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# Multidrug Resistance Patterns in Asymptomatic Bacteriuria among Patients with Comorbidities

**Dr. Misbah Fatima**
PG Nephrology, Abbasi Shaheed Hospital. misbah.ali06@yahoo.com
**Dr. Khurram Danial**
Chairman Department of Nephrology Karachi Metropolitan University Abbasi Shaheed Hospital. drkhurramdanial@yahoo.com
**Dr. Asifa Hafeez**
Assistant Professor Department of Nephrology, Karachi Metropolitan University, Abbasi Shaheed Hospital. asifakhurram@ymail.com
**Dr. Aqsa Fatima**
LUMHS Jamshoro. aqsazoheb@gmail.com

**Author Details**

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Corresponding E-mails & Authors*:

## Abstract

**Background**: Asymptomatic bacteriuria (ASB) is common among individuals with chronic comorbidities and may contribute to the growing burden of antimicrobial resistance. The emergence of multidrug-resistant (MDR) uropathogens poses significant challenges to clinical management, particularly in patients with repeated healthcare exposure and underlying medical conditions. This study aimed to investigate the prevalence and determinants of multidrug resistance in ASB among patients with comorbidities. **Methods**: A cross-sectional descriptive study was conducted in the nephrology outpatient department of Abbasi Shaheed Hospital, Karachi, between December 2024 and May 2025. A total of 208 adults aged 21–60 years with asymptomatic bacteriuria and at least one comorbidity was recruited through convenience sampling. Demographic and clinical data were collected using a structured questionnaire, while urine cultures and antibiotic susceptibility testing were performed using standard microbiological techniques. Descriptive statistics, chi-square tests and logistic regression analysis were applied to identify factors associated with MDR. **Results**: Bacterial growth was detected in 53.8% of participants, while 46.2% showed no growth. Multidrug-resistant organisms were identified in 19.7% of the study population. Escherichia coli was the predominant uropathogen, followed by Klebsiella, Enterococcus, Pseudomonas and Staphylococcus saprophyticus. Diabetes mellitus and immunosuppression demonstrated borderline associations with MDR, whereas chronic kidney disease showed a near-significant relationship. Catheterization emerged as the

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only independent predictor of multidrug resistance. Carbapenems, particularly meropenem and imipenem, exhibited the highest susceptibility rates, whereas resistance to amoxicillin and ciprofloxacin was comparatively high. **Conclusion**: Asymptomatic bacteriuria among patients with comorbidities represent an important reservoir of multidrug-resistant pathogens. Continuous surveillance, culture-guided treatment, rational antibiotic prescribing and improved catheter-management practices are essential to limit the spread of antimicrobial resistance and improve patient outcomes.

**Keywords**: asymptomatic bacteriuria, multidrug resistance, antimicrobial resistance, comorbidities, catheterization, uropathogens, antibiotic susceptibility.

## Introduction

### 1.1 Background

ASB are one of the most frequently seen bacterial infections in clinical practice and are a significant burden of the healthcare systems globally. ASB is a common condition in humans that causes significant morbidity, healthcare costs, and costly hospital stays and low quality of life, especially in vulnerable groups, affecting millions of people every year (Jha et al., 2025). Most ASB present with symptoms like dysuria, urgency to pass urine, frequent urination and lower abdominal pain, but many ASB have no symptoms. The diagnosis and treatment of this asymptomatic bacteriuria (ASB) are difficult due to the fact that infected people may have pathogenic microorganisms will not have any apparent clinical symptoms or signs of any disease (Kebede et al., 2025).

These infections are often asymptomatic and can be missed, and so can the treatment, causing a risk of poor clinical outcome of these infections in certain susceptible groups. Individuals with chronic comorbidities, such as diabetes mellitus, chronic kidney disease (CKD) and immune system disorders, are especially at risk of asymptomatic infections due to compromised immunity and increased risk of exposure to healthcare settings (Behairy et al., 2024). In these patients untreated infections can lead to symptomatic infections, pyelonephritis, sepsis and, in severe cases, permanent renal impairment. Thus, ASB s epidemiology and resistance patterns of high-risk groups is a public health priority.

The incidence of ASB is significantly different between different populations. The prevalence rates have been shown to be dependent on age, sex, physiologic state and chronic disease. Asymptomatic infection is more prevalent in older adults, pregnant women, diabetes mellitus patients and chronic kidney disease patients (Iqbal et al., 2024). Gender differences in prevalence of disease are also due to anatomical and physiological factors. ASB are more common among women, due to their shorter

urethra, proximity of the urethral opening to anus, hormonal influences and other biological factors which promote bacterial colonization (Al Qahtani et al., 2024).

