can occur during the healing process in hospitals, where when a noble patient is admitted to a health setting, there are no symptoms of infection and no incubation period. Infections acquired in the hospital may show symptoms after the patient is discharged, usually 30 days later (Sikora and Zahra, 2024). The incidence of HAIs is usually associated with hospital morbidity and mortality rates (Dadi et al., 2021). It is argued that approximately 37,000 deaths in Europe and 99,000 deaths in the United States were caused by HAIs, in addition to 18.5% of deaths in Latin America, 23.6% in Asia, and 29.3% in Africa. The prevalence of HAIs in Indonesia reached 15.74%; this figure is higher than in developed countries, which range from 4.8% to 15.5% (Jacob and Cummins, 2019).

HAIs are one of the evaluations of hospital service quality assessment, which can be identified to assess several indicators such as ventilator-associated pneumonia *(*VAP), central bloodstream infection (CLABSI), urinary tract infection (UTI), and surgical site infection (SSI) (Sartelli et al., 2023). Risk of disruption, such as urinary catheters and surgical procedures, can result in SSI; furthermore, ventilator intubation can impact VAP, and venous and arterial cannula can result in CLABSI and phlebitis (Whitaker et al., 2019). A preliminary survey conducted at a hospital with second-level healthcare facilities found that the incidence of SSI starting in 2019 was found to be 0.73%; in 2020, there was 0.52%; in 2021, it was 0.43%; and in 2022, it was 0.59%. Based on data from January to April 2023, the incidence of SSI reached 1.5%. This incidence rate reaches the SSI standard limit.

SSI can occur if nurses do not apply the standards in wound care (Zabaglo, Leslie SW, and Sharman, 2024). The "bundles" principle is the application of evidence-based wound care to improve maximum patient outcomes. Currently, many hospitals have not applied the bundles principle in providing wound care to patients. To evaluate the impact of the postoperative wound progression process, nurse compliance must be analyzed because the bundle application is a package of work for nurses and teams whose procedures must be adhered to at least 95% (Foghetti, 2025).

It is necessary to evaluate the relationship between nurses' compliance in preventing SSI using the bundles principle and the incidence of infection in a hospital with a level two health facility. Therefore, this study aims to investigate nurse adherence to the bundle's principle influences on wound infection during the healing process.

MATERIALS AND METHODS

This study was conducted in a hospital with level-two health facilities in Indonesia for three months, from January to March 2024. This type of research is quantitative to investigate the impact of infection incidence when *evidence-based theory* is applied. The respondents were 100 nurses determined by a total sampling with the criteria of working for more than one year and having received training in the principle

of bundles. Patients as intervention subjects were determined by *accidental sampling* for three months with the criteria of being adults and having clean surgical wounds without complications on the first day after surgery, not having complicated diseases. Identification of signs of infection will be carried out on the 3rd postoperative day because the re-epithelialisation phase has begun.

The instruments used to measure are nurse and patient demographic instruments and a compliance instrument consisting of 15 statement items about surgical site infection bundles. As for the interpretation of this instrument, it is considered compliant in the implementation of SSI bundles if at least 80% or 12 of the items are filled in always, often, or rarely. To assess nurse compliance, researchers distributed compliance instrument quizzes to nurses in the room who treated surgery patients. The data analysis process applied logistic regression to answer the correlation of the demographic data of nurses with compliance in carrying out the application of SSI bundles as an effort to prevent the occurrence of surgical wound infections.

Signs and symptoms of infection were identified using an observation infection monitoring checklist that was modified into seven statement items consisting of the type of surgery, type of incision wound fluid, signs of inflammation of the surgical wound area (five items), and signs of dehiscence. If the wound meets the signs of inflammation or dehiscence, it is declared an infection. This study was approved by the ethics committee of the Faculty of Medicine of Muhammadiyah University of Surakarta with number 4933/B.1/KEPK-FKUMS/VIII/2023.

RESULTS

The respondent demographic factors are presented in Table 1

Table 1. Subject Characteristics Nurses

Variables	Frequency	Percentage
Age (average)	35.72	
Gender		
Male	21	21.00
Female	79	79.00
Work Experience		
1-2 years	54	54.00
≥3 years	46	46.00
Education Level		
Diploma nursing	94	94.00
Professional nursing	6	6.00

Table 1 describes that the age has an average (mean) of 35.72. The majority of respondents were female, as many as 79 respondents (79.00%); 54 respondents (54.00%) had worked for 1-2 years, and 94 respondents (94.00%) had background education of diploma nursing.

Table 2. Characteristics of patients assessed for infection

Variables	Frequency	Percentage
Age (average)	35.00	100
Gender		
Male	284	14.65

Variables	Frequency	Percentage
Female	1654	85.34

Table 2 shows that the patient age category is presented in the form of an average (mean) with a value of 35.00. The majority of patient respondents were female, with as many as 1654 respondents (85.34%).

