

## **Antimicrobial Prescribing Profile at the Dermatovenereology Outpatient Clinic of Universitas Sebelas Maret Hospital Surakarta from August to December 2024**

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### **Abstract**

Antimicrobial agents, both topical and systemic, are commonly used in dermatology for the management of infectious skin diseases. Data regarding antimicrobial prescribing patterns in dermatovenereology outpatient settings in Indonesia remain limited. This study aimed to describe the antimicrobial prescribing profile at the Dermatovenereology Outpatient Clinic of Universitas Sebelas Maret Hospital, Surakarta. A retrospective descriptive study was conducted using electronic medical records and outpatient pharmacy data. Prescriptions containing antimicrobial agents issued at the Dermatovenereology Outpatient Clinic of Universitas Sebelas Maret Hospital between August and December 2024 were analyzed. Of 2,383 dermatovenereology outpatients, 510 (21.4%) received an antimicrobial agent. Topical antimicrobials were prescribed more frequently than systemic antimicrobials. The most commonly prescribed topical antimicrobials were 2% mupirocin cream (42.94%), 0.1% gentamicin cream (23.14%), and 2% fusidic acid cream (7.06%). Among systemic antimicrobials, azithromycin was the most frequently prescribed (13.3%), followed by cefixime (5.69%), metronidazole (2.75%), clindamycin (1.96%), doxycycline (1.76%), and cefadroxil (1.37%). Antimicrobial prescribing at the Dermatovenereology Outpatient Clinic of Universitas Sebelas Maret Hospital was dominated by topical antimicrobial agents, particularly 2% mupirocin cream and 0.1% gentamicin cream, while azithromycin was the most frequently prescribed systemic antimicrobial. These findings provide baseline data for monitoring antimicrobial use and may support antimicrobial stewardship initiatives in dermatology practice.

**Keywords:** Antimicrobial, Skin Infection, Systemic Antimicrobial, Topical Antimicrobial, Antimicrobial Trends

### **1. Introduction**

Antimicrobial agents play a vital role in dermatology, particularly in the management of skin infections. Many dermatologic conditions such as acne vulgaris, wound infections, secondary infected dermatitis, and impetigo can be effectively treated using antimicrobial agents. These agents may be administered either topically or systemically. Topical antimicrobials are particularly effective for superficial infections because they deliver high drug concentrations directly to the affected area while minimizing systemic exposure and toxicity.<sup>1</sup> Topical antimicrobial therapies are generally divided into two main categories: antiseptics and antimicrobial agents. Antiseptics are disinfectants that can

be applied to both intact and damaged skin to kill or inhibit microorganisms through various mechanisms, providing broad-spectrum and long-lasting antimicrobial activity. In contrast, antimicrobial agents are natural or synthetic compounds that inhibit or eliminate microorganisms at low concentrations by targeting specific cellular structures, often exhibiting a narrower spectrum of activity. Although generally less toxic, these agents are more susceptible to the development of bacterial resistance. Natural plant-derived substances including essential oils and oleoresins have also been used as topical antibacterial agents.<sup>2</sup>

Several broad-spectrum antimicrobials, including mupirocin, doxycycline,

minocycline, and trimethoprim-sulfamethoxazole, are widely prescribed in dermatologic practice. Nevertheless, prolonged antimicrobial use, monotherapy, or unnecessary concurrent topical-systemic therapy may contribute to antimicrobial resistance and systemic adverse effects.<sup>3</sup> Observational studies conducted in dermatology outpatient settings across Asia and the United States have demonstrated frequent antimicrobial prescribing, considerable variation in the use of topical and systemic agents, prolonged treatment durations, and prescribing practices that do not always align with established treatment guidelines. Such findings have raised concerns regarding antimicrobial resistance and highlighted the importance of antimicrobial stewardship in dermatology practice.<sup>2,4,5</sup> A multicenter cross-sectional study by MacGibeny et al. (2021–2022) further demonstrated substantial regional variation in antimicrobial prescribing among dermatology outpatients in the United States. These findings underscore the need for continuous monitoring of antimicrobial utilization to promote evidence-based prescribing and support antimicrobial stewardship efforts.<sup>2</sup>

Information on antimicrobial prescribing patterns in dermatology outpatient settings in Indonesia remains limited despite growing concerns regarding antimicrobial resistance. Local prescribing data are essential for identifying prescribing trends, monitoring antimicrobial utilization, and supporting antimicrobial stewardship initiatives aimed at optimizing antimicrobial use and reducing the risk of antimicrobial resistance. Furthermore, evidence regarding the distribution of topical and systemic antimicrobial prescribing in Indonesian dermatology practice is still scarce. Evaluating prescribing patterns in a tertiary referral hospital may therefore provide valuable baseline data for future prescribing audits,

stewardship programs, and evidence-based antimicrobial use in dermatology. This study aimed to describe the prescribing profile and distribution pattern of topical and systemic antimicrobials among dermatovenereology outpatients at Universitas Sebelas Maret Hospital, Surakarta from August to December 2024.

