

Analysis of Prophylactic Antibiotic Administration in Obstetrics, Gynecology, Orthopedics, and Gastrointestinal Surgery at Pondok Indah Bintaro Jaya Hospital January-March 2024

Evelina Endang Nurjaman*, Helen Andriani

Universitas Indonesia, Indonesia

Email: evelina.endangnurjaman@gmail.com*

ABSTRACT

Surgical site infections (SSIs) remain a significant global healthcare challenge, affecting 2–4% of surgical patients and ranking among the top three healthcare-associated infections. The inappropriate use of prophylactic antibiotics contributes to antimicrobial resistance (AMR), a critical public health threat. A preliminary audit conducted at Pondok Indah Bintaro Jaya Hospital between October and December 2023 revealed that compliance with both antibiotic type selection and administration timing (30–60 minutes before incision) remained below 60%, indicating substantial gaps in adherence to established guidelines. The study found that the correct type of antibiotic and the timing of administration (30–60 minutes before incision) were both below 60% adherence. The research objectives are to analyze the appropriateness and rationality of pre-surgical antibiotic prescriptions and to evaluate the causes of noncompliance. The research used a mixed-methods approach: descriptive statistics to analyze prescribing patterns, and semi-structured interviews to understand the reasons behind prescribing practices. Research findings show that adherence to prescribing guidelines for antibiotic prophylaxis was less than 60%. While doctors had the capability and opportunity to prescribe correctly, concerns about infection risk and surgical outcomes influenced their motivation, leading to potentially less judicious use of antibiotics.

KEYWORDS *antibiotic prophylaxis, appropriateness, rationality, behaviour*



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INTRODUCTION

Antimicrobial resistance (AMR) has emerged as one of the most pressing global health threats of the 21st century, with the World Health Organization (WHO) declaring it a priority issue requiring urgent multisectoral action (WHO, 2022). The O'Neill Report (2016) projected that without effective intervention, AMR could cause 10 million deaths annually by 2050, surpassing mortality from cancer and resulting in cumulative economic losses of up to USD 100 trillion globally (Natadidjaja & Oktaviani, 2022). This catastrophic trajectory is fundamentally driven by the inappropriate and excessive use of antibiotics across healthcare systems worldwide, including in surgical prophylaxis (Komite Pengendalian Resistensi Antimikroba, 2023).

Surgical site infections (SSIs) represent a substantial burden on global healthcare systems, affecting approximately 5 million patients annually worldwide (Chater et al., 2023; Howlett, 2021; Martha & Kresno, 2017). WHO data indicate that approximately 1 in 20 surgical patients experiences an SSI, with mortality rates ranging from 3% to 6% in high-income countries and up to 20% in low- and middle-income countries (WHO, 2022). Beyond the human toll, SSIs impose significant economic costs through prolonged hospital stays, additional treatments, and reduced productivity. The direct relationship between irrational prophylactic antibiotic use and the acceleration of AMR has been well established in the

literature, making surgical antibiotic stewardship a critical intervention point for preserving antibiotic efficacy (Boban, Kaur, & Singh, 2023; Cardwell, Root, & Halliday, 2023).

Surgical site infections (SSI) occur in 2–4% of surgical patients and rank among the top three healthcare-associated infections (Schonherr et al., 2020; Showalter & Williams, 2017; Willmott et al., 2021). Prevention requires prophylactic antibiotics with the correct choice, dose, timing, and duration (Cardwell, Root, & Halliday, 2023). Yet, studies show high rates of inappropriate prescriptions: 45% in Germany (Surat et al., 2022), 39.5% in Australia (Ierano et al., 2020), and 44.4% in France (Muller et al., 2015). Additionally, research from various European contexts reveals persistent challenges in guideline adherence. A comprehensive study by Martinez-Sobalvarro et al. (2022) examining antimicrobial stewardship across multiple countries found that non-compliance with surgical antibiotic prophylaxis guidelines ranged from 30% to 60%, with timing errors being the most frequent deviation. Furthermore, Giusti et al. (2016) documented that even in pediatric surgical settings, where infection prevention is particularly critical, healthcare professionals' attitudes and knowledge gaps significantly impacted prophylactic antibiotic practices.

