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Epidemiology and Burden of Infectious Diseases in a Tertiary Care Hospital

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ABSTRACT

Background: Infectious diseases remain a significant cause of morbidity and mortality, particularly in low- and middle-income countries. Tertiary care hospitals face increasing challenges from antimicrobial resistance and healthcare-associated infections, necessitating localized epidemiological data for effective management. The study aimed to determine the epidemiology and clinical burden of infectious diseases at Bakhtawar Amin Hospital, Multan, Pakistan, identifying high-risk populations, seasonal trends, and predictors of mortality.

Methods: A cross-sectional analytical study was conducted from January 2023 to December 2024. A total of 334 adult inpatients with confirmed infectious diseases were included. Data were extracted from medical records using ICD-10 codes. Variables included demographics, diagnosis, seasonality, antimicrobial use and outcomes. Statistical analysis was performed using SPSS version 26.0.

Results: The mean age was 48.6 ± 16.4 years; 54.8% were male. Respiratory tract infections (34.4%) were most common, followed by urinary tract (18.6%) and gastrointestinal infections (13.2%). Summer saw the highest admissions (31.1%), while winter showed peak respiratory illness (42.6%). Nosocomial infections accounted for 21.3% of cases. Antimicrobial use was high, with 22.5% of isolates being multidrug-resistant. Mortality was 16.2%, with age >60 years and diabetes as independent predictors of death.

Conclusion: Infectious diseases significantly burden tertiary care services, especially among older adults and diabetics. Targeted infection control, antimicrobial stewardship, and surveillance are critical to mitigating this burden.

Keywords: antimicrobial resistance, hospital-acquired infections, nosocomial infections, sepsis, seasonal variation

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INTRODUCTION

Infectious diseases remain a leading cause of morbidity and mortality worldwide, despite advances in medical science and public health interventions.[1] According to the Global Burden of Disease Study 2021, infectious diseases continue to contribute significantly to global disability-adjusted life years (DALYs), particularly in low- and middle-income countries (LMICs).[2] Infectious diseases such as tuberculosis, dengue, malaria, sepsis, and emerging viral infections place a substantial burden on healthcare systems.[3]

Tertiary care hospitals play a pivotal role in managing complex referral-based and often multidrug-resistant cases of infectious diseases.[4] These institutions serve as centers for specialized diagnostics, intensive care, and antimicrobial stewardship programs. However, due to their high patient turnover and concentration of immunocompromised individuals, tertiary hospitals are also hotspots for nosocomial infections and outbreaks.[5] The epidemiological patterns observed in these settings can provide critical insights into local disease dynamics which may differ significantly from national or global trends.

Local epidemiological data are essential for designing targeted interventions, optimizing resource allocation and guiding infection control policies.[6] While national surveillance systems offer broad estimates, they often fail to capture the microepidemiology of individual hospitals or regions.[7] For instance, seasonal variations in vector-borne diseases, antibiotic resistance profiles, and demographic risk factors may vary significantly across geographic locations.[8] Therefore, hospital-based studies are vital for understanding real-world clinical burdens and informing localized public health responses.

Despite this importance, there remains a lack of recent and comprehensive data describing the epidemiology of infectious diseases in tertiary care settings in many parts of the world, including South Asia.[9] Previous studies have highlighted the increasing incidence of healthcare-associated infections, rising antimicrobial resistance, and changing disease profiles due to climate change and urbanization.[10] However, most of these reports are either outdated or limited to specific disease categories rather than providing an overarching view of infectious disease burden.

This study aimed to address this gap by analyzing the epidemiology and burden of infectious diseases at a tertiary care hospital over a multi-year period. Objective of this study was to determine the distribution and clinical impact of infectious diseases in tertiary care setting and identifying high-risk populations, assessing seasonal trends and evaluating clinical outcomes such as length of hospital stay and mortality.

The central research question guiding this study was what are the predominant infectious disease patterns in a tertiary care hospital and how do they impact healthcare utilization? By answering this, we hope to inform evidence-based strategies for prevention, early diagnosis and effective management of infectious diseases in similar healthcare settings.

METHODOLOGY

This was cross-sectional analytical study conducted at Bakhtawar Amin Hospital, Multan from January 2023 to December 2024. Based on a recent study conducted at a tertiary care hospital in Lahore, Pakistan, which reported that approximately 32% (p=0.32) of adult inpatient admissions were due to infectious diseases,[11] confidence level 95% and margin of error 5% minimum sample size calculated was 334 patients.

Data were collected retrospectively from electronic and archived medical records of adult patients admitted during the study period. The primary sources of data included patient case files, discharge summaries, microbiology reports, and hospital information systems. All patients aged 18 years or older with a confirmed diagnosis of an infectious disease, based on clinical evaluation and laboratory findings, were included in the study. Diagnoses were classified using ICD-10 coding to ensure standardized categorization of infectious diseases.

The inclusion criteria comprised all adult inpatients with a final diagnosis of an infectious disease during the study period. Patients with non-infectious conditions, those whose medical records were incomplete or inaccessible, and cases where the diagnosis was inconclusive or undocumented were excluded from the analysis.