## **2. Method**

This retrospective descriptive study used secondary data obtained from electronic medical records and outpatient pharmacy records at Universitas Sebelas Maret Hospital, Surakarta. The study population consisted of all patients attending the Dermatovenereology Outpatient Clinic from August to December 2024. Patients who received at least one topical or systemic antimicrobial prescription were included in the analysis. The unit of analysis was individual patients rather than prescriptions or individual antimicrobial agents. For patients with multiple visits during the study period, only data from the first visit were included to avoid duplication. Duplicate records were identified using patient identification data and removed before analysis. In cases where more than one antimicrobial agent was prescribed during the same visit, only the primary antimicrobial prescribed was included in the analysis. Dermatovenereology diagnoses were obtained from electronic medical records and classified according to the International Classification of Diseases, Tenth Revision (ICD-10). Patients were categorized by sex, age group, and diagnosis. Age group classification followed the Indonesian Ministry of Health (Kementerian Kesehatan Republik Indonesia) guidelines (2023), namely infants and toddlers (0-5 years), children (5-9 years), adolescents (10-17 years), adults (18-59 years), and older adults ( $\geq 60$  years).<sup>6</sup> Data were analyzed descriptively and presented as frequencies

and percentages in tables. This study was designed to describe antimicrobial prescribing patterns and did not evaluate the appropriateness, rationality, or duration of antimicrobial therapy. Ethical approval was obtained from the Research Ethics Committee of Universitas Sebelas Maret Hospital, Surakarta, Indonesia (No. 095/UN27.46/TA.04.19/KEP/EC/2025).

### 3. Result

During the study period, 510 of 2,383 patients (21.4%) attending the Dermatovenereology Outpatient Clinic of Universitas Sebelas Maret Hospital, Surakarta, received topical and/or systemic antimicrobial therapy. The highest number of patients

receiving antimicrobial therapy was recorded in September (115 patients; 22.5%), followed by October (111 patients; 21.7%), August (100 patients; 19.6%), December (94 patients; 18.4%), and November (90 patients; 17.6%). Among patients receiving antimicrobial therapy, females accounted for the majority of cases (280 patients; 54.9%), while males accounted for 230 patients (45.1%). The age distribution was dominated by adults aged 18-59 years (280 patients; 54.9%), followed by adolescents aged 10-17 years (115 patients; 22.5%) and older adults aged ≥60 years (95 patients; 18.6%). Children aged 0-5 years and 5-9 years each accounted for 10 patients (1.96%).

**Table 1. Demographic characteristics and dermatovenereology diagnoses among patients receiving antimicrobial therapy at the Dermatovenereology Outpatient Clinic of Universitas Sebelas Maret Hospital, Surakarta, from August to December 2024**

| Characteristics                               | Cases | Percentage (%) |
|-----------------------------------------------|-------|----------------|
| Gender                                        |       |                |
| Men                                           | 230   | 45.1           |
| Women                                         | 280   | 54.9           |
| Age group (years)                             |       |                |
| 0-5                                           | 10    | 1.96           |
| 5-9                                           | 10    | 1.96           |
| 10-17                                         | 115   | 22.5           |
| 18-59                                         | 280   | 54.9           |
| ≥60                                           | 95    | 18.6           |
| Dermatovenereology Diagnosis                  |       |                |
| Impetigo                                      | 108   | 21.2           |
| Folliculitis                                  | 13    | 2.5            |
| Acne vulgaris                                 | 51    | 10.0           |
| Scabies with secondary infection              | 22    | 4.3            |
| Dermatitis with secondary infection           | 27    | 5.3            |
| Varicella with secondary infection            | 14    | 2.7            |
| Herpes zoster with secondary infection        | 19    | 3.7            |
| Cellulitis                                    | 35    | 6.9            |
| Erysipelas                                    | 12    | 2.4            |
| Hidradenitis suppurativa                      | 2     | 0.4            |
| Papulopustular rosacea                        | 8     | 1.6            |
| Postoperative wound infection                 | 101   | 19.8           |
| Nongonococcal sexually transmitted infections | 54    | 10.5           |
| Gonococcal sexually transmitted infections    | 44    | 8.6            |