The study carried out in Pakistan reflects global studies, hence, the prevalence of ASB was observed to be higher in females than in males (Rodrigues et al., 2020). But the inequalities in disease burden are not just gender based, and there is an important role of the increasing burden of chronic diseases in the population. Non-communicable diseases like diabetes, chronic kidney disease, hypertension are growing concerns in Pakistan, and are involved in greater susceptibility to infection. The epidemiologic and demographic changes highlight a need for targeted studies examining the possible association between multimorbidity of chronic conditions with multidrug-resistant urinary pathogens.

### 1.2 Antimicrobial Resistance and Multidrug Resistance in ASB

Antimicrobial resistance (AMR) to the increasing burden of the urinary tract infections (UTI) is also a major concern. Antimicrobial resistance is when microorganisms become resistant to antimicrobial medicines that they once were susceptible to. AMR has been identified as a major public health, food security and economic development challenge in the twenty-first century by the World Health Organization (WHO) (Kim et al., 2024). Resistant organisms are becoming more common and have made many commonly-used antibiotics less effective, making it more difficult to manage infections in both community and hospital settings.

Multidrug resistance (MDR) is resistance to three or more classes of antimicrobial agents, and is a particularly serious form of antimicrobial resistance. Multidrug-resistant pathogens are now known to cause ASB and are a serious threat for the healthcare providers as they restrict the therapeutic options and place patients at risk of therapeutic failure (Mousa et al., 2025). Especially, there has been a rising trend of multi-drug-resistant strains of common uropathogens (Escherichia coli, Klebsiella pneumoniae, Enterococcus faecalis and Pseudomonas aeruginosa) being found (Fitzpatrick et al., 2024).

Within these, Escherichia coli is by far the most common cause of both ASB's and the vast majority of asymptomatic ASB's globally. Nevertheless, resistance to E. coli has significantly risen in the past few years, making the use of empirical antimicrobial therapy difficult and requiring the use of more potent, wide-spectrum and costly antimicrobials (Gena et al., 2025). Klebsiella pneumoniae is another bacterium that has become a significant cause of HAI, due to its ability to gain and share resistance genes. The problem of the spread of MROs in health care institutions has therefore emerged as

a major concern, especially in low- and middle-income countries, where surveillance and antimicrobial stewardship programmes are not well-established.

In Pakistan, the burden of antimicrobial resistance is particularly high. Resistant strains of bacteria are common now because of the abundance of antibiotic products that can be used without a prescription, self-medication, weak regulations and infection-control protocols, and the widespread use of antibiotics (Fitzpatrick et al., 2024). Antibiotics are often administered without microbiological diagnosis, which fosters selection of resistant organisms and their spread in many health care facilities throughout the country. Consequent to this, alarming resistance rates of the hospital isolated urinary pathogens have been observed to the first line antimicrobial agents in Pakistan.

Previously, high level of resistance was observed for urinary isolates in Pakistan, especially towards cephalosporins, fluoroquinolones and beta-lactam antibiotics (Niaz et al., 2024). Access to diagnostic services is further constrained and antibiotic stewardship programmes are poorly implemented. Although antimicrobial resistance is increasingly recognised as a public health problem, there are still major gaps in the knowledge of the local epidemiology of MDROs in particular patient groups.

### 1.3 Comorbidities and susceptibility to ASB

Patients suffering from chronic comorbidities are one of the most vulnerable groups that are affected by ASB and antimicrobial resistance. One of the most common chronic conditions in the world, diabetes mellitus has always been linked to an enhanced risk for infection. Hyperglycemia may lead to impaired neutrophil function, which results in a decrease in host immunity and increased growth of bacteria via glycosuria and therefore bacterial colonization in the urinary tract (Ajabnoor et al., 2026). In addition, diabetic patients frequently have to undergo multiple health care visits and courses of antibiotic therapy, making them a risk of acquiring multidrug-resistant organisms.

Likewise, people with chronic kidney disease are at risk for developing ASB due to changes in their immune system and repeated exposure to healthcare interventions. Frequent hospitalization and invasive procedures are a risk for patients undergoing dialysis and long-term medical treatment, and can contribute to the risk of them becoming colonized and infected with resistant pathogens (Shafrin et al., 2022). Immunosuppressive disorders can make the body more susceptible by decreasing the immune response to invading microorganisms (Rodrigues et al., 2025).

Chronic comorbidities interact with antimicrobial resistance to form a complex clinical situation. People with underlying diseases are at higher risk of picking up multidrug-resistant organism and also at higher risk of developing ASB. It has been

shown in previous studies that some factors such as antibiotic usage, long hospitalization, urinary catheterization and chronic disease are important causes for the emergence of resistant pathogens and their persistence (Behairy et al., 2024). Therefore, it is important to have knowledge of the asymptomatic bacteriuria resistance pattern and associated risk factors in these populations.

