

ORIGINAL RESEARCH

An observational cross-sectional study of the role of transformational leadership style in reducing the risk of nosocomial infectionsRasid Ariyanti¹ , Sri Hananto Ponco Nugroho², Puguh Widiyanto³**Author information**¹Nursing Student, Universitas Muhammadiyah Magelang, Indonesia^{2,3}Department of Nursing, Universitas Kusuma Husada Surakarta, Indonesia ariyantirasid055@gmail.com <https://doi.org/10.31603/ihs.16981>**Submitted**
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30/6/2026**Abstract**

Nosocomial infections remain a serious challenge in healthcare services, contributing significantly to morbidity and mortality. This study aims to analyze the relationship between transformational leadership style and the reduction of nosocomial infection risk in the inpatient ward of the Hospital. A quantitative research method with a cross-sectional design was employed. Data were collected using questionnaires that measured nurses' perceptions of leadership style and actions to reduce nosocomial infection risk, and were analyzed using the Spearman Rank test. The results revealed a significant positive relationship between transformational leadership style and infection risk reduction measures ($p < 0.05$). These findings emphasize the critical importance of leadership in enhancing patient safety.

Keywords: Healthcare system, innovation in leadership, nosocomial infection, nursing management, transformational leadership

Introduction

Healthcare and nursing services delivered by hospital professionals are expected to meet various standards, particularly regarding patient safety (Patrician et al., 2024). This includes protecting patients from hospital-acquired infections, formally known as Healthcare-Associated Infection (HAI) (Alamer et al., 2022). HAIs, or nosocomial infections, remain a critical global challenge in healthcare systems, exerting a significant impact on morbidity, mortality, and overall healthcare costs (Sandu et al., 2025). The most frequent nosocomial infections include surgical site infections, urinary tract infections, lower respiratory tract infections, bloodstream infections, and skin infections (Raoofi et al., 2023; Aiesh et al., 2023). According to 2022 World Health Organization (WHO) data, approximately 7% to 15% of hospitalized patients contract a nosocomial infection (World Health Organization, 2022), affecting millions globally each year, with mortality rates reaching 10% in developing nations. Surveillance reports from the Ministry of Health of the Republic of Indonesia indicate that the domestic prevalence of nosocomial infections has reached 9.8%, based on studies conducted across several referral hospitals (Achmad, 2017). This risk has been further exacerbated in the post-COVID-19 era, driven by heightened healthcare worker workloads and an increased vulnerability among immunocompromised patients.

The prevalence of healthcare-associated infections (HAIs) across Central Java varies, with empirical data indicating incidence rates ranging between 5% and 10%. Specifically, a study conducted at RSUD Dr. Moewardi Surakarta reported a nosocomial infection rate of 9.5%. Concurrently, research at RSUP Dr. Sardjito Yogyakarta identified advanced age, immunosuppression, and the irrational use of antibiotics as the primary risk factors driving these infections. Methodological assessments at RSUD Prof. Dr. Margono Soekarjo Purwokerto further indicated that nursing compliance regarding infection prevention practices remains suboptimal. Regional surveillance data compiled by the Infection Prevention and Control (IPC) Committee of RSUD Muntilan revealed an escalating trend in localized HAIs. Furthermore, the incidence of decubitus ulcers increased from 0% to 0.675%, while phlebitis rates doubled from 5.84% to 11.8% as of July 2024. This surge is supported by operational gaps in risk-reduction protocols; during the same period, nursing compliance with hand hygiene and glove utilization was recorded at only 87%. Furthermore, institutional infrastructure constraints compounded these vulnerabilities, with the procurement of personal protective equipment (PPE) standing at 83% and the logistical availability of alcohol-based handrubs declining to 80%. Mitigating nosocomial infections relies heavily on strict adherence to established IPC guidelines, including hand hygiene, proper PPE deployment, and aseptic protocols.