Relationship between Socio-Demographic Factors and Nursing Adherence

Researchers conducted bivariate analysis testing using the logistic regression test. The data distribution of the analysis results is listed in Table 3.

Table 3. Bivariate Analysis

Variables		Low		High		*Odd Ratio* (95% CI)	*p-value*
		n	%	n	%		
Gender	Male	14	14.00	66	66.00	0.39 (0.13- 1.16)	0.092
	Female	7	7.00	13	13.00		
Work Experience	1-2 years	49	49.00	31	31.00	4.74 (1.56- 14.35)	0.006
	≥3 years	5	5.00	15	15.00		
Education Level	D3	76	76.00	4	4.00	2.11 (0.35- 12.43)	0.409
	Ners	18	18.00	2	2.00		

Table 3 describes that there is no significant relationship between gender and nurse compliance, p = 0.092 (p-value < 0.05). There is a significant relationship between length of service and nurse compliance, p = 0.006 (p-value < 0.05). Length of service of more than 3 years increased nurse compliance in implementing postoperative wound infection prevention by 4.74 times. There was no significant relationship between education and nurse compliance, p = 0.409 (p-value <0.05).

The relationship between nurse compliance and the incidence of surgical site infection

In this study, there were two sets of data that included information from nurses on compliance with the surgical site infection prevention app and patients on the incidence of postoperative wound infection. The nurses' data provided insight into their level of adherence to the app. The researcher performed the calculation by dividing it into two criteria: 1) score < average (50.33) = low; 2) ≥ average = high. The frequency of scores can be seen in Table 3.

Table 4. Frequency Score of Nurse Compliance

Category	Frequency	Percentage
High	80	80.00
Low	20	20.00

Table 4 shows that the level of nurse compliance in implementing postoperative site infection prevention in the low category was 80%, while in the high category, it was 20%. Meanwhile, patient data provides information on the number of postoperative site infections. Data from 1583 patients showed that 46 patients had postoperative site

infections. Based on this data, the rate of postoperative site infection in a hospital with second-level health facilities in Surakarta was 2.90%.

Table 5. Frequency Distribution of Infection Incidence in the Last 5 Years

Year	Percentage
2019	0.73
2020	0.52
2021	0.43
2022	0.59
2023 (January-April)	1.5
2023 (May-December)	2.90
2024 (January-April)	0.28

Table 5 describes that the frequency distribution of infection incidence over five years showed fluctuations with an increase in infection incidence in 2023, indicating that the level of nurse compliance in implementing postoperative site infection prevention, which was in the low category, was associated with an increase in the incidence of postoperative wound infection in a hospital with a second-level health facility in Surakarta.

DISCUSSION

This study found that there was no significant relationship between gender and nurse compliance in implementing postoperative wound infection prevention. Possibly, other factors such as education level, experience, or individual motivation have a more dominant role in determining the level of nurse compliance. In addition, differences in organizational culture, hospital policies, or other contextual factors may have also influenced the results of the study. These results need to be examined with caution, given the limited sample size and possibly insensitive measurement instruments.

A thorough evaluation of the research context is needed to understand the implications of these findings more deeply. Several studies have explained the relationship between gender and compliance. A study conducted by Yazid et al., (2021) showed that there is a significant relationship between gender and health protocol compliance attitudes. A study by Moran and Del Valle, (2016) explained that gender influences health protection behavior responses in the general population, with women being more likely to adopt or implement health protection behaviors.

Another finding is a significant correlation between tenure and nurses' compliance in implementing postoperative site infection prevention. Nurses with more than or equal to 3 years of service had a 4.74 times higher compliance rate in the implementation of surgical site infection prevention compared to nurses who worked for less than 3 years. The main factor behind this finding is accumulated experience. Nurses who have spent longer in the profession tend to have more mature knowledge and skills regarding postoperative site infection prevention.

This experience not only enhances their understanding of infection risks but also motivates them to adhere to preventive procedures more conscientiously to protect patient health. In addition, long working hours reflect the work culture and disciplinary norms that have been ingrained in nurses. Commitment to work and awareness of responsibility towards patients may play a key role in high compliance rates. These findings highlight the importance of work experience in shaping nurses' attitudes and

behaviors towards postoperative wound infection prevention, providing a more in-depth picture of the dynamics affecting adherence in a healthcare context.

Research by Sands and Aunger, (2020) explained that nurses with a long proportion of work shifts have a higher level of hand hygiene compliance. This is because they can allocate more time to interact with patients and fellow professionals. More time spent with patients can lead to more opportunities to practice hand hygiene and, ultimately, more hand hygiene activities performed. Nurses' education has no significant relationship with nurse compliance in implementing postoperative site infection prevention.