**Table 2. Distribution of prescribed topical and systemic antimicrobial agents among dermatovenereology outpatients at Universitas Sebelas Maret Hospital, Surakarta, from August to December 2024**

| Antimicrobials              | Month          |                |                |               |               | Total           |
|-----------------------------|----------------|----------------|----------------|---------------|---------------|-----------------|
|                             | August         | September      | October        | November      | December      |                 |
| 2 % Mupirocin cream 10g     | 48<br>(9.52%)  | 55<br>(10.91%) | 59<br>(11.70%) | 50<br>(9.92%) | 7<br>(1.39%)  | 219<br>(42.94%) |
| 0.1 % Gentamicin cream 5g   | 19<br>(3.77%)  | 23<br>(4.56%)  | 13<br>(2.58%)  | 16<br>(3.17%) | 47<br>(9.32%) | 118<br>(23.14%) |
| 2% Fusidic Acid cream 5g    | 6<br>(1.19%)   | 4<br>(0.79%)   | 7<br>(1.39%)   | 3<br>(0.59%)  | 16<br>(3.17%) | 36<br>(7.06%)   |
| Azithromycin tablet 500 mg  | 14<br>(2.78%)  | 21<br>(4.17%)  | 13<br>(2.58%)  | 10<br>(1.58%) | 10<br>(1.58%) | 68<br>(13.33%)  |
| Cefixime tablet 100 mg      | 5<br>(0.99%)   | 6<br>(1.19%)   | 12<br>(2.38%)  | 1<br>(0.20%)  | 5<br>(0.99%)  | 29<br>(5.69%)   |
| Metronidazole tablet 500 mg | 2<br>(0.40%)   | 2<br>(0.40%)   | 4<br>(0.79%)   | 4<br>(0.79%)  | 2<br>(0.40%)  | 14<br>(2.75%)   |
| Clindamycin tablet 300 mg   | 1<br>(0.20%)   | 3<br>(0.59%)   | 1<br>(0.20%)   | 1<br>(0.20%)  | 4<br>(0.79%)  | 10<br>(1.96%)   |
| Doxycycline tablet 100 mg   | 1<br>(0.20%)   | 1<br>(0.20%)   | 1<br>(0.20%)   | 4<br>(0.79%)  | 2<br>(0.40%)  | 9<br>(1.76%)    |
| Cefadroxil tablet 500 mg    | 4<br>(0.79%)   | 0<br>(0.00%)   | 1<br>(0.20%)   | 1<br>(0.20%)  | 1<br>(0.20%)  | 7<br>(1.37%)    |
| Total                       | 100<br>(19.6%) | 115<br>(22.5%) | 111<br>(21.7%) | 90<br>(17.6%) | 94<br>(18.4%) | 510<br>(100%)   |

The most common dermatovenereology diagnoses among patients receiving antimicrobial therapy were impetigo (108 patients; 21.2%), postoperative wound infection (101 patients; 19.8%), nongonococcal sexually transmitted infections (54 patients; 10.5%), acne vulgaris (51 patients; 10.0%), gonococcal sexually transmitted infections (44 patients; 8.6%), cellulitis (35 patients; 6.9%), dermatitis with secondary infection (27 patients; 5.3%), scabies with secondary infection (22 patients; 4.3%), herpes zoster with secondary infection (19 patients; 3.7%), varicella with secondary infection (14 patients; 2.7%), folliculitis (13 patients; 2.5%), erysipelas (12 patients; 2.4%), papulopustular rosacea (8 patients; 1.6%), and hidradenitis suppurativa (2 patients; 0.4%) (Table 1).

Topical antimicrobials were prescribed more frequently than systemic antimicrobials during the study period. Among topical agents, 2% mupirocin cream was the most frequently prescribed antimicrobial (n = 219;

42.94%) followed by 0.1% gentamicin cream (n = 118; 23.14%) and 2% fusidic acid cream (n = 36; 7.06%). These topical antimicrobials were prescribed throughout the study period. Among systemic antimicrobials, azithromycin 500 mg was the most frequently prescribed agent (n = 68; 13.33%) followed by cefixime 100 mg (n = 29; 5.69%), metronidazole 500 mg (n = 14; 2.75%), clindamycin 300 mg (n = 10; 1.96%), doxycycline 100 mg (n = 9; 1.76%), and cefadroxil 500 mg (n = 7; 1.37%). Prescription frequencies of metronidazole, clindamycin, doxycycline, and cefadroxil remained relatively consistent throughout the study period, whereas the use of azithromycin and cefixime varied across the study months. Azithromycin and cefixime remained the most frequently prescribed systemic antimicrobials during the study period (Table 2).