However, systemic execution remains hindered by underlying institutional variables, such as human resource deficits, prevailing leadership styles, heavy nursing workloads, and a lack of team motivation.

According to the Regulation of the Minister of Health (Permenkes) No. 11 (2017), leadership significantly contributes to enhancing patient safety in hospitals. This role entails encouraging and ensuring the implementation of patient safety programs, guaranteeing proactive initiatives for risk identification and incident reduction, promoting open communication and coordination, allocating adequate resources, and measuring the effectiveness of leadership contributions toward organizational performance and safety (Bhati et al., 2023; Nabilla & Dhamanti, 2023). Empirical evidence demonstrates that effective leadership correlates positively with increased adherence to infection prevention and control (IPC) practices within healthcare facilities (Keil et al., 2024). The primary mechanisms underlying this correlation include staff empowerment, transparent communication, and the cultivation of a work environment supportive of innovation. However, context-specific research within Indonesian hospitals remains limited, particularly regarding the quantitative reduction of HAI rates. While various leadership frameworks can be operationalized in hospital settings, transformational leadership stands out significantly (Al-Rjoub et al., 2024). Transformational leadership characterized by idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration is widely recognized for its capacity to elevate the commitment and clinical performance of healthcare professionals (Adalin et al., 2025). This specific leadership paradigm has proven effective in driving compliance with patient safety protocols and establishing a proactive organizational culture. Furthermore, literature indicates that transformational leadership exerts a positive influence on workplace empowerment (Notarnicola et al., 2024), which subsequently enhances nursing job satisfaction and minimizes adverse patient events compared to alternative leadership styles.

Prior studies have predominantly focused on the relationship between transformational leadership and job satisfaction or the general performance of healthcare professionals, leaving its direct impact on clinical outcomes such as HAI largely unexamined. This finding reinforces the urgency to empirically test the causal link between a transformational leadership paradigm and objective indicators of nosocomial infections. To address this literature gap, the present study aims to quantitatively analyze the association between transformational leadership styles and the reduction of nosocomial infection risks in a hospital setting. The findings are intended to serve as an evidence-based foundation for policy recommendations concerning clinical leadership development, with an ultimate focus on patient safety and the continuous improvement of healthcare service quality.

Method

This study employs a quantitative approach designed to evaluate the causal associations, variations, or direct influences between the investigated variables. A cross-sectional design was utilized to analyze the simultaneous occurrence of exposure risks and clinical outcomes. This observational framework facilitated rapid data collection and survey administration within a condensed timeframe, emphasizing concurrent measurement via structured questionnaires for both the independent and dependent variables. The target population comprised 138 staff nurses deployed across the inpatient wards of RSUD Muntilan, Magelang Regency. Participant selection was executed using a probability sampling approach to ensure that every individual within the population framework possessed an equal probability of selection. Specifically, a simple random sampling method was applied, allowing for randomized participant selection without stratification across the broader population. To determine the minimum required sample size from the total population, Slovin's formula was applied, yielding a calculated sample size of 103 nurses. Following this determination, randomized sample acquisition was conducted across each respective inpatient unit while strictly adhering to predetermined eligibility criteria. This study commenced in August 2024, spanning a multi-stage timeline that encompassed title submission, research proposal drafting, a proposal defense seminar, subsequent revisions, and primary data collection. Formal data collection was initiated immediately following the issuance of institutional research clearance and concluded in June 2025. The final reporting of research outcomes was executed upon completion of the entire analytical process. The investigation was conducted across nine designated inpatient and intensive care units at RSUD Muntilan, specifically including the Mawar, Anggrek, Gladiol, Flamboyan, Aster, Dahlia, and Edelweis Wards, alongside the Intensive Care Unit (ICU) and the Neonatal Intensive Care Unit (NICU). Data acquisition was facilitated digitally via standard Google Forms. The electronic survey links were systematically distributed to the designated units and administered exclusively to nursing professionals who fulfilled all predetermined inclusion and exclusion eligibility criteria.