### 1.4 Antibiotic Stewardship and Public Health implications

The growing problem of antimicrobial resistance has led to the development of a new priority in infection control and public health – antibiotic stewardship. The ultimate goal of the antibiotic stewardship programmes is to optimize the use of antimicrobials by promoting the correct use of these, as well as monitoring antimicrobial resistance trends and conducting microbiological testing and educational measures (Fatima et al., 2018). Empirical treatment is still practiced and has a significant role in the creation of resistance in urinary tract infections which are more prevalent than other infections and in which effective stewardship practices are very important.

Although there is an increasing awareness of the importance of stewardship programmers, there is a lack of consistency in how evidence-based strategies are implemented in many LMICs. The lack of diagnostic facilities, scarcity of resources and differences in the prescription patterns remain one of the biggest challenges in the fight against antimicrobial resistance. Therefore, in-depth epidemiological studies at local level should be conducted to support clinical decisions and targeted interventions.

### 1.5 Research Gap

Even though there was much investigation in the area of symptomatic ASB, the asymptomatic bacteriuria is relatively under studied and especially prevalent in developing countries. Because of lack of clinical symptoms, this often leads to underdiagnosis and underreporting, resulting in an underestimate of the burden of disease. Moreover, the prevalence and antibiotic resistance pattern of multidrug-resistant organisms in asymptomatic infections in patients who were having chronic co-morbidities have not yet been investigated in the context of the healthcare environment in Pakistan.

Abbasi Shaheed Hospital is one of the biggest tertiary care hospitals of Karachi, catering to a diverse population and is adequate to investigate multidrug resistance pattern in chronic comorbidities patients. It is important to have this context to help make sense of the prevalence of multidrug resistant organisms in ASB that are not causing symptoms to help shape diagnostic approaches, antimicrobial stewardship and to alleviate the burden of resistant infections.

Despite the fact that previous studies have focused on either antimicrobial resistance or ASB, there is little evidence to show the association of MDR pattern with the presence of chronic comorbidities in the asymptomatic population of Pakistan. This study aims to fill this gap by studying the prevalence and distribution of multi-drug-resistant organisms in asymptomatic patients with underlying comorbid conditions at Abbasi Shaheed Hospital, Karachi having ASB. The study will help to build the knowledge base and guide the creation of more effective screening, management and antimicrobial stewardship programs for high-risk populations that can identify the resistance patterns and clinical factors associated with these.

### 1.6 Research Objectives

The primary objective of this study is to delineate and compare the prevalence of multidrug-resistant organisms in asymptomatic bacteriuria among patients with different comorbidities

The specific objectives of the study are:

- To establish the prevalence of multidrug-resistant organisms in patients without symptoms due to ASB when they have comorbidities like diabetes, chronic kidney disease, and immunosuppressive conditions.
- To determine the classes of MDR organisms causing ASB and characterize their resistance to antibiotics.
- To assess the relationship between the comorbidities (e.g., diabetes, hypertension, renal disease) and the prevalence of MDR in ASB.
- To evaluate the relationship between demographic and clinical characteristics, such as age, sex, previous use of antibiotics and hospitalization and the presence of multidrug-resistant organisms.
- To review the clinical significance of MDR organisms in AB and to share the results of policies designed to enhance AB and antimicrobial stewardship in high-risk populations.

### 1.7 Research Questions

The following research questions guide the study:

- What is the prevalence of asymptomatic bacteriuria caused by multi-drug-resistant organisms (MDROs) among patients with different comorbidities (e.g., diabetes, chronic kidney disease, immunosuppression, etc.)?
- Which comorbidities are most strongly associated with an increased risk of harboring multi-drug-resistant organisms (MDROs) in cases of asymptomatic bacteriuria?

## 2. Methodology

### 2.1 Study design

The study design was a cross-sectional descriptive study, which was used to explore the multidrug resistance patterns in ASB s in patients with comorbidities. The study was carried out in a large tertiary care hospital, Abbasi Shaheed Hospital, Karachi with huge and diversified population attending the hospital. The cross-sectional design was chosen to determine the prevalence of multidrug resistant organisms (MDROs) among a specific population at one time and evaluate the relationship between chronic medical conditions and MDROs. While this may be appropriate for determining prevalence patterns and statistical associations, it doesn't prove causality.

This study was conducted on the patients who visited the Nephrology Outpatient Department (OPD) and are often seen suffering from chronic diseases like diabetes mellitus, chronic kidney disorder (CKD), hypertension, renal stone disease and immunosuppressive disorders. The nephrology patients were in line with the study aim of assessing multidrug resistance in clinically vulnerable patient populations.

### 2.2 Sample size and sampling technique

Twenty-eight participants were excluded because of errors in their data, leaving 208 participants in the study. Sample size was calculated based on the prevalence of ASB in Pakistan, and it was deemed adequate to estimate the prevalence of MDR and understand the association between chronic comorbidities and MDR.