This finding indicates that other factors may be more likely to influence nurses' level of compliance in the context of postoperative site infection prevention, such as work experience, individual motivation, or organizational culture. These results also demonstrate the complexity and multiple factors involved in assessing and understanding the factors that influence nurses' level of compliance in implementing postoperative site infection prevention practices in a healthcare setting. In addition, the limited sample size may also influence these findings; therefore, further research with a larger sample may provide a more in-depth and reliable picture of the factors influencing nurses' adherence to postoperative site infection prevention practices.

Research by Hammerschmidt and Manser, (2019) showed that improved knowledge, behaviors, and attitudes can increase hand hygiene compliance among nurses in nursing homes, but adherence to standards also depends on the availability of infrastructure in the work area and the presence of role models. The relationship between nurse compliance in the implementation of postoperative site infection prevention and the incidence of postoperative site infection in a hospital with second-level health facilities in Surakarta could not be analyzed statistically due to the limited type of data obtained. But descriptively can be described with the results of the low level of nurse compliance in the implementation of postoperative site infection prevention and the relatively low incidence of postoperative site infection in a hospital with second-level health facilities in Surakarta.

The level of nurse compliance in the implementation of postoperative site infection prevention was described as low based on the results of a survey using a questionnaire developed by the researcher and has been tested for validity and reliability on 20 nurses outside the study subjects. The incidence of postoperative site infection in patients in a hospital with second-level health facilities in Surakarta resulted in a rate of 2.90%, which was categorized as low. The discrepancy between the level of nurse compliance in implementing postoperative site infection prevention, which is classified as low, and the incidence rate of postoperative site infection, which is classified as low in one type C hospital in Surakarta.

This can be explained by several reasons, namely 1) Low-risk patient population: A hospital with second-level health facilities tends to have patient populations at low risk of postoperative site infection. This could be due to a healthier patient profile, less invasive surgical procedures, or environmental conditions that favour infection prevention. 2) Monitoring and rapid response: despite low compliance, a system of monitoring and rapid response to potential cases of infection may be effective in such hospitals. This can help identify and treat cases of postoperative site infection quickly so that the incidence rate remains low. 3) Surveillance and Response System: An effective surveillance system and rapid response to potential infection cases may help control and reduce the incidence of postoperative wound infection, even if nurse

compliance is low; and 4) Environmental Factors: Environmental conditions in the hospital, such as the cleanliness of the operating room or the layout of the facility, can also contribute to a low incidence of postoperative site infection.

Research by Vaismoradi et al., (2020) explained that patient participation, healthcare provider knowledge and attitudes, nurse collaboration, appropriate electronic equipment and systems, regular education and feedback, and standardization of care processes influence nurses' adherence to patient safety principles. Nurses are expected to adhere to organizational strategies to identify hazards and risks through patient assessment, care planning, monitoring and surveillance activities, rechecking, offering assistance, and communicating with other healthcare providers (Henneman, 2017; Vaismoradi, Jordan, and Kangasniemi, 2015). Hand hygiene is the simplest and most effective measure to prevent healthcare-associated infections.

Research suggests that reported adherence to hand hygiene is likely related to openness to hospital management communication, perception of performance by coworkers, increased interaction with patients and other staff members, and decreased stress, busyness, and cognitive load associated with the implementation role (Sands and Aunger 2020).

CONCLUSIONS

The frequency distribution of infection incidence over five years showed fluctuations with an increase in infection incidence in 2023, indicating that the level of nurse compliance in implementing postoperative site infection prevention, which was in the low category, was associated with an increase in the incidence of postoperative site infection in a hospital with a second-level health facility in Surakarta.

ACKNOWLEDGEMENTS

We would like to thank the Directorate General on Higher Education, Research, and Technology (Ditjent Diktiristek) for funding this year's research under the Master Thesis Research Schema with contract number 108/ES/PG.02.00.PL/2024; 007/LL8/PB/AL.04/2024; 196.129/A.3-III/LRI/VI/2024.

REFERENCES

Al-Tawfiq, Jaffar A., and Paul A. Tambyah. 2014. "Healthcare Associated Infections (HAI) Perspectives." *Journal of Infection and Public Health* 7(4):339–44. doi: 10.1016/j.jiph.2014.04.003.

Dadi, Nitin Chandra Teja, Barbora Radochová, Jarmila Vargová, and Helena Bujdáková. 2021. "Impact of Healthcare-Associated Infections Connected to Medical Devices—An Update." *Microorganisms* 9(11):2332. doi: 10.3390/microorganisms9112332.

Foghetti, Domitilla. 2025. "Surgical Wounds: Principles of Postoperative Care." *Alfuad Jurnal Sosial Keagamaan* 5(2):133–41. doi: 10.1007/978-3-031-60462-1_16.