The study utilized a questionnaire regarding nurses' knowledge and surgical site infection prevention practices. The initial section collected demographic data, including name/initials, age, sex, education level, length of service, and history of Infection Prevention and Control (IPC) training. The subsequent section contained statements addressing nurses'

practices in reducing nosocomial infection risks within the inpatient wards of RSUD Muntitan. This instrument comprised 21 positive statements evaluated on a 4-point Likert scale ("Always" = 4, "Often" = 3, "Sometimes" = 2, and "Never" = 1), yielding total scores ranging from 21 to 84. The data were measured on an ordinal scale using the median as a cut-off point—due to non-normal distribution—to categorize numerical values into categorical outcomes: $\geq$ Median (Practices implemented) and $<$ Median (Practices not implemented). Additionally, the transformational leadership style questionnaire was measured using a 12-item questionnaire reflecting the four indicators of transformational leadership proposed by Bass and Avolio (1994): idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Items were rated on a 4-point Likert scale ("Strongly Agree" = 4, "Agree" = 3, "Disagree" = 2, and "Strongly Disagree" = 1), with a maximum score of 48. Mean scores were utilized to determine the categorical values for each indicator.

The validity test of the nosocomial infection risk reduction questionnaire yielded a Content Validity Index (CVI) of 0.96. This result is declared valid as it exceeds the standard CVI threshold of 0.8. Reliability testing was conducted by comparing the Cronbach's alpha coefficient against the r-table value, where a questionnaire is considered reliable if Cronbach's alpha is greater than or equal to the r-table value. The reliability tests yielded Cronbach's alpha values ranging from 0.691 to 0.8178, which exceeded the r-table value of 0.362, confirming that the nosocomial infection risk reduction questionnaire is reliable. Validity testing measures whether a questionnaire is legitimate and capable of accurately assessing the targeted constructs. Conversely, reliability testing evaluates the consistency of responses, requiring a Cronbach's alpha coefficient >0.6 to pass. For the transformational leadership style questionnaire, validity was evaluated using an r-table threshold of 0.349, with items deemed valid when $r_{\text{calculated}} > r_{\text{table}}$. The corresponding reliability test yielded a Cronbach's alpha of 0.839.

Univariate statistical analysis was executed to systematically examine and summarize the empirical properties of each individual variable within the study, establishing a baseline profile of the cohort's demographic and primary outcome metrics. Prior to inferential testing, data distribution characteristics were formally evaluated; given that the dataset departed significantly from a normal distribution, descriptive measures of central tendency and dispersion were appropriately operationalized using median values alongside minimum and maximum ranges rather than standard parametric means and deviations. The descriptive analysis comprehensive spectrum encompassed participant sociodemographic attributes—specifically age, sex, educational background, length of professional employment, and prior participation in Infection Prevention and Control (IPC) training modules—alongside the core structural constructs of the investigation: transformational leadership style as the independent variable and the systematic reduction of nosocomial infection risks as the primary dependent variable. Following the initial univariate assessment, bivariate inferential analysis was conducted to rigorously evaluate the empirical relationship and degree of association between the independent variable of transformational leadership behaviors and the dependent variable of nosocomial infection risk reduction among nursing personnel. Because both primary variables were quantified using ordinal measurement scales derived from non-parametrically distributed composite scores, Spearman's rank-order correlation coefficient (ρ) was selected as the non-parametric statistical test to determine the direction, magnitude, and statistical significance of the inter-variable associations. To preserve strict institutional integrity and protect subject welfare throughout all phases of data collection and analytical processing, the entire operational protocol of this study underwent formal review and received full ethical clearance from the Health Research Ethics Committee of the Faculty of Health Sciences at Universitas Muhammadiyah Magelang under institutional approval reference number 0104/KEPK-FIKES/II.3.AU/F/2025.

