World Journal of Current Medical and Pharmaceutical Research
Content available at www.saap.org.in ISSN: 2582-0222

EVALUATION OF ANTIBIOTIC PRESCRIBING PATTERNS IN HOSPITALISED CELLULITIS PATIENTS: A PROSPECTIVE DRUG UTILISATION STUDY

MUSARRATH MUBEEN[1*], AFREEN KHATOON[2], NUMAIR GAYAS[2], HAJIRA BEGUM[2], MADEEHA KHANAM[2]

[1*]Assistant Professor, Department of Pharmacology, Smt. Sarojini Ramulamma College of Pharmacy, (Palamuru University), Seshadri Nagar, Mahabubnagar District, Telangana State, India.

[2]Pharm. D Intern, Smt. Sarojini Ramulamma College of Pharmacy, (Palamuru University), Seshadri Nagar, Mahabubnagar District, Telangana State, India.

ARTICLE HISTORY

Received on: 16-05-2026
Revised on: 09-06-2026
Accepted on: 19-07-2026

ABSTRACT

Cellulitis is a common bacterial infection involving the skin and subcutaneous tissues that requires timely and appropriate antibiotic therapy to prevent complications. However, empirical and inappropriate antibiotic prescribing contributes to antimicrobial resistance and adversely affects treatment outcomes. The present prospective observational study evaluated antibiotic prescribing patterns and their adherence to standard treatment guidelines among hospitalized cellulitis patients using drug utilization metrics. The study was conducted over six months in the Department of Surgery of a tertiary care hospital and included 100 inpatients diagnosed with cellulitis. Data were collected from patient case records, medication charts, and laboratory reports. Antibiotic utilization was assessed using the World Health Organization (WHO) Defined Daily Dose (DDD) and Drug Utilization 90% (DU90%) methodologies, while descriptive statistics, Chi-square test, and ANOVA were used for data analysis. Most patients belonged to the 41–60-year age group (68%), with males accounting for 65% of cases. Lower limb cellulitis was the predominant clinical presentation (74%). Ceftriaxone (46%) was the most frequently prescribed antibiotic, followed by amoxicillin–clavulanate (17%) and clindamycin (16%). DU90% analysis identified ceftriaxone, amoxicillin–clavulanate, linezolid, and clindamycin as the most commonly utilized antibiotics. The overall recovery rate was 73%, although severe cases were associated with longer hospital stays and lower recovery rates. A significant association was observed between disease severity and duration of hospitalization ($p < 0.05$). The findings emphasize the need to strengthen guideline-based prescribing, encourage culture-directed antibiotic therapy, and implement antimicrobial stewardship programs to optimize antibiotic use and minimize antimicrobial resistance.

Keywords: *Cellulitis, antibiotic utilization, drug utilization review, Defined Daily Dose (DDD), Drug Utilization 90% (DU90%), antimicrobial stewardship, antibiotic prescribing, tertiary care hospital.*

***Corresponding Author**
Musarrath Mubeen

DOI: https://doi.org/10.37022/wjcmpr.v8i2.406

INTRODUCTION

Cellulitis is an acute bacterial infection involving the dermis and subcutaneous tissues, characterized by erythema, warmth, edema, tenderness, and pain. It is one of the most common skin and soft tissue infections (SSTIs) requiring prompt antimicrobial therapy to prevent complications such as abscess formation, necrotizing fasciitis, bacteremia, and sepsis [1,2]. The global incidence of cellulitis has increased considerably over recent decades, contributing substantially to healthcare utilization and hospital admissions. Cellulitis accounts for approximately 2–3% of hospital admissions and is a frequent cause of emergency department visits. The disease predominantly affects adults, particularly individuals with diabetes mellitus, obesity, chronic venous insufficiency, peripheral vascular disease, lymphedema, trauma, surgical wounds, and immunocompromised conditions. Lower limb cellulitis is the most frequently encountered presentation, accounting for nearly 70–80% of reported cases [3].The most common causative organisms include β-haemolytic streptococci, particularly *Streptococcus pyogenes*, and *Staphylococcus aureus*. However, methicillin-resistant *Staphylococcus aureus* (MRSA) and Gram-negative pathogens are increasingly encountered among hospitalized patients and individuals with healthcare-associated infections. Therefore, empirical antimicrobial therapy should be selected based on disease severity, patient-related risk factors, and local

antimicrobial susceptibility patterns until microbiological results become available [4].