A structured data extraction form was used to collect relevant variables, including demographic characteristics (age, sex), clinical diagnosis, ICD-10 codes, duration of hospital stay, treatment outcomes (discharge, mortality, ICU admission), antimicrobial use and microbiological culture and sensitivity results . Data on seasonality were also recorded by noting the month and season of admission. Infections were further categorized as either community-acquired or nosocomial (hospital-acquired) based on the time of onset relative to hospitalization.

Statistical analysis was performed using IBM SPSS Statistics version 26.0. Descriptive statistics were used to summarize demographic and clinical characteristics, with continuous variables expressed as means and standard deviations, and categorical variables presented as frequencies and percentages. To evaluate seasonal trends, time-series analysis and seasonal decomposition techniques were applied. Univariate logistic regression analysis was conducted to identify potential risk factors associated with poor clinical outcomes, such as mortality or prolonged hospital stay. Variables found to be statistically significant in univariate analysis were subsequently included in a multivariate logistic regression model to determine independent predictors of adverse outcomes.

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of Nishtar Medical University, Multan (Ref: NMU/IRB/2023/045). Confidentiality and privacy were maintained throughout the study; all patient identifiers were removed during data abstraction, and only anonymized data were used for analysis.

RESULTS

A total of 334 adult inpatients diagnosed with infectious diseases were included in this study conducted at Nishtar Hospital, Multan, from January 2023 to December 2024. The mean age of the patients was 48.6 ± 16.4

years with a slight male predominance 183 (54.8%) compared to females 151(45.2%). The majority of patients belonged to the middle-aged (40–60 years) group, accounting for 132 (39.5%) of the total cases. Nearly one-third of the patients 105 (31.4%) were aged over 60 years (Table I).

Infectious diseases were classified using ICD-10 codes. The most common category was respiratory tract infections accounting for 115 (34.4%) of all cases. This was followed by urinary tract and renal infections 62 (18.6%), gastrointestinal infections 44 (13.2%) and sepsis or bloodstream infections 38 (11.4%). Other infections, including central nervous system infections, skin and soft tissue infections and tuberculosis comprised of 75 (22.4%) (Table II).

Admission data across seasons revealed distinct seasonal variation in infectious disease incidence. The highest number of admissions occurred during the summer season June–August 104 (31.1%) primarily due to gastrointestinal and urinary tract infections. Winter months December–February saw a peak in respiratory tract infections 49 out of 115 cases (42.6%), consistent with viral outbreaks and seasonal flu-like illnesses (Table III).

Of the 334 patients included in the study, 265 (79.3%) were discharged while 54 (16.2%) expired during hospitalization. A total of 15 (4.5%) patients were transferred to the ICU due to worsening clinical conditions. The overall mean length of hospital stay was 8.4 ± 4.2 days with septic patients having the longest average stay (11.2 ± 5.1 days) (Table IV).

Approximately 71 (21.3%) of infections were classified as nosocomial occurring 48 hours or more after hospital admission. The most common nosocomial infections were urinary tract infections 23 (32.4%) and pneumonia 18 (25.4%). Community-acquired infections accounted for the remaining 263 (78.7%).

Among the 334 patients, 298 (89.2%) received antibiotics with third-generation cephalosporins and fluoroquinolones being the most commonly prescribed. Of those tested, multidrug-resistant organisms (MDROs) were identified in 67 (22.5%) cases including methicillin-resistant Staphylococcus aureus (MRSA) and extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae.

Univariate analysis identified several variables significantly associated with mortality, including age >60 years, prolonged hospital stay (>7 days), admission to ICU and presence of comorbidities such as diabetes and chronic kidney disease. These variables were entered into a multivariate logistic regression model, which showed that age >60 years (OR: 2.45, 95% CI: 1.32–4.55, p=0.004) and comorbid diabetes (OR: 1.92, 95% CI: 1.05–3.51, p=0.034) were independent predictors of mortality.

Table 1: Demographic characteristics of patients admitted with infectious diseases (n = 334)

Variable	Category	Frequency (%)
Age group (years)	<20	15 (4.5%)
	20–39	71 (21.3%)
	40–60	132 (39.5%)
	>60	105 (31.4%)
Gender	Male	183 (54.8%)
	Female	151 (45.2%)

Table 2: Distribution of infectious disease categories based on icd-10 classification

Infectious Disease Category	Frequency (%)
Respiratory Tract Infections	115 (34.4%)
Urinary Tract/Renal Infections	62 (18.6%)
Gastrointestinal Infections	44 (13.2%)
Sepsis/Bloodstream Infections	38 (11.4%)
Central Nervous System Infections	21 (06.3%)
Skin and Soft Tissue Infections	18 (05.4%)
Tuberculosis	15 (04.5%)
Others	21 (06.3%)
Total	334 (100%)

Table 3: Seasonal distribution of infectious disease admissions (n = 334)

Season	Number of Admissions	Percentage (%)
Winter	89	26.6
Spring	65	19.5
Summer	104	31.1
Autumn	76	22.8