Results

Participant data presented in the table indicate that the majority of respondents were in their productive age range of 31–40 years ($n=45;44\%$). In terms of gender distribution, male respondents accounted for 11 individuals (11%), whereas female respondents comprised the vast majority at 92 individuals (89%). Regarding educational attainment, 77 respondents (75%) held a Diploma in Nursing (D III), while 26 respondents (25%) possessed a Professional Nurse degree (Ners). A significant majority of respondents had a work tenure exceeding 3 years ($n=80;78\%$), followed by those with 1–3 years of service ($n=17;16\%$), and those employed for less than 1 year ($n=6;6\%$). Furthermore, most participants had previously received Infection Prevention and Control (IPC) training ($n=89;86\%$), whereas 14 respondents (14%) had not yet received such training. Data reveal that 54 respondents (52%) rated the quality of transformational leadership as high, 46 respondents (45%) rated it as very high, and 3 respondents (3%) rated it as low. Regarding clinical practices, 53 respondents (52%) performed nosocomial infection risk reduction measures, whereas 50 respondents (48%) did not implement these measures. The data further illustrate specific risk reduction practices among nurses at RSUD

Muntilan, with hand hygiene (41%) and the use of Personal Protective Equipment (PPE) (42%) identified as the most common practices. Although compliance and awareness regarding these two areas remain high, occupational safety practices (24%) and environmental hygiene (23%) recorded lower engagement, highlighting the need for enhanced focus and targeted training in these domains (**Table 1**).

Table 1. Characteristics of participants.

Variables	Frequency (n)	Percentage (%)
Age (years)		
21-30	22	21
31-40	45	44
41-50	35	34
51-60	1	1
Sex		
Male	11	11
Female	92	89
Education in nursing		
Diploma III	77	75
Bachelor	26	25
Work duration (years)		
< 1	6	6
1-3	17	16
> 3	80	78
Attending workshop (infection control)		
Yes	89	86
No	14	14
Quality of leadership style		
Very high	46	45
High	54	52
Low	3	3
Very low	0	0
Preventive measures		
Actions implemented	53	52
Actions not implemented	50	48
Aspect of preventive measures		
Hand hygiene		41
Using personal protective equipment		42
Occupational safety practices		24
Patient care		20
Environmental hygiene		23

The table demonstrates that the subgroup of respondents perceiving a "very high" level of transformational leadership exhibited a higher frequency of "actions implemented" (n=28) compared to "actions not implemented" (n=18). This indicates that higher levels of transformational leadership correlate with increased nosocomial infection risk reduction behaviors ($p=0.003$). Consequently, the null hypothesis is rejected and the alternative hypothesis is accepted, confirming a statistically significant relationship between transformational leadership style and the reduction of nosocomial infection risks (**Table 2**).

Discussion

The findings of this study are supported by prior research demonstrating that age influences nurses' compliance in implementing nosocomial infection prevention protocols (Nofal et al., 2017). Age often represents the peak of an individual's career maturity and clinical skill development, suggesting that senior nurses tend to have a deeper

appreciation for the importance of preventive practices. Furthermore, greater maturity is frequently associated with enhanced leadership capabilities, which can positively influence the implementation of patient safety protocols within hospital settings (Brasier et al., 2023). These findings highlight the necessity of considering demographic characteristics when analyzing the relationship between leadership style and nosocomial infection risk reduction. This can be highlighted that demographic attribute, including sex, can shape approaches and behaviors within nursing practice. In the context of this study, female nurses often possess broader experience in patient management and safety protocol execution, which may contribute to lower nosocomial infection risks. As noted by study, the presence of experienced nurses can significantly enhance patient safety outcomes (Sadeghi et al., 2025).

Table 2. Bivariate analysis.