Antibiotic therapy remains the cornerstone of cellulitis management. Current treatment guidelines recommend narrow-spectrum antibiotics for uncomplicated cellulitis, whereas broader-spectrum antibiotics are reserved for severe infections or patients with risk factors for resistant pathogens. Nevertheless, broad-spectrum antibiotics are frequently prescribed empirically, contributing to antimicrobial resistance, increased treatment costs, adverse drug reactions, and prolonged hospitalization [5].

Antimicrobial resistance has emerged as one of the greatest global public health threats. Inappropriate antibiotic prescribing-including unnecessary use of broad-spectrum agents, incorrect dosing, prolonged duration of therapy, and irrational combinations-accelerates the development of resistant microorganisms. The World Health Organization (WHO) has emphasized the importance of antimicrobial stewardship programmes to promote rational antibiotic use and preserve the effectiveness of existing antimicrobial agents [6,7].Drug utilization research provides a systematic approach for evaluating prescribing practices and promoting the rational use of medicines. According to the WHO, drug utilization research evaluates the marketing, distribution, prescription, and use of medicines, with particular emphasis on their medical, social, and economic consequences. Standardized methodologies such as the Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) classification system and Drug Utilization 90% (DU90%) analysis are widely used to quantify antibiotic consumption, compare prescribing patterns, and assess the quality of drug use across healthcare settings [8,9].

The Defined Daily Dose (DDD) represents the assumed average maintenance dose per day for a drug used for its principal indication in adults and provides an internationally accepted measure of drug consumption. Similarly, DU90% analysis identifies the medicines accounting for 90% of total drug utilization and serves as a practical indicator of prescribing quality. These methodologies have been extensively employed to monitor antibiotic prescribing and evaluate antimicrobial stewardship interventions in hospitals [10].

Several studies have demonstrated considerable variation in antibiotic prescribing patterns for cellulitis across different healthcare institutions. Empirical therapy often deviates from guideline recommendations because of physician preference, local prescribing habits, institutional policies, and concerns regarding resistant pathogens. Continuous evaluation of prescribing practices through prospective drug utilisation review is therefore essential to improve treatment outcomes, minimise unnecessary antibiotic exposure, and reduce antimicrobial resistance [11].Considering the increasing burden of cellulitis, widespread empirical antibiotic use, and the global threat of antimicrobial resistance, periodic evaluation of antibiotic prescribing practices is essential. Therefore, the present study was undertaken to prospectively evaluate antibiotic utilization patterns among hospitalised cellulitis patients using WHO-recommended DDD and DU90% methodologies, assess adherence to standard treatment guidelines, and determine treatment outcomes in a tertiary care hospital [12].

MATERIALS AND METHODS

Study Design and Setting

A prospective, observational, non-interventional study was conducted over a period of six months in the Department of Surgery, SVS Medical College and Hospital, Mahabubnagar, Telangana, India. The study was designed to evaluate antibiotic prescribing patterns, drug utilization, and treatment outcomes among hospitalized patients diagnosed with cellulitis.

Study Population

A total of 100 adult inpatients diagnosed with cellulitis were included during the study period. Eligible patients were enrolled after obtaining written informed consent.

Inclusion Criteria

- Adult patients (≥18 years) diagnosed with cellulitis.
- Patients of either gender.
- Hospitalized patients receiving antibiotic therapy.
- Patients willing to provide written informed consent.

Exclusion Criteria

- Patients with recurrent cellulitis or chronic skin infections.
- Immunocompromised patients, including HIV-positive individuals.
- Patients with severe comorbid conditions that significantly influenced antibiotic selection.
- Pregnant and lactating women.
- Patients with incomplete medical records.
- Patients unwilling to participate.

Data Collection

Patient information was collected prospectively from inpatient case records, medication charts, laboratory reports, and clinical notes using a structured data collection form. Demographic characteristics, clinical presentation, site and severity of cellulitis, laboratory investigations, comorbidities, antibiotic therapy (drug, dose, route, frequency, and duration), treatment modifications, adverse drug reactions, and clinical outcomes were documented. Patients were followed until discharge to assess treatment response and outcomes.[13,14]

Assessment of Disease Severity

Cellulitis was categorized as mild, moderate, or severe based on clinical presentation and the recommendations of the Infectious Diseases Society of America (IDSA). The severity classification was used to evaluate the appropriateness of antibiotic therapy and treatment outcomes.