In the Southeast Asian context, the challenge is equally pronounced. A systematic review by Liang et al. (2017) highlighted that low- and middle-income countries face additional barriers including limited resources, inadequate infrastructure, and insufficient training programs for antimicrobial stewardship. A study conducted in Indonesian hospitals by Sadli, Halimah, Winarni, & Widyatmoko (2022) found that rational antibiotic use remained below 60% across multiple facilities, indicating a systemic issue requiring comprehensive intervention. Similarly, Liu et al. (2019) examined antibiotic prescribing behaviors in primary care settings in China, demonstrating that physician attitudes, subjective norms, and perceived behavioral control significantly influenced prescribing decisions—factors that extend to surgical prophylaxis contexts.

In Indonesia, antibiotic stewardship is regulated by the Ministry of Health Decree No. 28/2021 and No. 8/2015 on AMR Control Program (PPRA). Despite these, surveillance data (2019) revealed persistently high AMR-related deaths. An audit at Pondok Indah Bintaro Jaya Hospital (Oct–Dec 2023) showed prophylactic antibiotic compliance remained below 60%. This compliance rate falls significantly short of the national PPRA target of $\geq 80\%$ adherence to antibiotic prescribing guidelines, highlighting a critical gap between policy expectations and clinical practice. The discrepancy between mandated standards and actual implementation suggests that regulatory frameworks alone are insufficient without addressing underlying behavioral and systemic factors that influence physician decision-making (Kemenkes RI, 2015; Kementerian Kesehatan, 2017; Kementerian Kesehatan, 2021).

Table 1. Compliance with Prophylactic Antibiotic Type

Item	Oct	Nov	Dec
Correct Type	26	25	14
Sampling	54	58	55
Compliance	48%	43%	25%

Source: Primary data, preliminary audit results at Pondok Indah Bintaro Jaya Hospital (Oct-Dec 2023)

Table 2. Compliance with Timing of Prophylactic Antibiotic

Item	Oct	Nov	Dec
On Time	30	30	24
Sampling	54	58	55
Compliance	56%	52%	44%

Source: Primary data, preliminary audit results at Pondok Indah Bintaro Jaya Hospital (Oct-Dec 2023)

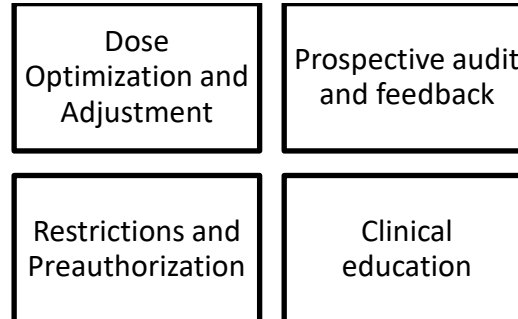


Figure 1. Strategy for Antibiotic Prescription Stewardship

(Multidisciplinary collaboration to ensure adherence to prophylactic antibiotic guidelines – Riggi & Abbo, 2021)

The preliminary audit data presented in Tables 1 and 2 reveal a concerning downward trend in compliance across the three-month observation period, suggesting that without systematic intervention, adherence rates may continue to deteriorate. This pattern is particularly alarming given the established correlation between guideline non-compliance and increased SSI rates, prolonged hospital stays, and escalating healthcare costs (de Jonge et al., 2021; Martinez-Sobalvarro et al., 2022).

Despite the implementation of national antimicrobial stewardship policies and the establishment of hospital-specific antibiotic guidelines, compliance with prophylactic antibiotic prescribing recommendations at Pondok Indah Bintaro Jaya Hospital remains critically low. With adherence rates for both antibiotic type selection and administration timing consistently below 60%—significantly short of the national PPRA target of $\geq 80\%$ —there exists an urgent need to systematically evaluate the appropriateness and rationality of current prescribing practices. Furthermore, a comprehensive analysis of the underlying factors contributing to non-compliance has not yet been conducted, limiting the development of targeted interventions to improve antimicrobial stewardship. Without addressing these gaps, the hospital risks continued contribution to antimicrobial resistance, increased post-operative infection rates, compromised patient safety, and elevated healthcare costs.

The urgency of this research is underscored by multiple converging factors. First, Indonesia's commitment to the Global Action Plan on Antimicrobial Resistance requires measurable improvements in antibiotic stewardship across all healthcare facilities. Second, the escalating burden of AMR-related infections demands immediate action to preserve the efficacy of existing antibiotics for future generations. Third, the significant gap between current compliance rates (below 60%) and national targets ($\geq 80\%$) represents a critical patient safety concern that requires evidence-based intervention strategies.