Leadership style	Reducing nosocomial infection		<i>p</i>	<i>r</i>
	Action implemented	Action not implemented		
Very high	28	18	0.003	0.291
High	25	29		
Low	0	3		
Very low	0	0		

While a Diploma in Nursing (D III) provides the foundational knowledge and clinical skills essential for nursing practice, it may not be as comprehensive as a Professional Nurse (Ners) degree, which typically incorporates advanced education and more rigorous clinical training. Nurses with a bachelor background generally possess a deeper grasp of nursing theory and evidence-based practice, potentially enhancing their compliance with infection prevention protocols (Schnelli et al., 2023). Higher educational levels correlate with a greater capacity to implement complex policies and procedures, including nosocomial infection risk reduction. Consequently, the educational profile of the respondents offers valuable insights into both the potential and challenges of applying transformational leadership styles and infection prevention practices within hospital environments. Furthermore, nurses with over three years of work experience typically possess greater clinical knowledge and superior skills in applying patient safety protocols and preventing nosocomial infections. Research emphasizes that work tenure significantly influences nurses' adherence to infection control measures (Babore et al., 2024). Experienced nurses often serve as mentors to newer staff, guiding them to understand the critical importance of established protocols and institutional policies. Similarly, study demonstrated that both clinical experience and formal education contribute to increased compliance with hospital infection control practices (Giordano et al., 2025). Therefore, the tenure characteristics of respondents highlight important workforce dynamics at RSUD Muntilan, underscoring the need for continuous professional development and training programs where experienced and novice nurses collaborate to enhance infection prevention and patient safety outcomes.

Infection Prevention and Control (IPC) training is critically important, as adequate training enhances nurses' compliance with infection prevention protocols, directly contributing to the reduction of nosocomial infection risks (Rebmann et al., 2025). Nurses who participated in IPC training were better equipped to identify and implement effective preventive measures. Furthermore, our study emphasized that nurses receiving IPC training tend to exhibit greater confidence in executing workplace safety procedures. This confidence contributes to a lower incidence of hospital-acquired infections, thereby advancing overall patient safety. IPC training also imparts essential practical skills required to execute preventive actions effectively, including the proper utilization of personal protective equipment and aseptic techniques (Barratt & Gilbert, 2021). Consequently, the respondents' IPC training profile provides crucial insights into nurses' readiness and capability to implement patient safety protocols. Bivariate analysis demonstrated a statistically significant relationship between transformational leadership style and the implementation of infection risk reduction practices, indicating a weak yet significant positive correlation between these variables. Transformational leadership plays a crucial role in mitigating nosocomial infection risks within hospital environments. This finding aligns with the theoretical framework proposed by Bernard M. Bass, which posits that leaders employing a transformational style inspire and motivate followers to achieve higher goals beyond their self-interests (Hayati et al., 2014). In the context of nosocomial infection risk reduction, transformational leaders play a vital role in fostering a culture of patient safety. They communicate a clear vision regarding the importance of infection prevention, set a positive example, and empower staff to actively participate in prevention efforts. Consequently, this study identified that nurses working under transformational leadership demonstrated higher compliance rates with infection prevention protocols.

One key dimension of transformational leadership is Idealized Influence, wherein leaders serve as respected and trusted role models for team members (Ystaas et al., 2023). When leaders consistently demonstrate a strong commitment to infection prevention practices, nurses are more likely to emulate these behaviors. Furthermore, Inspirational Motivation helps establish a clear vision regarding the importance of infection control and how each team member contributes to this objective. Leaders who effectively articulate this vision can heighten nurses' motivation to strictly adhere to protocols. Another relevant dimension is Intellectual Stimulation, through which leaders encourage nurses to engage in critical thinking and develop innovative solutions for infection prevention challenges (Lindert et al., 2022). By providing opportunities for nurses to participate in decision-making and contribute feedback, transformational leaders foster a sense of ownership over hospital infection control programs. Finally, Individualized Consideration emphasizes providing personalized support and attention to each nurse. Leaders who remain attentive to the individual needs and professional development of their staff help nurses navigate and overcome obstacles in executing infection prevention practices. The role of transformational leaders is paramount in cultivating a safety culture within hospital environments (Steinmann et al., 2018). Effective leaders focus not only on clinical outcomes but also on nurturing the individual growth of team members, thereby inspiring nurses to actively participate in infection control measures. As noted by study that nurses led by transformational leaders' report feeling more valued and committed to infection prevention practices, which yields positive effects on overall patient safety (Ibrahim et al., 2024). Conversely, research highlights that leaders who fail to provide clear direction and support can cause confusion and non-compliance with safety procedures (Jun & Lee, 2023). Supporting these findings, study asserted that transformational leaders foster a work environment that drives collaboration, innovation, and motivation among team members, ultimately enhancing adherence to infection prevention protocols (Mohajer-Bastami et al., 2026).