Evaluation of Antibiotic Utilization

Antibiotic prescribing patterns were evaluated based on antibiotic class, route of administration, frequency, duration of therapy, and empirical versus definitive treatment. The appropriateness of antibiotic prescriptions was assessed according to the Infectious Diseases Society of America (IDSA) and Centers for Disease Control and Prevention (CDC) recommendations, considering drug selection, dose, route, frequency, duration, disease severity, and the likely causative pathogens.

Drug utilization was quantified using the World Health Organization (WHO) Anatomical Therapeutic

Chemical/Defined Daily Dose (ATC/DDD) methodology. Drug Utilization 90% (DU90%) analysis was also performed to identify the antibiotics accounting for 90% of the total antibiotic consumption.

Outcome Measures

The primary outcome was the pattern of antibiotic utilization in hospitalised cellulitis patients. Secondary outcomes included adherence to treatment guidelines, clinical recovery, treatment modification, occurrence of adverse drug reactions, duration of hospitalisation, and association between disease severity and clinical outcome [15,16].

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Comparisons of the length of hospital stay among severity groups were performed using one-way analysis of variance (ANOVA). Associations between categorical variables, including disease severity and clinical outcome, were evaluated using the Chi-square test. A two-tailed p-value < 0.05 was considered statistically significant [17].

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of SVS Medical College and Hospital, Mahabubnagar, Telangana, India (Approval No. IEC/DHR-03/(04-3)/2025). Written informed consent was obtained from all participants before enrolment, and patient confidentiality was maintained throughout the study in accordance with the Declaration of Helsinki.

RESULTS AND DISCUSSION

A total of 100 hospitalised patients diagnosed with cellulitis were included in the present study. The demographic characteristics, disease severity, antibiotic prescribing patterns, clinical outcomes, and drug utilisation were evaluated.

Age Distribution of Patients

The majority of patients belonged to the 41–60 years age group (68%), followed by 18–40 years (20%) and >60 years (12%).The findings indicate that middle-aged adults were more frequently affected by cellulitis, probably because of a higher prevalence of diabetes mellitus, obesity, vascular disease, and occupational trauma (Table 1and Figure 01).

Table 01: Age-wise distribution of patients with cellulitis.

Age (Years)	Frequency	Percentage (%)
18–40	20	20
41–60	68	68
>60	12	12
Total	**100**	**100**

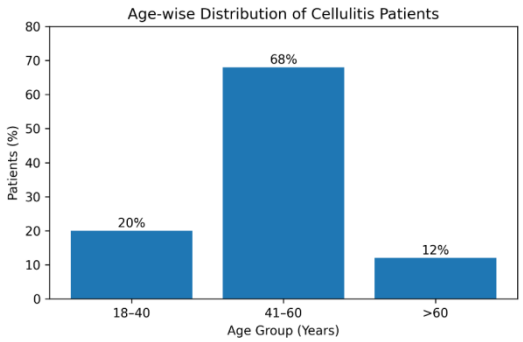

Figure 01: Age-wise distribution of patients with cellulitis.

Gender Distribution

Among the study population, males accounted for 65% and females for 35%.Malepredominance may be related to increased occupational exposure, trauma, and associated risk factors (Table 02).

Table 02: Gender-wise distribution of patients with cellulitis.

Gender	Frequency	Percentage (%)
Male	65	65
Female	35	35
Total	**100**	**100**

Distribution According to Site of Cellulitis

Lower-limb cellulitis was the predominant presentation.Lower-limb cellulitis represented nearly three-fourths of all cases, consistent with the higher frequency of trauma, diabetic foot infections, and venous insufficiency (Table 03).

Table 03: Distribution of cellulitis according to the site of infection.

Site	Frequency	Percentage (%)
Face	6	6
Upper limb	20	20
Lower limb	74	74
Total	**100**	**100**

Severity of Cellulitis

Moderate cellulitis constituted the largest proportion of cases. Most patients presented with moderate cellulitis, indicating that hospital admission commonly occurred after disease progression (Table 04).

Table 04: Distribution of patients according to cellulitis severity.

Severity	Frequency	Percentage (%)
Mild	35	35
Moderate	40	40
Severe	25	25
Total	**100**	**100**

Antibiotic Utilization Pattern

The antibiotic utilization pattern demonstrated that ceftriaxone was the most frequently prescribed antibiotic (46%), followed by amoxicillin–clavulanate (17%), clindamycin (16%), linezolid (12%), and piperacillin–tazobactam (9%). The predominance of ceftriaxone suggests that empirical broad-spectrum therapy was commonly adopted for the management of hospitalized cellulitis patients. Similar prescribing patterns have been reported in previous studies owing to ceftriaxone's broad antimicrobial coverage, favorable pharmacokinetic profile, and convenient once-daily dosing. These findings emphasize the importance of periodic prescription audits and antimicrobial stewardship programs to promote rational antibiotic use and reduce the risk of antimicrobial resistance(Table 05 and Figure 02).