Moreover, despite various policies being implemented at national and institutional levels, the irrational use of prophylactic antibiotics remains a major driver of antimicrobial resistance in surgical settings. Without systematic compliance evaluation and rigorous audits that examine both prescribing patterns and their underlying behavioral determinants, Indonesia

risks a continued increase in post-operative infections, escalating healthcare costs, and declining patient safety outcomes. The absence of comprehensive data on physician behaviors and motivations further impedes the development of effective, context-specific interventions tailored to the unique challenges faced by Indonesian healthcare institutions.

Finally, the timing of this research coincides with growing international recognition of the need for behavioral approaches to antimicrobial stewardship. Recent literature emphasizes that traditional interventions focusing solely on guideline dissemination and regulatory enforcement have proven insufficient; understanding the psychological, social, and organizational factors that shape prescribing behavior is essential for designing sustainable change initiatives (Acampora et al., 2023; Acampora et al., 2023; Farrell et al., 2023; Greene & Wilson, 2022). This study responds to that call by integrating behavioral science frameworks with quantitative compliance assessment, offering a model for comprehensive antimicrobial stewardship research.

The general objective of this study is to evaluate the compliance and rationality of prophylactic antibiotic prescriptions as key quality indicators of antimicrobial resistance stewardship at Pondok Indah Bintaro Jaya Hospital. Specific objectives include: (1) describing the level of compliance with prophylactic antibiotic prescribing guidelines across four parameters (indication, type, timing, and duration) in obstetrics/gynecology, orthopedic, and gastrointestinal surgeries; (2) examining the association between physician profiles (gender, specialty, years of service) and prescription compliance; (3) identifying and analyzing the root causes of non-compliance among physicians using behavioral science frameworks; (4) documenting the incidence of surgical site infections across the study population; and (5) assessing the overall quality of prophylactic antibiotic prescribing practices.

This research offers substantial benefits to multiple stakeholders. For Pondok Indah Bintaro Jaya Hospital, the findings provide robust evidence to inform the refinement and enhancement of antimicrobial stewardship strategies, enabling targeted interventions that address specific compliance gaps and behavioral barriers. For other healthcare institutions in Indonesia and beyond, this study encourages the adoption of similar mixed-methods approaches to evaluate prophylactic antibiotic use, contributing to the broader national and regional efforts to combat AMR. For educational institutions, the research generates valuable empirical data that can inform curriculum development and training programs in antimicrobial stewardship, surgical prophylaxis, and behavioral change interventions. Finally, for the researcher, this study offers the opportunity to identify actionable root causes of non-compliance and to apply theoretical and practical knowledge in health services management toward the improvement of hospital quality and patient safety.

METHOD

This research applies a mixed-method approach. The first phase is quantitative-descriptive to assess compliance and rationality of prophylactic antibiotic prescriptions (type, indication, timing, and duration), and their association with physician profiles (gender, specialty, years of service). The second phase is qualitative, aiming to explore underlying reasons for non-compliance through semi-structured interviews, and to formulate recommendations.

The study is conducted at Pondok Indah Bintaro Jaya Hospital, South Tangerang, Banten, a tertiary-care private hospital serving diverse patient populations. Data collection runs from April to May 2024, utilizing retrospective medical records from January to March 2024 for the quantitative phase, and conducting interviews during April to May 2024 for the qualitative phase. This three-month observation period provides a representative sample of prescribing patterns while accounting for seasonal variations in surgical volumes.

Data Collection

1. Phase I: Medical records of obstetrics/gynecology, orthopedic, and gastrointestinal surgery patients who received prophylactic antibiotics (excluding patients on empirical antibiotics prior to surgery and physicians <1 year tenure).
2. Phase II: Semi-structured interviews with heads of specialty peer groups (OBGYN, Orthopedic, Surgery) and OR unit head if needed. Interviews last ~30 minutes, audio-recorded, with informed consent.

Table 3. Interview Guide

No	Question
1	What references do you use when prescribing antibiotics for surgery?
2	What considerations influence your prescribing decisions?
3	Are you aware of hospital antibiotic guidelines for your specialty?
4	What is your opinion on prophylactic antibiotic recommendations in your field?
5	What barriers prevent adherence to hospital guidelines?
6	What is your response to the compliance data (Phase I results)?