A non-probability sampling method, namely convenience sampling, was used, which involved patients who were eligible, attending the nephrology clinic during the study period, being recruited consecutively until the number of patients required for the study was obtained. This was a practical way to access high-risk patients and helped to ensure access in a hospital-based setting, but may not be generalisable to the broader population.

### 2.3 Eligibility Criteria

#### 2.3.1 Inclusion Criteria

The participants were those who:

- Adults aged 21-60 years were;
- He/she had to attend the Nephrology OPD at Abbasi Shaheed Hospital;
- Had or had not had an asymptomatic urine culture that was positive for bacteria;
- Went diagnosis on at least one of the following conditions: diabetes mellitus, chronic kidney disease, hypertension, renal stone disease or immunosuppressive disorders.

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### Exclusion Criteria

Patients were excluded if they had a history of symptomatic UTI, antibiotic use in the last 3 months or had been admitted to hospital in the previous 3 months or had no documentation of comorbid conditions. These criteria allowed the study to be restricted to asymptomatic infections and to limit the effect of recent medical treatments on the pattern of antimicrobial resistance.

### 2.4 Data Collection:

The data were collected from December 2024 to May 2025 by structured questionnaires and medical examination reports. Demographic data such as age, sex, marital status, along with clinical data about diabetes mellitus, chronic kidney disease, hypertension, benign prostatic hyperplasia, renal stone disease, frequency of use of catheter, and immunosuppressive diseases were collected. Microbiological records were used to obtain laboratory results such as urine culture results, bacterial isolates and the antimicrobial susceptibility profile.

The outcome measured in the study was the multidrug resistance status. Demographic, comorbidities, previous clinical history and microbiological features were included as independent variables. Laboratory parameters included were bacterial growth, identification of the organisms and antibiotic sensitivity.

### 2.5 Microbiological Assessment

The presence of asymptomatic bacteriuria was confirmed by the urine culture report and the microorganisms responsible for the infection were determined. The study was limited to the most common uropathogens (Escherichia coli, Klebsiella pneumoniae, Enterococcus faecalis and others bacteria found in the microbiological analysis). The study definition included multidrug resistant organisms as those that were resistant to three or more antimicrobial agents, and antimicrobial susceptibility testing was used to determine their resistance patterns.

### 2.6 Statistical Analysis

Data analysis was done using both descriptive and inferential statistical techniques. Demographic, clinical and microbiological data was summarized by frequencies and percentage. Multidrug resistance was compared with categorical variables such as diabetes mellitus, chronic kidney disease, hypertension, catheterization and immunosuppression by using chi-square tests. A p value of $< 0.05$ was used for criteria of statistical significance.

Multidrug resistance was predicted by means of logistic regression analysis, accounting for potential confounders. To quantify the relationships, odds ratios and intervals were calculated. Further, independent-samples t-test and one-way analysis of

variance (ANOVA) were used, as appropriate, to determine differences in means between groups. The data were checked for missing data before analysis and those with significant missing data were not included in the inferential tests to ensure accurate and reliable results.

### 2.7 Ethical Considerations

Ethical approval was done prior to starting the data collection. Before participating in the study, all participants were given information about the study and provided informed consent. The confidentiality and anonymity of participants was ensured through the use of identification codes and access to the research data was limited. All participation was voluntary, and the participants did not have to be hospitalized with the study; the study did not have an impact on the clinical care of the participants. Ethical procedures, as accepted for studies involving human participants, were followed in all study procedures.

## 4. Results

### 4.1 Overview

The results are shown in this chapter after conducting the study of multidrug resistance (MDR) pattern of asymptomatic bacteriuria (ASB) cases of patients with comorbidities at Abbasi Shaheed Hospital, Karachi. The results are presented as descriptive statistics, microbiological results, and inferred analysis between the relationship of comorbid conditions and the multi-drug resistance. Frequency distributions, chi-square tests and logistic regression models are included in the analyses.

### 4.2 Demographic and clinical characteristics:

The participants in the study included 208. Most respondents were male (61.1%, n = 127) and females accounted for 38.9% (n = 81) of the population in the study. The participants were also evaluated for comorbidities such as diabetes mellitus, chronic kidney disease (CKD), renal stone disease, hypertension, benign prostatic hyperplasia (BPH), catheterization and immunosuppression.

