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ORIGINAL ARTICLE

Antimicrobial Resistance (AMR) Patterns in Community-Acquired Infections

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ABSTRACT

Background: To determine the prevalence and antimicrobial resistance patterns of bacterial isolates obtained from patients with community-acquired infections presenting to Jinnah Hospital, Lahore.

Methods: A cross-sectional study was carried out at the department of Medicine, Jinnah Hospital, Lahore, from June 2022 to May 2023. A total of 82 patients with clinically diagnosed community-acquired infections were enrolled. Clinical specimens were collected, cultured, and bacterial isolates were identified using standard microbiological techniques. Antimicrobial susceptibility was assessed by the Kirby-Bauer disk diffusion method in accordance with Clinical and Laboratory Standards Institute (CLSI) guidelines. Data were analyzed using SPSS version 26.

Results: The most common infections were urinary tract (37.8%) and respiratory tract infections (28%). Escherichia coli (34.1%) was the predominant isolate, followed by Staphylococcus aureus (20.7%) and Klebsiella pneumoniae (18.3%). Resistance rates were highest against fluoroquinolones (76.8%), β-lactams (74.4%), and cephalosporins (69.5%), while carbapenems showed the highest sensitivity (75.6%). Multidrug resistance was observed in 34.1% of isolates, and MRSA was frequently detected among Gram-positive organisms.

Conclusion: The study highlights a high prevalence of resistance among community-acquired infections, particularly to commonly prescribed antibiotics such as fluoroquinolones and cephalosporins. The emergence of carbapenem resistance and multidrug-resistant organisms underscores the urgent need for antimicrobial stewardship, rational prescribing, and community-level awareness programs.

Keywords: Antimicrobial resistance, Community-acquired infections, Escherichia coli, Multidrug resistance.

INTRODUCTION

Antimicrobial resistance (AMR) has become one of the greatest threats to global health, undermining decades of progress in infectious disease management. Once easily treatable infections are now increasingly difficult to manage due to the rapid spread of resistant pathogens. The World Health Organization (WHO) has repeatedly warned that without effective interventions, common infections could become life-threatening, leading to prolonged illness, higher healthcare costs, and increased mortality[1-3].

In low- and middle-income countries such as Pakistan, the problem is compounded by the widespread availability of antibiotics without prescription, self-medication, and lack of strict antimicrobial stewardship policies. Studies from Pakistan and neighboring countries have documented rising resistance rates among both Gram-positive and Gram-negative organisms. Community-acquired infections, which include urinary tract infections, respiratory tract infections, bloodstream infections, and skin and soft tissue infections, are among the most frequently encountered conditions in outpatient and emergency departments[4-6].

Among bacterial pathogens, Escherichia coli and Klebsiella pneumoniae dominate urinary and gastrointestinal infections, while Staphylococcus aureus and Streptococcus pneumoniae are important causes of respiratory and skin infections. Resistance to fluoroquinolones, cephalosporins, and β-lactams has been widely reported in these organisms, with carbapenems increasingly used as the last line of defense. However, the emergence of carbapenem-resistant Enterobacteriaceae and methicillin-resistant Staphylococcus aureus (MRSA) has raised serious concerns for clinicians and public health authorities alike[7-9].

In Pakistan, most available research has focused on hospital-acquired infections, with relatively limited data on resistance patterns in community-acquired infections. Yet, resistance emerging in the community poses a greater challenge, as it affects a large segment of the population and limits the effectiveness of first-line empirical treatments[10].

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This study was conducted to investigate the prevalence and resistance patterns of bacterial pathogens causing community-acquired infections among patients presenting to Jinnah Hospital, Lahore. By identifying the most common organisms and their resistance profiles, the study aims to provide evidence that can inform local treatment guidelines and contribute to the broader effort of combating AMR.

METHODOLOGY

This study was conducted in the Department of Medicine, Jinnah Hospital, Lahore, over a period of one year from June 2022 to May 2023. It was designed as a cross-sectional observational study to evaluate the antimicrobial resistance (AMR) patterns in community-acquired infections.

A total of 82 patients were enrolled during the study period. Patients of both genders and all age groups presenting with symptoms of community-acquired infections were included. Community-acquired infection was defined as the onset of infection in patients with no history of hospitalization, surgical procedure, or invasive intervention in the preceding three months.

Inclusion Criteria

- Patients presenting with clinically diagnosed community-acquired infections such as urinary tract infection, respiratory tract infection, bloodstream infection, skin and soft tissue infection, or gastrointestinal infection.
- Patients providing informed consent for sample collection and laboratory analysis.