Source: Developed by researchers

Research Instruments

1. Quantitative: Excel database of surgery type, operator, antibiotic type, administration time vs. incision “time-out”, and SSI data from infection control reports. Doctor profile data (gender, specialty, tenure) from medical staff records.
2. Qualitative: Semi-structured interview guide (Table 5.1).

Data Processing and Analysis

1. Variables: Compliance (dependent), antibiotic type, indication, timing, duration (independent), SSI incidence, physician profiles (gender, age, specialty, tenure).
2. Compliance Categories: 80% = Good; 60–80% = Fair; <60% = Poor.
3. Quantitative Analysis: Univariate (descriptive), Chi-square for associations, logistic regression (multivariate) with $p < 0.05$ using SPSS.
4. Qualitative Analysis: Audio transcripts analyzed via thematic analysis and triangulation until saturation, mapped with COM-B behavioral model.

Table 4. Example of Univariable Analysis

Characteristics	Compliance $\geq 80\%$ (n=..)	Compliance $< 80\%$ (n=..)	Odds Ratio (95% CI)	p
Male gender				
>3 years tenure				
Specialty group				

Table 5. Example of Multivariable Analysis

Characteristics	Odds Ratio (95% CI)	p
Male gender		
>3 years tenure		
Surgical type		

Research Ethics

Approval was obtained from the Ethics Committee, Faculty of Public Health, Universitas Indonesia, and hospital management. Informed consent will be secured from all participants. Confidentiality will be strictly maintained; physician names will not appear in reports, and findings will not affect individual performance evaluations.

RESULT AND DISCUSSION

Compliance with Prophylactic Antibiotic Prescriptions

Compliance with prophylactic antibiotic prescriptions in this study was determined based on four parameters: indication, type of antibiotic, timing of administration, and duration of administration. Compliance was defined as being met if all components within one patient care episode were consistent with the hospital's antibiotic guidelines or with the Ministry of Health guidelines. The findings revealed that overall compliance was poor, with only 9% (18 out of 208 surgeries) meeting all criteria. Although these results were obtained from only a three-month study period, they provide an overview of prescribing patterns in general, considering that the same group of specialists are responsible for prescriptions throughout the year, and their decision-making is unlikely to change without interventions.

There is limited research on prophylactic antibiotics in Indonesia. However, according to a literature review by Sadli, Halimah, Winarni, & Widyatmoko (2022), the rational use of antibiotics in several Indonesian hospitals remained below 60%. Similarly, a study in German university hospitals by Surat et al. (2022) reported inappropriate prophylactic antibiotic prescribing in 45% of cases. Another study in France by Muller et al. (2015) found 44.4% noncompliance. These findings align with the results of this study, indicating that rational prophylactic antibiotic prescribing remains a significant issue requiring attention from both physicians and hospital management.

The hospital antibiotic guidelines were developed in accordance with principles outlined in the Ministry of Health Regulation No. 28 of 2021 on Antibiotic Use (Chapter 4: Prophylactic and Therapeutic Antibiotics), as well as based on the hospital's local bacterial resistance profile. However, the results show that these guidelines have not been well implemented. Although Pondok Indah Bintaro Jaya Hospital has procedures in place for preparing patients undergoing surgery, they lack detailed steps regarding prophylactic antibiotic prescribing, including screening for appropriate indication and type, and ensuring administration within 30–60 minutes before incision. Consequently, inconsistencies remain in practice, contributing to low compliance levels. Another contributing factor is the absence of a restriction mechanism when prescriptions deviate from the guidelines.

Compliance with Indication of Prophylactic Antibiotics

Prophylactic antibiotic use is considered appropriate if administered for clean surgeries involving prosthesis implantation and for clean-contaminated surgeries (Ministry of Health, 2021). Based on this study, the average compliance with prophylactic antibiotic indications for obstetric, orthopedic, and gastrointestinal surgeries at Pondok Indah Bintaro Jaya Hospital during January–March 2024 was 89%, falling into the “good” category.