Table 05: Pattern of antibiotic utilization among hospitalized cellulitis patients.

Antibiotic	Frequency	Percentage (%)
Ceftriaxone	46	46
Amoxicillin–Clavulanate	17	17
Clindamycin	16	16
Linezolid	12	12
Piperacillin–Tazobactam	9	9
Total	**100**	**100**

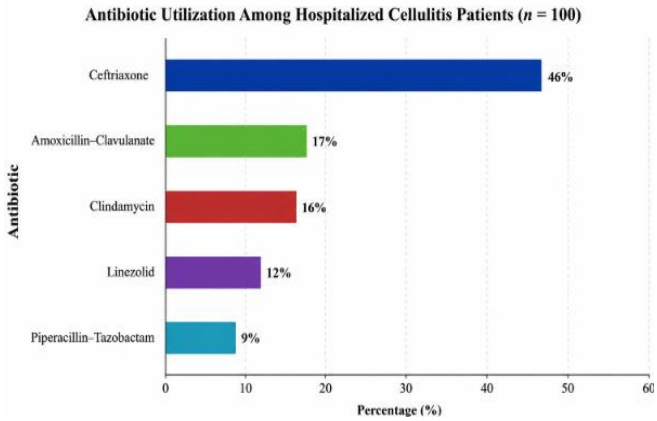

Figure 02: Pattern of antibiotic utilization among hospitalized cellulitis patients.

Adherence to Treatment Guidelines

The adherence of antibiotic prescribing to established treatment guidelines is presented in Table 6. Among the 100 prescriptions evaluated, 42% demonstrated low adherence, while 30% showed high adherence and 28% exhibited medium adherence (Table 06).

Table 06: Distribution of antibiotic prescribing according to guideline adherence.

Adherence Level	Frequency	Percentage (%)
High	30	30
Medium	28	28
Low	42	42
Total	**100**	**100**

Clinical Outcome

The clinical outcomes of hospitalized cellulitis patients are summarized in Table 7. Of the 100 patients included in the study, 73% achieved complete clinical recovery during hospitalization, whereas 27% did not recover completely at the time of discharge.

Table 07: Clinical outcomes among hospitalized cellulitis patients.

Clinical Outcome	Frequency	Percentage (%)
Recovered	73	73
Not recovered	27	27
Total	**100**	**100**

Severity and Length of Hospital Stay

The association between cellulitis severity and the duration of hospitalization is presented in Table 8. Patients with mild cellulitis had a mean hospital stay of 6.8 ± 1.2 days, whereas those with moderate and severe cellulitis required 8.0 ± 1.3 and 9.5 ± 1.5 days, respectively.The findings demonstrate a progressive increase in the duration of hospitalization with increasing disease severity. Patients with severe cellulitis required longer inpatient care due to extensive infection, the need for prolonged intravenous antibiotic therapy, and closer clinical monitoring. Similar studies have reported that greater disease severity is associated with prolonged hospital stay, increased healthcare costs, and a higher risk of complications. These findings emphasize the importance of early diagnosis and timely initiation of appropriate antimicrobial therapy to reduce hospitalization and improve patient outcomes.

Table 08: Association between cellulitis severity and length of hospital stay.

Severity	N	Mean Length of Stay (Days)	SD
Mild	35	6.8	1.2
Moderate	40	8.0	1.3
Severe	25	9.5	1.5

Severity and Clinical Outcome

The relationship between cellulitis severity and clinical outcome is presented in Table 9. Recovery was highest among patients with mild (80.0%) and moderate cellulitis (85.0%), whereas patients with severe cellulitis exhibited the highest proportion of non-recovery (56.0%).The results indicate that clinical outcome was strongly influenced by disease severity, with recovery rates decreasing as the severity of cellulitis increased. Patients with severe cellulitis were more likely to experience treatment failure because of extensive tissue involvement, associated comorbidities, delayed presentation, or infection with resistant microorganisms. These observations are consistent with previous clinical studies demonstrating that disease severity is an important predictor of prolonged recovery, increased hospitalization, and poorer therapeutic outcomes. Early intervention and adherence to evidence-based

treatment guidelines are therefore essential to improve recovery rates.

