



ASSESSING THE BURDEN OF NOSOCOMIAL INFECTIONS AND SEASONAL VARIATIONS IN A TERTIARY CARE HOSPITAL: A RETROSPECTIVE STUDY

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Abstract:

Introduction: Healthcare-associated infections, often known as nosocomial infections (HAIs), pose serious risks to patient safety and global healthcare systems. These infections are associated with increased rates of morbidity and death as well as the growth of antibiotic-resistant bacteria. They are frequently associated with invasive procedures and use of medical devices. Nevertheless, there is a lack of standardized surveillance for HAIs, despite their widespread impact. This study aimed to examine the dynamics of nosocomial infections, including infection rates, surgical site infections, and antibiotic resistance, in a tertiary care hospital in Pakistan.

Methodology: Data were collected retrospectively from January 2023 to December 2023 and covered the following topics: patient demographics, infection types and severity, surgical techniques, trends of antibiotic resistance, antibiotic stewardship initiatives, and environmental evaluations.

Results: The study's findings demonstrated a sizable patient population, with urinary tract infections ranking highest among several types of nosocomial infections. Seasonal differences were noted, with pneumonia predominating in winter and gastrointestinal and skin infections being more common in summer. Different infection types have different mortality rates, with pneumonia having the highest death rate.

Conclusion: This study highlights the prevalence of nosocomial infections, their seasonal fluctuations, and the critical role of infection prevention and control techniques in reducing their impact on patient outcomes and healthcare systems.

Keywords: Nosocomial infections; Healthcare-associated infections, seasonal variations; pneumonia; urinary tract infections, gastrointestinal infections

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Introduction:

An infection acquired while receiving medical care but absent at the time of admission is known as nosocomial infection. Healthcare-associated illness (HAI) is another type of illness. Hospital-assisted living facilities, ambulatory care centers, and other healthcare environments may experience these. They also appeared after discharge. Infections related to health that potentially endanger workers are also categorized as occupational illnesses (HAIs). An infection arises when a disease or pathogen infects a susceptible host. In modern healthcare, these infections are associated with invasive procedures, use of indwelling medical equipment, and prosthetic devices. The pathogen (viral, fungal, or bacterial) that causes the infection and the type or source of the infection determines the etiology of health-associated infections (HAIs) (1).

In the medical field, HAI is the most common adverse event jeopardizing patient safety. They greatly increase morbidity and mortality rates as well as the financial strain on healthcare systems, families, and individuals. The development of bacteria resistant to certain medications is another problem related to HAI. A total of 3.2% of all hospitalized patients in the US and 6.5% in the EU/EEA had HAI, suggesting that the frequency is likely much higher internationally. The worldwide burden of HAIs is unknown, because there are no established standards for monitoring HAIs. However, efforts to develop surveillance systems and infection control strategies have been made through infection prevention and control initiatives (2).

Types of Infections Associated with Healthcare (HAI): Diverse forms of HAI serve as a representation of responsible pathogens that come from distinct sources. The forms of HAI are generally categorized by the Centers for Disease Control and Prevention as follows:

- a. Bloodstream infections linked to central lines (CLABSI)
- b. Urinary tract infections linked to catheter use (CAUTI)
- c. Surgical site infections during surgery (SSI)
- d. Pneumonia related to ventilators (VAP) (2).

Worldwide, the most common outcome of patient care is an illness linked to healthcare facilities. However, data from underdeveloped countries are scarce. Infections related to medical care are prevalent in underdeveloped nations (3).

Infections related to healthcare (HAI) are a serious public health issue that influence the quality of life, morbidity, and mortality. They also pose a

significant financial strain to global health systems. However, effective infection prevention and control (IPC) strategies can avoid a significant number of healthcare-associated infections (HAIs). To successfully manage antimicrobial resistance and prevent HAI, including outbreaks of highly transmissible infections through high-quality care within the framework of universal health coverage, improvements in IPC are essential, both nationally and at the institutional level (4).

The objective of this study was to understand the dynamics of nosocomial infections over time by identifying past trends and patterns in infection rates, surgical site infections, and antibiotic resistance.

Methodology:

The data was collected retrospectively for the time frame of January 2023 to December 2023 at a tertiary care hospital in Pakistan.

Demographics: Baseline data on sex, age, type of residence the patient came from, and cause of hospital admission were recorded.

Data on Infections: Backlogs of nosocomial infections documented throughout the year 2023 were gathered and classified according to the type (bloodstream, urinary tract, and surgical site infections, for example) and degree of severity.

Clinical Records: Patients with nosocomial infections were identified through a retrospective review of their clinical records, laboratory results, and diagnostic imaging data.

Seasonal changes: Seasonal changes in infection rates were examined using retrospective data, accounting for potential influences on infection patterns from other variables as well as climate.

Surgical Data: To Retrospective surgical data were examined to ascertain the quantity and variety of surgeries performed throughout the retrospective research period. The surgeries were divided into groups based on the possible risk of infection.

Surgical site infections: Identifying past instances of these infections was the main goal, along with determining how common they were, what kind of infections they were, and whether there were any risk factors involved.

The resistance to antibiotics: To identify bacteria resistant to antibiotics that were present in the hospital throughout the retrospective period, old microbiology reports were examined. We determined the prevalence of multidrug-resistant organisms (MDROs) in the patients.