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Gender | Male | 127 | 61.1 |
| | Female | 81 | 38.9 |
| Marital status | Married | 143 | 68.8 |
| | Single | 34 | 16.3 |
| | Divorced | 16 | 7.7 |
| | Widowed | 15 | 7.2 |
| Diabetes mellitus | Yes | 74 | 35.6 |
| | No | 134 | 64.4 |

| | | | |
|---|---|---|---|
| Chronic kidney disease (CKD) | Yes | 99 | 47.6 |
| | No | 109 | 52.4 |
| Renal stone disease | Yes | 35 | 16.8 |
| | No | 173 | 83.2 |
| Hypertension | Yes | 109 | 52.4 |
| | No | 99 | 47.6 |
| Benign prostatic hyperplasia (BPH) | Yes | 9 | 4.3 |
| | No | 199 | 95.7 |
| Catheterization | Yes | 31 | 14.9 |
| | No | 177 | 85.1 |
| Immunosuppression | Yes | 19 | 9.1 |
| | No | 189 | 90.9 |

### 4.3 Distribution of Uropathogens and Prevalence of Multidrug Resistance

The urine culture results showed growth of bacteria in 53.8% of all participants while no bacteria were found in 46.2%. Of the isolated microorganisms, Escherichia coli was the most commonly found pathogen, with 30.8% (n = 64) of cases. Other microbes were also identified such as Klebsiella, Enterococcus, Pseudomonas and Staphylococcus saprophyticus.

The multidrug resistance rate was 19.7% (n = 41), and 80.3% (n = 167) of the participants were classified as non-MDR cases. Therefore, almost one out of five subjects in the study were infected with organisms resistant to several antibiotics.

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Urine culture results | Bacterial growth present | 112 | 53.8 |
| | No bacterial growth | 96 | 46.2 |
| Organism isolated | *Escherichia coli* | 64 | 30.8 |
| | *Klebsiella* spp. | — | 8.7 |
| | *Enterococcus* spp. | — | — |
| | *Pseudomonas* spp. | — | — |
| | *Staphylococcus saprophyticus* | — | 5.3 |
| | No growth | 96 | 46.2 |
| Multidrug resistance status | MDR present | 41 | 19.7 |
| | MDR absent | 167 | 80.3 |

### 4.4 Association Between Comorbidities and Multidrug Resistance

The relationship between multidrug resistance and comorbidities was explored by chi-square analyses. The findings showed that borderline association existed between diabetes mellitus and MDR, and between immunosuppression and MDR. A similar association that was almost significant was observed for chronic kidney disease.

All clinical variables were associated with multidrug resistance and only catheterization was clearly statistically significant in the bivariate analysis.

| Comorbidity | Status | Non-MDR, n (%) | MDR, n (%) | Total, n (%) | Pearson $\chi^2$ | p-value | Interpretation |
|---|---|---|---|---|---|---|---|
| Diabetes mellitus | Yes | 54 (73.0) | 20 (27.0) | 74 (35.6) | 3.884 | 0.049 | Borderline significant |
| | No | 113 (84.3) | 21 (15.7) | 134 (64.4) | | | |
| Chronic kidney disease | Yes | 74 (74.7) | 25 (25.3) | 99 (47.6) | 3.665 | 0.056 | Not significant; near-significant trend |
| | No | 93 (85.3) | 16 (14.7) | 109 (52.4) | | | |
| Renal stone disease | Yes | 25 (71.4) | 10 (28.6) | 35 (16.8) | 2.087 | 0.149 | Not significant |
| | No | 142 (82.1) | 31 (17.9) | 173 (83.2) | | | |
| Hypertension | Yes | 83 (76.1) | 26 (23.9) | 109 (52.4) | 2.482 | 0.115 | Not significant |
| | No | 84 (84.8) | 15 (15.2) | 99 (47.6) | | | |
| Benign prostatic hyperplasia | Yes | 6 (66.7) | 3 (33.3) | 9 (4.3) | 1.103 | 0.294 | Not significant |
| | No | 161 (80.9) | 38 (19.1) | 199 (95.7) | | | |
| Catheterization | Yes | 19 (61.3) | 12 (38.7) | 31 (14.9) | 8.308 | 0.004 | Statistically significant |
| | No | 148 (83.6) | 29 (16.4) | 177 (85.1) | | | |

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| Immunosuppression | Yes | 12 (63.2) | 7 (36.8) | 19 (9.1) | 3.877 | 0.049 | Borderline significant |
| | No | 155 (82.0) | 34 (18.0) | 189 (90.9) | | | |

### 4.5 Antibiotic Susceptibility Patterns

There was a significant variation in the pattern of resistance to antibiotics detected among the isolated uropathogens. The carbapenems were the most effective, and were active against most multidrug-resistant isolates, especially meropenem and imipenem.