Conclusion

The results of this study indicate regarding leadership perception, more than half of the respondents rated the head nurse's transformational leadership style as high. This leadership framework effectively cultivates a positive work environment, fosters interprofessional collaboration, and elevates motivation among team members. In terms of clinical compliance, more than half of the respondents consistently executed risk-reduction measures against healthcare-associated infections. However, a notable minority failed to implement these measures routinely, highlighting persistent operational challenges in maintaining effective preventive practices. Inferential statistical analysis revealed a significant positive correlation between a transformational leadership style and the execution of infection risk-reduction practices, characterized by a weak correlation coefficient. Consequently, respondents who perceived high transformational leadership were significantly more proactive in adhering to nosocomial infection prevention protocols. It is highly recommended to maintain terminological consistency by transitioning from the legacy term "Nosocomial Infection" to the globally accepted abbreviation HAI to prevent ambiguity in international publications. Furthermore, researchers must safeguard data quality by emphasizing in-depth statistical analyses capable of yielding robust insights into infection control. Future studies should also critically re-evaluate or avoid using the median as a cut-off point for categorical data partitioning. Relying on median splits frequently introduces a high risk of classification bias and reduces generalizability, as the scoring criteria dynamically shift when applied to independent datasets.

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AI statements

The authors declare that no generative text artificial intelligence (AI) tools or machine learning models were utilized for data analysis, interpretation, or figure generation during this study. The use of AI-assisted technology was strictly limited to the Grammarly plugin within Microsoft Office solely for grammatical editing, copyediting, and improving the overall readability of the manuscript.

Author declaration

All authors contributed to formulating the research idea, conducting the data analysis, and preparing the manuscript for journal publication. All authors have read and approved the final version of the manuscript.

Availability of data and materials

All data pertaining to the research variables of this study are presented within the results section of this manuscript. For readers requiring further detailed information, inquiries may be directed to the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. There are no professional or institutional conflicts of interest between the investigators and RSUD Muntilan or any associated administrative bodies.

Ethical clearance

This study was reviewed and ethically approved by the Health Research Ethics Committee of the Faculty of Health Sciences at Universitas Muhammadiyah Magelang (Approval Number: 0104/KEPK-FIKES/II.3.AU/F/2025).

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Publishers and journal's note

The findings of this study offer insights that hospitals can utilize to improve patient safety regarding nosocomial infections. Despite its straightforward design, this research provides essential baseline data that paves the way for further research developments.

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Authors' perspective

Innovation points

- This study bridges a critical gap in nursing literature by directly connecting a management framework (transformational leadership) to an objective clinical outcome (the reduction of nosocomial infection/HAI risks).
- the research efficiently captures a real-world snapshot of how a head nurse's leadership style correlates with active nursing compliance and infection-control behaviors.
- The study provides essential baseline data and a foundational framework that hospitals can use to design clinical leadership development programs aimed at optimizing patient safety and lowering infection rates.

Potential areas of interest

- Given that a cross-sectional design, how does the study address or acknowledge the limitation of not being able to establish a definitive, long-term causal relationship??
- How did the observational framework account for or control exogenous confounding factors or heavy fluctuating nursing workloads that could alter infection compliance metrics regardless of leadership quality?
- What psychometric tools or data-splitting benchmarks were utilized to classify leadership scores as "high" or "low" without introducing classification bias?

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