Table 09: Association between cellulitis severity and clinical outcome.

Severity	Recovered	Not Recovered	Total
Mild	28	7	35
Moderate	34	6	40
Severe	11	14	25
Total	**73**	**27**	**100**

Drug Utilisation 90% (DU90%) Analysis

The DU90% analysis of antibiotic utilization is presented in Table 10 and Figure 3. Ceftriaxone accounted for the highest proportion of antibiotic consumption (38.41%), followed by amoxicillin–clavulanate (25.70%), linezolid (13.57%), and clindamycin (12.76%). Together, these four antibiotics constituted 90.44% of the total antibiotic utilization, representing the DU90% segment. The findings indicate that antibiotic prescribing was concentrated on a limited number of agents, highlighting the need for periodic drug utilization reviews and antimicrobial stewardship programs to ensure rational antibiotic prescribing and minimize the development of antimicrobial resistance.

Table 10: Drug Utilisation 90% (DU90%) analysis of antibiotics prescribed for cellulitis.

Antibiotic	Total DDD	% of Total	Cumulative (%)
Ceftriaxone	283.00	38.41	38.41
Amoxicillin–Clavulanate	189.38	25.70	64.11
Linezolid	100.00	13.57	77.68
Clindamycin	94.00	12.76	90.44
Piperacillin–Tazobactam	70.39	9.55	99.99

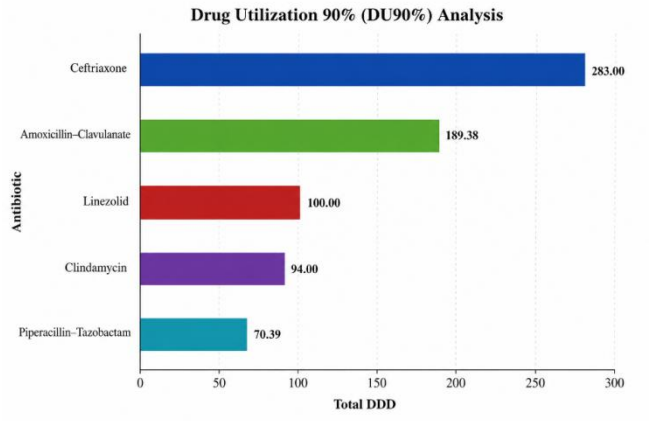

Figure 03: Drug Utilization 90% (DU90%) analysis of antibiotics prescribed for cellulitis.

CONCLUSION

This prospective observational study demonstrated that empirical broad-spectrum antibiotics, particularly ceftriaxone, were the most frequently prescribed agents for the management of hospitalized cellulitis patients. DU90% analysis revealed that ceftriaxone, amoxicillin–clavulanate, linezolid, and clindamycin accounted for more than 90% of total antibiotic utilization. Although a satisfactory clinical recovery rate of 73% was observed, only 30% of prescriptions showed high adherence to standard treatment guidelines, while 42% demonstrated low adherence. Increasing disease severity was associated with prolonged hospital stay and poorer clinical outcomes. These findings highlight the importance of promoting evidence-based prescribing, encouraging culture-guided antibiotic selection whenever feasible, and strengthening antimicrobial stewardship programmes to improve therapeutic outcomes, optimize antibiotic utilization, and reduce the emergence of antimicrobial resistance in hospitalized cellulitis patients.

STUDY LIMITATIONS

The present study has several limitations. First, it was conducted at a single tertiary care hospital with a relatively small sample size of 100 patients, which may limit the generalizability of the findings to other healthcare settings. Second, microbiological culture and antimicrobial susceptibility data were not available for all patients, limiting the assessment of the appropriateness of empirical antibiotic therapy. Third, patients were followed only until hospital discharge; therefore, long-term outcomes, recurrence rates, and post-discharge complications could not be evaluated. In addition, prescribing practices may have been influenced by local institutional protocols and antibiotic availability, which may differ across hospitals. Finally, pharmacoeconomic outcomes and detailed adverse drug reaction assessments were not comprehensively evaluated.