On the other hand, commonly used antibiotics such as fluoroquinolones and some cephalosporins had lower susceptibility rates which indicate that there is growing resistance to these drugs in urinary pathogens. These results highlight the need for culture-guided therapy and antimicrobial stewardship programmers.

| Antibiotic | Sensitive, n (%) | Resistant, n (%) | Not tested, n (%) |
|---|---|---|---|
| Amoxicillin | 28 (13.5) | 84 (40.4) | 96 (46.2) |
| Ciprofloxacin | 64 (30.8) | 46 (22.1) | 98 (47.1) |
| Nitrofurantoin | 78 (37.5) | 34 (16.3) | 96 (46.2) |
| Meropenem | 102 (49.0) | 0 (0.0) | 106 (51.0) |
| Cotrimoxazole | 62 (29.8) | 0 (0.0) * | 146 (70.2) |
| Ceftriaxone | 62 (29.8) | 0 (0.0) * | 146 (70.2) |
| Piperacillin–tazobactam | 78 (37.5) | 0 (0.0) * | 130 2.5) |

### 4.6 Logistic Regression Analysis

Demographic and clinical features were incorporated in multivariable logistic regression analysis to determine the independent predictors of multidrug resistance. Diabetes mellitus, chronic kidney disease and immunosuppression showed association in bivariate analyses but catheterization was the only independent predictor of multidrug resistance.

The results suggest that the use of these types of catheters could be a significant contributor to the acquisition and persistence of multidrug resistant infections among patients who have asymptomatic UTI and chronic comorbidities.

| Predictor | Outcome of multivariable analysis | Interpretation |
|---|---|---|
| Diabetes mellitus | Not an independent predictor | The bivariate association did not remain independently significant after adjustment |
| Chronic kidney disease | Not an independent predictor | No independent association with MDR was identified |

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| | | |
|---|---|---|
| Renal stone disease | Not an independent predictor | No independent association with MDR was identified |
| Hypertension | Not an independent predictor | No independent association with MDR was identified |
| Benign prostatic hyperplasia | Not an independent predictor | No independent association with MDR was identified |
| Catheterization | **Independent predictor of MDR** | Catheterization remained significantly associated with MDR after adjustment for the other clinical variables |
| Immunosuppression | Not an independent predictor | The borderline bivariate association did not remain independently significant after adjustment |

### 4.6 Association of Age with MDR and Organism Distribution

There was no statistically significant association between age and multidrug resistance status. Similarly, there was no significant difference in age among the organism categories, indicating that age was not a major factor in determining the resistance patterns among this group.

Overall, the results show that multidrug resistance is a significant clinical issue in a population of ASB patients with chronic comorbidities and no urethral symptoms. Several comorbidities showed different levels of association with MDR, but the strongest association was with catheterization.

## 5. Discussion

### 5.1 Overview of the Findings

In the present study, multidrug resistance (MDR) pattern was studied in asymptomatic bacteriuria (ASB) of patients with co-morbidities seen in nephrology outpatient department at Abbasi Shaheed Hospital Karachi. This study was undertaken due to the high incidence of chronic diseases, and the rising incidence of antimicrobial resistance in bacteria causing ASB. The results showed that 19.7% of the participants had MDR organisms identified and in 53.8% of patients, bacteria growth was observed. The predominant pathogen was Escherichia coli followed by Klebsiella, Enterococcus, Pseudomonas and Staphylococcus saprophyticus. However, diabetes mellitus and chronic kidney disease and immunosuppression showed different associations with MDR with catheterization being the only independent predictor of resistant infection. Moreover, a high level of activity was observed for the isolated pathogens with resistance to a number of antibiotics in common use being significant.

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### 5.2 Prevalence of Multidrug Resistance in Asymptomatic bacteriuria

The study found that almost one-fifth (19.7%) of people with no symptoms of ASB who were tested had organisms that were resistant to more than one antibiotic. Multidrug-resistant pathogens are an important public health issue among people with asymptomatic bacteriuria; however, this condition is often thought of as clinically unimportant. Patients with chronic diseases tend to make multiple contacts with health services, use antibiotics for a longer duration, and are more likely to be colonized with resistant organisms in their urinary tracts, which all help to promote and maintain the presence of resistant organisms.

In the present study, resistance prevalence was like previous study which showed that the prevalence rate of resistance of urinary pathogens in developed and developing countries is increasing. Significant resistance has been reported to the uropathogens among patients with diabetes mellitus and chronic kidney disease in studies from South Asian countries as well as among patients with a history of even multiple hospitalizations. Growing proportion of asymptomatic infections with MDR strains is a worrying situation because such patients could be reservoirs of MDR organisms and spread MDR infection in health care facilities and community.

It is possible that the relatively low prevalence found in this study could be due to variations in local prescribing patterns, infection control measures and patient demographics. However, the results did provide further evidence that resistance to antimicrobials continues to emerge and the need for ongoing surveillance programmers in high-risk populations for antimicrobial resistance patterns.

### 5.3 Microbiological Profile of Uropathogens

Microbiological analysis showed that the most common organism was Escherichia coli (E. coli) which was found in about a third of cases. This result is consistent with previous literature, which consistently showed E. coli as the most common pathogen in both etiology of ASB in both symptomatic and asymptomatic patients. E. coli can attach the uroepithelium with fimbriae and adhesins and increases its capacity to colonize the urinary tract and to develop a persistent infection.