Table 4: Clinical outcomes among patients with infectious diseases

Outcome	Frequency (%)
Discharge	265 (79.3%)
Mortality	54 (16.2%)
ICU Admission	15 (4.5%)
Mean Length of Stay (days)	8.4 ± 4.2
Mean LOS – Survivors	7.8 ± 3.5
Mean LOS – Non-survivors	11.2 ± 5.1

Table 5: Antimicrobial use and resistance patterns (n = 298 patients receiving antibiotics)

Antibiotic Class	Prescribed (n)	% of Total Prescriptions
Third-generation Cephalosporins	142	47.7%
Fluoroquinolones	98	32.9%
Carbapenems	25	8.4%
Others	33	11.1%

Multidrug-resistant organisms		
MRSA	29	9.7%
ESBL-producing Enterobacteriaceae	38	12.8%
Other	10	3.4%
Total MDRO Cases	67	22.5%

DISCUSSION

This study provides a comprehensive overview of the epidemiology and burden of infectious diseases at Nishtar Hospital, Multan, over a two-year period. Findings of the study indicate that respiratory tract infections were the most common cause of hospitalization followed by urinary tract and gastrointestinal infections. These patterns align with recent reports from other tertiary care hospitals in Pakistan, where respiratory and genitourinary infections are frequently observed among adult inpatients.[12] The high prevalence of respiratory infections during winter months highlights the influence of seasonal variation on disease incidence likely driven by environmental factors such as cold weather and indoor crowding which facilitate viral transmission.[13]

The mean age of patients was 48.6 ± 16.4 years with nearly one-third being elderly (>60 years), indicating a significant disease burden among older adults. This is consistent with global trends showing increased susceptibility to infections in aging populations due to comorbidities and immune senescence.[14] Male predominance (54.8%) may reflect either higher exposure risk or healthcare-seeking behavior differences as noted in previous studies from South Asia.[15]

Approximately 21.3% of infections were nosocomial primarily involving the urinary tract and lower respiratory tract. These findings highlight the need for improved infection control practices in high-risk areas such as ICUs and surgical wards where invasive procedures and prolonged hospital stays increase the risk of healthcare-associated infections.[16]

Antimicrobial use was widespread with third-generation cephalosporins and fluoroquinolones being the most commonly prescribed agents. Alarmingly, 22.5% of isolates were multidrug-resistant including MRSA and ESBL-producing Enterobacteriaceae. This high rate of antimicrobial resistance reflects the growing challenge of antibiotic misuse and inadequate stewardship in Pakistani hospitals.[17] The presence of MDROs not only complicates treatment but also increases morbidity, mortality, and healthcare costs.

Multivariate analysis identified age >60 years and diabetes mellitus as independent predictors of mortality. These findings are supported by regional and international literature showing that older age and metabolic

comorbidities significantly increase the risk of adverse outcomes in infectious disease patients.[18,19] Prolonged hospital stay and ICU admission were also associated with higher mortality in univariate analysis, emphasizing the need for early identification and management of high-risk patients.

A key strength of this study lies in its data collection over a two-year period, allowing robust assessment of seasonal trends and clinical outcomes. Additionally the use of ICD-10 coding ensured standardized diagnosis classification, enhancing the generalizability of findings. The inclusion of both community-acquired and nosocomial infections provide comprehensive view of the infectious disease landscape in a major public sector hospital in southern Punjab.

As a single-center, retrospective chart review findings may not be fully representative of other regions in Pakistan. Missing microbiology data limited ability to perform detailed pathogen-specific analyses. Furthermore, the lack of longitudinal follow-up beyond hospital discharge restricts our understanding of long-term outcomes and readmission rates.

To address the growing burden of infectious diseases and the rising threat of antimicrobial resistance it is imperative to implement targeted interventions across healthcare settings. Strengthening hospital infection control measures particularly in high risk units such as intensive care and surgical wards can significantly reduce the transmission of both community- acquired and nosocomial infections. Infection prevention protocols including proper hand hygiene, sterilization practices and isolation procedures should be reinforced through regular audits and staff training. Concurrently the implementation of structured antimicrobial stewardship programs is essential to curb the inappropriate use of antibiotics which has contributed to the emergence of multidrug-resistant organisms. These programs should promote evidence-based prescribing, de-escalation strategies and rapid diagnostic testing to optimize therapy. Expanding existing surveillance systems to systematically monitor infectious disease trends, pathogen distribution and antibiotic resistance patterns at both institutional and regional levels will aid in early detection of outbreaks and inform policy decisions. Lastly given the increased vulnerability of elderly patients and those with comorbid conditions such as diabetes, targeted interventions including early screening, aggressive management and vaccination drives should be prioritized to improve clinical outcomes in these high-risk groups.

CONCLUSION

Infectious diseases remain a major cause of hospitalization and mortality particularly among middle-aged and elderly patients. Respiratory and urinary tract infections dominate the disease profile with notable seasonal variation and high prevalence of multidrug-resistant organisms. Age over 60 years and diabetes are independent predictors of mortality highlighting the need for targeted preventive and therapeutic strategies.

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

AUTHORS' CONTRIBUTIONS

All authors contributed equally as per ICMJE policy

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