#### 4. Discussion

Antimicrobials are commonly used in dermatology for the treatment of bacterial skin infections, prevention of surgical-site

infections, management of selected inflammatory dermatoses, and treatment of sexually transmitted infections.<sup>7</sup> In this study, female patients at the Dermatovenereology Outpatient Clinic of Universitas Sebelas Maret Hospital were more likely to receive antimicrobial therapy. Based on age group, patients aged 18-59 years were the most frequent recipients of both topical and systemic antimicrobial therapy (n = 280; 54.9%), followed by the 10-17 years group (n = 115; 22.5%), the >60 years group (n = 95; 18.6%) and the 0-5 years and 5-9 years groups, each consisting of 10 patients (1.96%). This finding is consistent with national surveillance data from the Centers for Disease Control and Prevention (CDC) in 2024, which demonstrated higher outpatient antibiotic prescribing rates among females than males. Additionally, adults aged ≥20 years accounted for approximately 80% of all outpatient oral antibiotic prescriptions in the United States.<sup>8</sup> This pattern may reflect the predominance of adult female patients attending dermatovenereology outpatient clinics, as well as the substantial burden of dermatological conditions that frequently require antimicrobial therapy in these populations.<sup>9,10</sup>

A total of 510 patients with dermatovenereology conditions received either topical or systemic antimicrobial therapy, with topical antimicrobials being prescribed more frequently. The preference for topical antimicrobials may be attributed to their ease of application, which promotes better patient adherence, minimizes systemic adverse effects, and offers lower cost and easier accessibility.<sup>11</sup> The most frequently prescribed topical antimicrobial was 2 % mupirocin cream (n = 219; 42.94%) followed by 0.1 % gentamicin cream (n = 118; 23.14%) and 2% fusidic acid cream (n = 36; 7.06%). This finding may be explained by the distribution of dermatovenereology diagnoses observed

in our study, where impetigo (21.2%) and postoperative wound infections (19.8%) were the most common conditions requiring antimicrobial therapy. Mupirocin is widely recommended for the treatment of impetigo and secondarily infected superficial skin lesions because of its activity against *Staphylococcus aureus* and *Streptococcus pyogenes*, which are among the most common causative organisms of superficial bacterial skin infections. In addition, mupirocin is considered an effective topical treatment for localized skin and soft tissue infections due to its ability to achieve high local antimicrobial concentrations while minimizing systemic exposure. These characteristics may explain its frequent use in our outpatient dermatology setting.<sup>1</sup> Similar findings were reported in a multicenter study conducted by Sultana et al. (2022) in Bangladesh, which identified mupirocin as one of the most commonly prescribed topical antimicrobials in dermatology clinics, reflecting its important role in the management of superficial bacterial skin infections.<sup>9</sup> The high frequency of mupirocin prescribing observed in this study underscores the importance of antimicrobial stewardship. A study by Peterson et al. (2017) in Chicago reported that mupirocin resistance in methicillin-resistant *Staphylococcus aureus* (MRSA) increased from 3.9% to 10.9% during a period of intensive mupirocin use, with a strong correlation between mupirocin consumption and resistance development ( $R^2 = 0.89$ ).<sup>12</sup> These findings suggest that regular monitoring of topical antimicrobial utilization is necessary to preserve the long-term effectiveness of mupirocin in clinical practice.<sup>13</sup>