Klebsiella, Enterococcus, Pseudomonas and Staphylococcus saprophyticus were some of the other microorganisms identified. They are common in people who have underlying medical illnesses, exposure to the hospital environment over and over again and invasive medical procedures. Pseudomonas and Klebsiella species are especially known for their ability to obtain resistance genes from plasmids and horizontal gene transfer, which can be done with multiple drugs, and thus are responsible for the multidrug resistance.

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More evidence of the role of chronic disease on the distribution of pathogens in this study. Alterations in host immunity, impaired renal clearance of bacteria and higher exposure to healthcare workers are common conditions in patients with diabetes, chronic kidney disease and immunosuppressive conditions, which provide an environment for bacteria to colonies. The predominance of E. coli and presence of other opportunistic pathogens indicated that both community-acquired and healthcare-associated mechanisms might be responsible for the asymptomatic ASB in this population.

### 5.4 Association Between Comorbidities and Multidrug Resistance

A main aim of the study was to assess if there was an association between multidrug-resistant and chronic co-morbidities. The results showed borderline associations between diabetes mellitus and immunosuppression and MDR and chronic kidney disease (CKD) was near significant. These results are biologically plausible since all of these conditions are linked with diminished immune function and higher health care service use.

ASB have long been known to be a risk factor in diabetes mellitus. Hyperglycemia can affect the functions of neutrophils, decrease immune response and allow bacteria to multiply due to glucosuria. Diabetes, although not statistically significant in the present study, has been shown in other studies to be associated with the development of MDR and the current study confirmed this.

Likewise, chronic kidney disease was almost significantly associated with the MDR. Hospital admissions are often necessary for patients with renal impairment, and they often have to undergo repeated diagnostic tests, antibiotic therapy and hospital admission, which increases the risk of them becoming colonized with resistant organisms. Furthermore, there may be changes in host defense mechanisms which allow a persistence of bacterial growth as a result of impaired renal function.

Immunosuppression there was also on the border line showing an association with MDR. Resistant strains of opportunistic infections are especially a risk to individuals with compromised immunity who tend to also be treated with antimicrobials for longer periods of time, enhancing the selective pressure for resistant strains of infection. The relatively small sample size of the study, though, might have restricted the strength of the association that could be demonstrated in the study with the relatively few of immunosuppressed patients.

It was the discovery of catheterization being the only independent predictor of MDR that was the most important. Resistant infection was significantly higher in patients with catheterization when compared with those without catheterization. Catheters offer

a direct route of infection for bacteria, and allow for the formation of biofilms that help bacteria to escape host immunity and antimicrobial drugs. Bacteria in biofilms provide protection and allow other bacteria to share resistance genes as well as to survive long-term antibiotic treatment. The fact that the use of catheterization was an independent predictor, even after multivariable analysis, underscores the need to reduce unnecessary catheterization and improve the management of catheterization.

### 5.5 Antibiotic Susceptibility Patterns and Clinical Implications

There was considerable variability in sensitivity of the antibiotics tested. Amoxicillin and ciprofloxacin were the two with high resistance, thus indicating that these may not be good empirical drugs for urinary pathogens in this setting. Selective pressure may have led to the rise of resistance as these antibiotics have been used intensively in the hospital and community settings.

Nitrofurantoin exhibited a relatively good susceptibility pattern and had a lower level of resistance than amoxicillin or ciprofloxacin. This result is in line with previous international evidence, which showed efficacy of nitrofurantoin for uncomplicated ASB. It has relatively limited use and is only used at night in the urine, which could contribute to its continued effectiveness.

The most significant one was the activity of the carbapenems, meropenem and imipenem, against the isolated pathogens. No resistance to meropenem was reported among the study population, which further supports the utility of carbapenems as valuable drugs for the treatment of multidrug-resistant and/or severe infections. However, the overuse of carbapenems can pose a large threat in the form of the emergence of carbapenem-resistant organisms.

Susceptibility patterns observed have significant clinical implications. Prescribing antibiotics on an empirical basis – without information – may become less effective in areas experiencing increasing rates of antimicrobial resistance. Rather, the use of culture-directed therapeutic approaches, especially those using patients with chronic diseases, relapsing infections, and prior antibiotic therapy is recommended. In addition, hospital-based antibiotic stewardship programmers are also important to ensure the efficacy of current antimicrobials and to limit the dissemination of resistance.

### 5.6 Strengths and Limitations

There are no weaknesses, but some strengths, that should be acknowledged. It is a novel area of investigation, as it concentrates on the asymptomatic ASB in patients with comorbidities, in a nephrology environment. Second, it was possible to assess the different factors that could be associated with multidrug resistance as a comprehensive

group of chronic conditions was included. Third, it combined microbiological data with clinical data to improve the understanding of resistance patterns.