Exclusion Criteria

- Patients with hospital-acquired infections (onset of infection ≥48 hours after hospital admission).
- Patients who had received broad-spectrum intravenous antibiotics within the last 72 hours before presentation.
- Incomplete clinical records or insufficient specimen volume for culture.

Demographic and clinical information including age, gender, residential area, comorbidities, and recent history of antibiotic use was recorded using a structured proforma.

Clinical specimens such as urine, sputum, blood, pus, wound swabs, and stool were collected under aseptic conditions.

Each specimen was transported immediately to the microbiology laboratory for processing. Culture and sensitivity testing were performed following standard microbiological techniques.

Microbiological Procedures

- **Culture:** Specimens were inoculated on appropriate culture media such as Blood agar, MacConkey agar, and Chocolate agar, and incubated under recommended conditions.
- **Identification of isolates:** Bacterial colonies were identified on the basis of morphology, Gram staining, and standard biochemical tests. When required, an automated identification system was used for confirmation.
- **Antimicrobial susceptibility testing:** The susceptibility of bacterial isolates was determined using the **Kirby-Bauer disk diffusion method** according to the Clinical and Laboratory Standards Institute (CLSI) guidelines. Antibiotics tested included penicillins, cephalosporins, fluoroquinolones, aminoglycosides, carbapenems, macrolides, tetracyclines, and trimethoprim-sulfamethoxazole.
- **Detection of resistant strains:** Multidrug resistance (MDR) was defined as resistance to three or more antibiotic classes. Extended spectrum β-lactamase (ESBL) producing isolates were confirmed using double-disk synergy testing, and methicillin-resistant Staphylococcus aureus (MRSA) was identified using cefoxitin disk diffusion.

All data were entered and analyzed using SPSS version 26. Descriptive statistics were used to summarize demographic and clinical variables. Frequencies and percentages were calculated for categorical variables, while mean and standard deviation were used for continuous variables. Associations between demographic factors, infection types, and resistance patterns were assessed using the chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 82 patients with community-acquired infections were included in this study. The majority of cases presented with urinary tract and respiratory tract infections. The mean age was in the mid-thirties, with a slightly higher proportion of females. Comorbid conditions, especially diabetes, were frequently observed. Most isolates showed resistance to commonly used antibiotics such as fluoroquinolones and cephalosporins, while carbapenem resistance and multidrug resistance were also noted.

Urinary tract infections were the most common (37.8%), followed by respiratory infections (28%). Bloodstream and skin infections were less frequent. The differences between infection types were statistically significant.

Most patients were between 21–40 years, and females slightly outnumbered males. Urban patients constituted the majority of cases (63.4%), which was statistically significant. The presence of comorbidities, especially diabetes, was also significantly associated with infection occurrence.

Table 1: Demographic Characteristics of Patients (n = 82)

Variable	Frequency (n)	Percentage (%)	p-value
Age groups			
<20 years	10	12.2	
21–40 years	29	35.4	
41–60 years	25	30.5	
>60 years	18	21.9	0.08
Gender			
Male	35	42.7	
Female	47	57.3	0.21
Residence			
Urban	52	63.4	
Rural	30	36.6	0.04*
Comorbidities			
Present	27	32.9	
Absent	55	67.1	0.02*

*Significant at p<0.05

Table 2: Distribution of Infection Types (n = 82)

Infection type	Frequency (n)	Percentage (%)	p-value
Urinary tract infection	31	37.8	
Respiratory infection	23	28.0	
Bloodstream infection	14	17.1	
Skin/soft tissue	9	11.0	
Gastrointestinal	5	6.1	0.03*

Table 3: Bacterial Isolates from Clinical Specimens (n = 82)

Organism	Frequency (n)	Percentage (%)	p-value
Gram-negative			
Escherichia coli	28	34.1	
Klebsiella pneumoniae	15	18.3	
Pseudomonas aeruginosa	8	9.8	
Gram-positive			
Staphylococcus aureus	17	20.7	
Streptococcus spp.	7	8.5	
Others	7	8.5	0.01*

Table 4: Antimicrobial Resistance Patterns (n = 82)

Antibiotic class	Sensitive n (%)	Resistant n (%)	p-value
β-lactams (penicillins)	21 (25.6)	61 (74.4)	0.001*
Cephalosporins	25 (30.5)	57 (69.5)	0.002*
Fluoroquinolones	19 (23.2)	63 (76.8)	0.001*
Aminoglycosides	47 (57.3)	35 (42.7)	0.12
Carbapenems	62 (75.6)	20 (24.4)	0.04*
Sulfonamides (TMP-SMX)	29 (35.4)	53 (64.6)	0.03*

Table 5: Multidrug Resistance (MDR) Status (n = 82)