Gidey, Kidu, Meles Tekie Gidey, Berhane Yohannes Hailu, Zigbey Brhane Gebreamlak, and Yirga Legesse Niriayo. 2023. "Clinical and Economic Burden of Healthcare-Associated Infections: A Prospective Cohort Study." *PLOS ONE* 18(2):e0282141. doi: 10.1371/journal.pone.0282141.

Hammerschmidt, Judith, and Tanja Manser. 2019. “Nurses’ Knowledge, Behaviour and Compliance Concerning Hand Hygiene in Nursing Homes: A Cross-Sectional Mixed-Methods Study.” *BMC Health Services Research* 19(1):547. doi: 10.1186/s12913-019-4347-z.

Henneman, Elizabeth A. 2017. “Recognizing the Ordinary as Extraordinary: Insight Into the ‘Way We Work’ to Improve Patient Safety Outcomes.” *American Journal of Critical Care : An Official Publication, American Association of Critical-Care Nurses* 26(4):272–77. doi: 10.4037/ajcc2017812.

Jacob, George, and Martina N. Cummins. 2019. “Common Organisms Responsible for Healthcare-Associated Infection (HCAI).” in *Tutorial Topics in Infection for the Combined Infection Training Programme*. Oxford University Press.

Lowe, Hattie, Susannah Woodd, Isabelle L. Lange, Sanja Janjanin, Julie Barnet, and Wendy Graham. 2021. “Challenges and Opportunities for Infection Prevention and Control in Hospitals in Conflict-Affected Settings: A Qualitative Study.” *Conflict and Health* 15(1):94. doi: 10.1186/s13031-021-00428-8.

Moran, Kelly R., and Sara Y. Del Valle. 2016. “A Meta-Analysis of the Association between Gender and Protective Behaviors in Response to Respiratory Epidemics and Pandemics.” *PloS One* 11(10):e0164541. doi: 10.1371/journal.pone.0164541.

Sands, Madeline, and Robert Aunger. 2020. “Determinants of Hand Hygiene Compliance among Nurses in US Hospitals: A Formative Research Study.” *PloS One* 15(4):e0230573. doi: 10.1371/journal.pone.0230573.

Sartelli, Massimo, Stefano Bartoli, Felice Borghi, Stefano Busani, Andrea Carsetti, Fausto Catena, Nicola Cillara, Federico Coccolini, Andrea Cortegiani, Francesco Cortese, Elisa Fabbri, Domitilla Foghetti, Francesco Forfori, Antonino Giarratano, Francesco Maria Labricciosa, Pierluigi Marini, Claudio Mastroianni, Angelo Pan, Daniela Pasero, Marco Scatizzi, Bruno Viaggi, and Maria Luisa Moro. 2023. “Implementation Strategies for Preventing Healthcare-Associated Infections across the Surgical Pathway: An Italian Multisociety Document.” *Antibiotics* 12(3):521. doi: 10.3390/antibiotics12030521.

Sikora, A., and F. Zahra. 2024. *Nosocomial Infections*. Treasure Island: StatPearls Publishing.

Vaismoradi, Mojtaba, Sue Jordan, and Mari Kangasniemi. 2015. “Patient Participation in Patient Safety and Nursing Input - a Systematic Review.” *Journal of Clinical Nursing* 24(5–6):627–39. doi: 10.1111/jocn.12664.

Vaismoradi, Mojtaba, Susanna Tella, Patricia A Logan, Jayden Khakurel, and Flores Vizcaya-Moreno. 2020. “Nurses’ Adherence to Patient Safety Principles: A Systematic Review.” *International Journal of Environmental Research and Public Health* 17(6). doi: 10.3390/ijerph17062028.

Whitaker, Brett, Karen A. Alroy, Erica Guthrie, Sarah Schildecker, Susan Hiers, Jill Woodard, and S. Arunmozhi Balajee. 2019. “Strengthening Laboratory Capacity for Detection of Respiratory Viral Pathogens through the Global Health Security Agenda (GHSA) Framework.” *African Journal of Laboratory Medicine* 8(1). doi: 10.4102/ajlm.v8i1.861.

Yazid, Tantri Puspita, Irwan Iskandar, Salsabila Salsabila, and Oktri Permata Lani. 2021. “GENDER CORRELATION BETWEEN COMPLIANCE AND THE HEALTH PROTOCOL IN THE NEW NORMAL ERA (THE CASE ON STUDENTS IN PEKANBARU).” *Alfuad: Jurnal Sosial Keagamaan* 5(2):51. doi: 10.31958/jsk.v5i2.4667.

Zabaglo, M., Leslie SW, and T. Sharman. 2024. *Postoperative Wound Infections*. Treasure Island: StatPearls Publishing.