It is noteworthy, however, that orthopedic surgery had a lower compliance rate of 76%. Specifically, 19 out of 46 orthopedic clean surgeries (41%) still received prophylactic

antibiotics, while 5 out of 46 clean surgeries with prostheses (11%) did not receive them. Interviews with the orthopedic peer group leader revealed concerns that omitting prophylactic antibiotics might increase the risk of surgical site infections (SSI) and expose surgeons to patient complaints or legal accountability. There was also a tendency among orthopedic surgeons to withhold prophylactic antibiotics in pediatric cases, even when guidelines recommended their use. From a COM-B behavioral model perspective, physicians had the capability and opportunity to comply with prophylactic antibiotic indications but were hindered by motivational barriers rooted in fear of adverse outcomes if antibiotics were not prescribed. This finding aligns with Farrell et al. (2023), who highlighted that one of the main challenges in rational antibiotic prescribing is physician anxiety about patient outcomes and the need for greater awareness of antimicrobial resistance.

Compliance with Type of Prophylactic Antibiotics

Compliance with the type of prophylactic antibiotics was defined as appropriate when the antibiotic choice was consistent with the hospital's guidelines for gastrointestinal, orthopedic, and obstetric-gynecological surgeries (Ministry of Health, 2021). Overall compliance in this study was 33%, which falls into the "poor" category. For orthopedic surgeries, compliance was between 60–80% (67%), which classifies as "fair."

In obstetric surgeries, compliance was particularly poor, with only 21% adherence. Interviews with the obstetrics peer group leader revealed that hospital guidelines recommend first-generation cephalosporins. However, there was a prevailing belief among obstetricians that second- and third-generation cephalosporins were more effective in preventing SSIs. This perception was reflected in prescription patterns: among clean-contaminated obstetric surgeries, first-generation cephalosporins were used in only 21% (30 out of 141 surgeries), while third-generation cephalosporins were prescribed in 77% (109 out of 141 surgeries).

In gastrointestinal surgeries, compliance with antibiotic type was also poor at 37%. Interviews with the surgery peer group leader indicated that physicians often differentiated between general gastrointestinal surgeries (e.g., appendectomy) and more complex procedures (e.g., biliodigestive surgery), believing that broader-spectrum antibiotics were warranted in the latter. The peer group leader further emphasized that non-compliance should not always be equated with guideline violation, as certain medical judgments fall within the physician's competence and responsibility.

Hospital guidelines for gastrointestinal surgery recommend second-generation fluoroquinolones (Li et al., 2018). However, the study found that prescriptions were split between second-generation fluoroquinolones (37%, 14 out of 38 surgeries) and third-generation cephalosporins (44%, 17 out of 38 surgeries). Interestingly, fluoroquinolones were prescribed exclusively by general surgeons, consistent with the peer group leader's view that antibiotic selection may vary depending on the complexity of the case.

It is important to note that the antibiotic recommendations in hospital guidelines are largely consistent with those stated in Ministry of Health Regulation No. 28 of 2021, which specifies first-generation systemic cephalosporins as the standard prophylactic antibiotic. Cefazolin, for example, has proven efficacy in reducing bacterial colonization at the incision site, is safe in combination with anesthetics, and carries a low risk of inducing bacterial

mutation. Nonetheless, this study found that compliance with antibiotic type selection remains poor.

In 2013, the Indonesian Society of Obstetrics and Gynecology (POGI) released its **Guidelines on Prophylactic Antibiotics in Obstetric and Gynecological Surgery**, also recommending first-generation cephalosporins as the first-line choice.

CONCLUSION

This three-month study at Pondok Indah Bintaro Jaya Hospital found critically low compliance with prophylactic antibiotic prescribing guidelines in obstetrics/gynecology, orthopedic, and gastrointestinal surgeries, with only 9% of cases fully meeting indication, type, timing, and duration criteria. While indication compliance was relatively high (89%), adherence to antibiotic type (33%), timing (54%), and duration (45%) was substantially below standards, particularly among orthopedic surgeons. Variability within and between specialties revealed a lack of standardized protocols. Importantly, no surgical site infections occurred post-operatively regardless of guideline adherence. Using the COM-B model, qualitative analysis indicated that motivational factors—such as concerns about infection risk, doubts on antibiotic efficacy, and prioritizing immediate safety over antimicrobial resistance—primarily drove non-compliance. These findings highlight the need for interventions targeting physician attitudes and decision-making alongside traditional guideline dissemination. Future research should develop and test behaviorally informed stewardship interventions through implementation science, conduct long-term studies evaluating impacts on compliance and antimicrobial resistance, and expand to diverse surgical specialties and healthcare settings to enhance stewardship, preserve antibiotic efficacy, and improve patient safety.

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