Azithromycin was the most frequently prescribed systemic antimicrobial in the present study (13.33%), followed by cefixime (5.69%). Similar findings were reported by Sultana et al. (2022) in Bangladesh, where

azithromycin was identified as the most frequently prescribed antimicrobial in dermatology outpatient clinics, accounting for 22% (104/463) of all antimicrobial prescriptions.<sup>9</sup> The prescribing pattern observed in the present study may be related to the substantial proportion of sexually transmitted infections, which accounted for 19.1% of all diagnoses, including nongonococcal sexually transmitted infections (10.5%) and gonococcal sexually transmitted infections (8.6%). The 2024 World Health Organization (WHO) updated recommendations for sexually transmitted infections recognize azithromycin as a treatment option in selected chlamydial infections and in alternative gonorrhea treatment regimens, while cefixime remains an alternative oral treatment for gonococcal infection, particularly when ceftriaxone is unavailable or unsuitable.<sup>14</sup> Therefore, the predominance of azithromycin and cefixime in the present study appears consistent with the distribution of sexually transmitted infection-related diagnoses observed in this outpatient population. In addition, acne vulgaris accounted for 10.0% of diagnoses in this study. Current acne management guidelines recognize macrolides, including azithromycin, as potential systemic treatment options in selected patients when tetracyclines are contraindicated or not suitable, which may have further contributed to its prescribing frequency.<sup>15</sup> Antimicrobial stewardship remains important for azithromycin prescribing because increasing resistance has been reported globally. Recent WHO surveillance identified internationally spreading gonococcal strains with high-level azithromycin resistance, and updated WHO sexually transmitted infections recommendations have incorporated evolving resistance patterns into treatment guidance.<sup>14</sup>

The antimicrobial prescribing pattern observed in this study largely reflected the spectrum of dermatovenereology conditions encountered in routine clinical practice. The predominance of bacterial skin infections, particularly impetigo and postoperative wound infections, in this study was associated with a higher use of topical antimicrobials, whereas the substantial proportion of sexually transmitted infections may explain the frequent prescribing of azithromycin and cefixime. These findings highlight the importance of considering local disease epidemiology when evaluating antimicrobial utilization and developing antimicrobial stewardship strategies in dermatology practice.<sup>5,16,17,18,</sup>

The antimicrobial prescribing pattern observed in this study may have been influenced not only by the local disease profile but also by the hospital formulary. The predominance of mupirocin, gentamicin, fusidic acid, azithromycin, and cefixime likely reflects their availability within the Universitas Sebelas Maret Hospital formulary and their suitability for common dermatological conditions encountered in outpatient practice.<sup>19</sup> Hospital formularies play an important role in guiding antimicrobial selection by restricting available therapeutic options to agents that have been evaluated for efficacy, safety, and cost-effectiveness. A recent systematic review by Martínez et al. (2025) demonstrated that changes in hospital formularies significantly influenced prescribing patterns, with 7 of 8 included studies reporting increased utilization of formulary-listed medications and decreased utilization of restricted or removed medications.<sup>20</sup> In the Universitas Sebelas Maret Hospital formulary, several systemic antimicrobials are subject to specific prescribing restrictions, including cefixime and other higher-tier antibiotics, which may have contributed to the concentration of

prescribing within a relatively limited number of antimicrobial agents.<sup>19</sup> Therefore, the prescribing pattern identified in this study likely reflects the combined influence of local disease burden and formulary-driven prescribing policies.<sup>20,21,22</sup>

This study has several limitations. First, it was conducted at a single tertiary-care center, which may limit the generalizability of the findings, as antimicrobial prescribing patterns can be influenced by geographical factors, local disease epidemiology, community characteristics, seasonal variations, and institutional prescribing policies. Second, the availability of antimicrobial agents within the hospital formulary and government procurement system may have affected prescribing practices. Third, this study was limited to dermatovenereology outpatients and did not evaluate the appropriateness, guideline adherence, duration, or clinical outcomes of antimicrobial therapy. Therefore, the findings should be interpreted primarily as a description of prescribing patterns rather than prescribing quality. Future multicenter studies with larger sample sizes, longer observation periods, and the inclusion of both inpatient and outpatient populations are needed to provide a more comprehensive evaluation of antimicrobial utilization and to support antimicrobial stewardship efforts aimed at optimizing antimicrobial use and minimizing the risk of antimicrobial resistance.

## 5. Conclusion

Topical antimicrobial agents were prescribed more frequently than systemic agents among dermatovenereology outpatients at Universitas Sebelas Maret Hospital Surakarta during the study period. Mupirocin was the most frequently prescribed topical antimicrobial, whereas azithromycin was the most commonly

prescribed systemic antimicrobial. The observed prescribing pattern appeared to reflect the local disease profile, particularly the high proportion of impetigo, postoperative wound infections, and sexually transmitted infections, as well as the influence of the hospital formulary. These findings establish a baseline for future evaluation of prescribing appropriateness and stewardship interventions and may serve as a basis for evaluating and optimizing antibiotic use in dermatology services to promote rational prescribing practices and reduce the risk of antimicrobial resistance.

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