There are a number of caveats, however. The cross-sectional design precludes causal inferences of the association between comorbidities with multidrug resistance. Since data collected were cross sectional, temporal relationships and disease progression were not examined.

The research took place in one institution, potentially compromising the research's ability to be generalized to other healthcare institutions or geographical areas. In addition, the sample size was good for statistical analysis, but could have decreased the power to detect weaker associations for some comorbidities, especially for immunosuppressive disorders and benign prostatic hyperplasia.

In addition, a number of important factors affecting the results were not explored in detail such as previous exposure to antibiotics, length and severity of chronic disease, hospitalisation outside of the exclusion period, and microbial virulence factors. These factors should be included in future studies to further refine the capacity of resistance models to predict resistance.

### 5.7 Implications for Clinical Practice and Future Research

These results of this study have clinical implications. Asymptomatic ASB (without symptoms) in patients with chronic comorbidities must be realized by healthcare professionals that they can contain multidrug-resistant organisms without clinical manifestations. Resistant infection is most likely in the catheterized patients and these patients should be looked at particularly.

The level of antimicrobial resistance surveillance should be reinforced to provide evidence to support appropriate antibiotic prescribing. The use of culture and susceptibility testing should be considered when starting antibiotic treatment for people at high risk, to avoid unnecessary antibiotics and thus the spread of resistance.

Rational antibiotic prescribing, public health and infection control education, and infection control measures are all crucial elements of antibiotic stewardship programmes from a public health point of view. Limiting unnecessary catheterization and enhancing catheter-care practices may prove to be especially effective ways of controlling the spread of MDR pathogens.

The findings of this study should be replicated in larger populations with multicenter and longitudinal designs to validate the study in the future and connect causality. Further studies looking at the use of antibiotics, the use of health services, the genetics of the microbes and their resistance mechanisms would provide further understanding of the issue of multidrug resistance in asymptomatic bacteriuria.

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## 6. Conclusion

The purpose of this study was to observe multidrug resistance (MDR) pattern in asymptomatic bacteriuria (ASB) in patients having comorbidities attending the Nephrology OPD of Abbasi Shaheed Hospital, Karachi. The results show that in medically complex patients, asymptomatic ASB are a significant reservoir of antimicrobial resistance and should be more clinically relevant. The study was able to accomplish its goals as it found the prevalence of multidrug resistance, uropathogens which are the leading cause of uropathogenic infection and the antibiotic susceptibility pattern and the association between chronic comorbidities and resistant infections.

The findings showed that 19.7% of the study population was carrying organisms resistant to multiple drugs, meaning that almost one in every five patients was carrying organisms resistant to more than one class of antibiotic. Slightly more than half of the participants had bacteria grown, and Escherichia coli was the most common bacteria found. There were other clinically important pathogens like Klebsiella, Enterococcus, Pseudomonas and Staphylococcus saprophyticus. These results confirm the well-recognized role of E. coli as the most frequent causative pathogen of ASB and reveal the role of opportunistic pathogens in patients suffering from chronic diseases.

The study also showed that, diabetes mellitus, chronic kidney disease, and immunosuppression had different associations with multidrug resistance. But multivariable analysis found that the only independent predictor of MDR was catheterization. This observation highlights the role of invasive urinary procedures in the process of bacterial colonization, biofilm formation and dissemination of resistant organisms. The risk of catheterization is the strongest predictor identified, pointing to a need for better catheter-management practices and more stringent infection-control measures in healthcare.

Results of the ANTIBIOTIC SUSCEPTIBILITY pattern showed high resistance (HR) to the most commonly used antibiotics, such as amoxicillin and ciprofloxacin, while comparatively favorable susceptibility was found to nitrofurantoin. The activity of carbapenems, specifically meropenem and imipenem, against the isolated pathogens was still high, highlighting the significance of these drugs in treating MDR infections. However, the use of "covers" should be used with caution and consideration, as it may contribute to the spread of antimicrobial resistance.

This research's findings have significant implications for clinical practice and public health. To maintain the efficacy of current anti-microbials, regular monitoring of anti-microbial resistance trends, culture-driven anti-microbial use and enhanced anti-microbial stewardship programmes should be implemented. Additionally, actions to

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help to reduce unnecessary catheterization and support evidence-based prescribing should be prioritized for the high-risk groups.

The study offers good institution-based evidence, but because of its cross-sectional and single-center design, it is not possible to determine causal relationships and to draw general conclusions for other populations. Multicenter and longitudinal studies with more clinical and microbiological data are recommended to further elucidate multidrug resistance in asymptomatic ASB.

To summarize, ASB occurring in the absence of symptoms are an important source of multidrug resistant bacteria within patients who are having other medical conditions. Early detection of resistance patterns, rational antibiotic use and targeted preventive measures will play an important role in decreasing the burden of antimicrobial resistance and ultimately help to improve patient outcome.

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