MDR status	Frequency (n)	Percentage (%)	p-value
MDR present	28	34.1	
MDR absent	54	65.9	0.01*

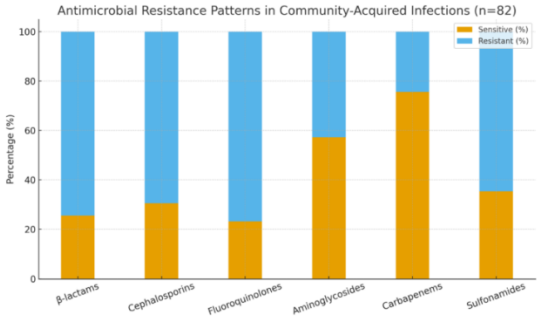

Figure 1: Graph of antimicrobial resistance patterns from your study. It shows the proportion of isolates that were sensitive vs. resistant to each antibiotic class, making it clear that fluoroquinolones, β-lactams, and cephalosporins had the highest resistance, while carbapenems remained the most effective.

Analysis: E. coli was the most frequently isolated pathogen (34.1%), followed by Klebsiella (18.3%) and S. aureus (20.7%). This distribution was statistically significant, reflecting a predominance of Gram-negative organisms.

High resistance rates were observed against fluoroquinolones (76.8%) and β-lactams (74.4%). Cephalosporins also showed a high resistance pattern (69.5%). Carbapenems remained the most effective group with 75.6% sensitivity, though resistance (24.4%) was emerging.

DISCUSSION

The findings of this study highlight an alarming prevalence of antimicrobial resistance in community-acquired infections at Jinnah Hospital, Lahore. The predominance of Escherichia coli as the most common isolate, particularly in urinary tract infections, is consistent with reports from other regional and international

studies. Several studies conducted in South Asia have similarly identified E. coli as the leading pathogen in urinary and bloodstream infections, with high resistance rates to fluoroquinolones and cephalosporins[11-13].

In the present study, resistance to β-lactams, cephalosporins, and fluoroquinolones exceeded 70%, which mirrors the growing body of evidence pointing to the misuse and over-prescription of these agents in outpatient settings. Comparable results were reported, who noted fluoroquinolone resistance rates of 72% in urinary isolates. Similar resistance patterns have also been observed in India, where cephalosporin resistance in E. coli and Klebsiella exceeded 65%[14,15].

The relatively preserved sensitivity of carbapenems in this study (75.6%) is encouraging, but the emergence of carbapenem resistance in nearly one-quarter of isolates raises concern. Studies from tertiary centers in Pakistan and neighboring countries have described a steady rise in carbapenem-resistant Enterobacteriaceae, often associated with poor treatment outcomes and higher mortality[16,17]. This trend emphasizes the urgent need for surveillance and stewardship measures to prevent the further spread of carbapenem resistance, which represents the last line of defense for many severe infections.

Among Gram-positive organisms, Staphylococcus aureus was frequently isolated, with methicillin-resistant strains contributing substantially to the burden. The presence of MRSA in community settings has been documented in several reports from Asia and the Middle East[18]. Such findings suggest that resistant strains once confined to hospitals are increasingly establishing themselves in community environments, complicating empirical treatment choices.

The occurrence of multidrug resistance in 34% of isolates in this study is particularly concerning. Similar rates have been described in other studies across Pakistan, ranging from 30–40%[19,20]. The clinical implications are profound, as MDR infections often require prolonged hospitalization, more toxic or costly drugs, and are associated with poorer outcomes.

Several factors contribute to the high AMR burden in community settings, including widespread over-the-counter antibiotic access, self-medication, incomplete treatment courses, and lack of regulation in prescribing practices. In addition, poor awareness among patients and healthcare providers regarding appropriate antibiotic use exacerbates the problem. These findings underscore the need for coordinated antimicrobial stewardship programs at the community level, strengthened microbiological surveillance, and education campaigns targeting both prescribers and the general public.

CONCLUSION

This study demonstrates a high prevalence of antimicrobial resistance among community-acquired infections at Jinnah Hospital, Lahore, with E. coli being the most common isolate. Resistance to fluoroquinolones, cephalosporins, and β-lactams was widespread, while carbapenem resistance was also emerging. The presence of MRSA and multidrug-resistant organisms highlights the growing challenge of managing infections in outpatient and emergency settings.

There is an urgent need to strengthen antimicrobial stewardship, ensure rational prescribing practices, and establish regular surveillance systems at both hospital and community levels. Without immediate and coordinated interventions, the rising trend of resistance threatens to undermine the effectiveness of existing therapies and increase the burden of infectious diseases in Pakistan.

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