RECOMMENDATIONS

To optimize the management of cellulitis and promote rational antibiotic use, healthcare institutions should strengthen antimicrobial stewardship programmes and ensure greater adherence to national and international treatment guidelines, including IDSA recommendations, through regular prescription audits and continuous clinician education. Routine microbiological culture and antimicrobial susceptibility testing should be encouraged whenever clinically appropriate to facilitate culture-guided therapy and minimize unnecessary empirical broad-spectrum antibiotic use. Periodic Drug Utilization Evaluation (DUE), Defined Daily Dose (DDD), and Drug Utilization 90% (DU90%) analyses should be incorporated into hospital practice to monitor antibiotic consumption and prescribing quality. Furthermore, hospitals should develop institution-specific antibiotic prescribing protocols based on local antimicrobial resistance patterns. Future research should involve multicentre studies with larger sample sizes, extended follow-up periods, pharmacoeconomic evaluations, and comprehensive monitoring of adverse drug reactions to generate robust evidence that supports improved

treatment outcomes, cost-effective healthcare delivery, and effective strategies to combat antimicrobial resistance.

FUNDING

Nil

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

ACKNOWLEDGMENT

We also thank the patients who consented to participate in this research.

AUTHOR CONTRIBUTIONS

Musarrath Mubeen conceived and designed the study, supervised the research work, and drafted the manuscript. Afreen Khatoon, Numair Gayas, Hajira Begum, Madeeha Khanam,contributed to data collection, analysis, and manuscript preparation. All authors reviewed and approved the final version of the manuscript.

ETHICAL STATEMENT

The ethical committee clearance was obtained from SVS MEDICAL COLLEGE HOSPITAL before initiating the study. Reference number: IEC/DHR-03/ (04-3)/2025

REFERENCES

1. Stevens DL, Bisno AL, Chambers HF, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. Clin Infect Dis. 2014;59(2):e10–e52.
2. Raff AB, Kroshinsky D. Cellulitis: A review. JAMA. 2016;316(3):325–337.
3. Phoenix G, Das S, Joshi M. Diagnosis and management of cellulitis. BMJ. 2012;345:e4955.
4. Dryden MS. Complicated skin and soft tissue infection. J Antimicrob Chemother. 2010;65(Suppl 3):iii35–iii44.
5. [National Institute for Health and Care Excellence (NICE). Cellulitis and erysipelas: antimicrobial prescribing. NICE Guideline NG141; 2019.
6. World Health Organization. Antimicrobial Resistance: Global Report. Geneva: WHO; 2023.
7. O'Neill J. Tackling Drug-Resistant Infections Globally: Final Report and Recommendations. Review on Antimicrobial Resistance; 2016.
8. World Health Organization. Introduction to Drug Utilization Research. Geneva: WHO; 2003.
9. WHO Collaborating Centre for Drug Statistics Methodology. ATC/DDD Index 2024. Oslo, Norway.
10. Bergman U, Popa C, Tomson Y, et al. Drug utilization 90%—A simple method for assessing the quality of drug prescribing. Eur J Clin Pharmacol. 1998;54(2):113–118.
11. Jenkins TC, Knepper BC, Moore SJ, et al. Microbiology and initial antibiotic therapy for hospitalized patients with cellulitis. DiagnMicrobiol Infect Dis. 2010;66(4):395–400.
12. Holloway K, van Dijk L. The World Medicines Situation 2011: Rational Use of Medicines. World Health Organization; 2011.
13. Wiederhold, A. K., Cartuliares, M. B., Jeppesen, K., &Skjøt-Arkil, H. (2024). Characteristics and Antibiotic Treatment of Patients with Cellulitis in the Emergency Department. *Antibiotics (Basel, Switzerland)*, *13*(11), 1021.
14. Lin V, Callado GY, Pardo I, Gutfreund M, Hsieh MK, Pereira AMR, Kwong BY, Aleshin M, Holubar M, Salinas JL, Diekema DJ, Marra AR. Diagnostic stewardship and dermatology consultation in cellulitis management: a systematic literature review and meta-analysis. Arch Dermatol Res. 2024 Nov 30;317(1):61.
15. Park S, Thursky K, Zosky-Shiller L, James R, Cheah R, Hall L, Ierano C. The quality of antimicrobial prescribing in skin and soft tissue management in Australian hospitals: an analysis of the National Antimicrobial Prescribing Survey data. J Hosp Infect. 2024 Oct;152:142-149.
16. Shu Z, Cao J, Li H, Chen P, Cai P. Efficacy and safety of first- and second-line antibiotics for cellulitis and erysipelas: a network meta-analysis of randomized controlled trials. Arch Dermatol Res. 2024 Sep 6;316(8):603.
17. Peghin M, Graziano E, Rovelli C, Grossi PA. Prevention and treatment of recurrent cellulitis. Curr Opin Infect Dis. 2023 Apr 1;36(2):95-101