Antibiotic Stewardship: To comprehend antibiotic use rules, antibiotic prescription monitoring, and measures to avoid improper antibiotic consumption, historical documents pertaining to

the hospital's antibiotic stewardship program were examined.

Environmental Assessment: A review of the hospital's environmental cleaning procedures from 2023 period's historical records and paperwork was conducted. The cleaning frequency, disinfection procedures, and use of antimicrobial surfaces were examined in this evaluation.

Descriptive Analysis: To compare infection rates, patient demographics, and relevant variables, historical data were subjected to descriptive statistical analysis.

Results:

The hospital in which the study was conducted included hundreds of patients. Admissions or indoor facilities attend to almost 2500 to 3000 patients every month. The female population was 56.2%, and the total number of events was 1,115, among which the highest frequency was urinary tract infection.

Several types of nosocomial infections frequently found in healthcare settings are listed in Table 1. Illnesses that fall under this category include skin and soft tissue infections, pneumonia, bloodstream infections, urinary tract infections, and surgical site infections.

Table 1: Frequency of Nosocomial Infections

Type of Nosocomial Infection	Number of Cases (Historical Data)	Mortality Rate (%)	Affected Areas/Units
Surgical Site Infections	129	2.2	Surgical Wards
Urinary Tract Infections	468	1.5	Nephrology/urology Unit
Bloodstream Infections	107	3.8	Haematology Ward
Pneumonia	135	4.1	Respiratory Unit
Gastrointestinal Infections	256	2.7	Medicine Ward
Skin and Soft Tissue Infections	20	1.0	General Wards

Mortality Rate (%): This column shows the proportion of patients who regrettably did not leave the hospital after acquiring a specific nosocomial illness. This is a crucial parameter for determining

the severity of each type of infection. Increased death rates may indicate that patients are more vulnerable to certain illnesses. The highest percentage of patients died of pneumonia (4.1%).

Table 2: Seasonal Variation in Nosocomial Infections

Season	Type of Nosocomial Infection	Number of Cases	Affected Areas/Units
Spring	Surgical Site Infections	32 (24.8%)	Surgical Wards
	Urinary Tract Infections	118 (25.2%)	Nephrology/Urology Unit
	Bloodstream Infections	26 (24.2%)	Haematology Ward
	Pneumonia	33 (24.4%)	Respiratory Unit
	Gastrointestinal Infections	54 (21.1%)	Medicine Ward
	Skin and Soft Tissue Infections	5 (25%)	General Wards
Summer	Surgical Site Infections	35 (27.1%)	Surgical Wards
	Urinary Tract Infections	125 (26.7%)	Nephrology/Urology Unit
	Bloodstream Infections	28 (26.1%)	Haematology Ward
	Pneumonia	26 (19.2%)	Respiratory Unit
	Gastrointestinal Infections	78 (30.4%)	Medicine Ward
	Skin and Soft Tissue Infections	6 (30%)	General Wards
Fall	Surgical Site Infections	32 (24.8%)	Surgical Wards
	Urinary Tract Infections	121 (25.8%)	Nephrology/Urology Unit
	Bloodstream Infections	27 (25.2%)	Haematology Ward
	Pneumonia	34 (25.1%)	Respiratory Unit
	Gastrointestinal Infections	65 (25.3%)	Medicine Ward
	Skin and Soft Tissue Infections	5 (25%)	General Wards
Winter	Surgical Site Infections	30 (23.2%)	Surgical Wards
	Urinary Tract Infections	104 (22.2%)	Nephrology/Urology Unit
	Bloodstream Infections	26 (24.2%)	Haematology Ward
	Pneumonia	42 (31.1%)	Respiratory Unit
	Gastrointestinal Infections	59 (23.04%)	Medicine Ward
	Skin and Soft Tissue Infections	4 (20%)	General Wards

Gastrointestinal infections occurred more frequently in summer (30.4%) and skin infections (30%). Similarly, UTI was more common in summer (26.7%) and pneumonia was more common in winter (31.1%).

Discussion:

Extensive research has been conducted on hospital-acquired infections (HAI). Southeast Asia has a pooled prevalence of 9.0% for all hospital-acquired infections (HAIs). This indicates that 9.0% of the patients in the studies or medical institutions that were included had at least one HAI while they were in the hospital. The range (7.2% to 10.8%) within which the true prevalence is predicted to reside with 95% confidence is provided by the 95% confidence interval (CI).

Incidence density rates for the following categories of HAIs are provided: 14.7 instances of ventilator-associated pneumonia (VAP) occur every 1000 ventilator-days. represents the mean frequency of ventilator-associated pneumonia (VAP) cases per 1,000 days of patient care. At 4.7 instances per 1000 catheter days, central line-associated bloodstream infection (CLABSI) occurs. With central venous catheters in place for 1000 days, this translates to an average of 4.7 instances of CLABSI per 1000 days. Infections of the urinary tract associated with catheters (CAUTI): 8.9 occurrences per 1000 catheter days. This represents the mean frequency of catheter-associated urinary tract infections (CAUTIs) per 1,000 days. Surgical Site Infection (SSI) Pooled Incidence: 7.8% is the stated pooled incidence of SSI. Accordingly, 7.8% of patients who underwent surgery also had surgical site infections while in the hospital (5).

A total of 2,221 long-term care facilities (LTCF) with 117,138 residents and 1,209 acute care hospitals (ACH) with 310,755 patients participated in point prevalence surveys of healthcare-associated infections (HAI) and antimicrobial use in the European Union and European Economic Area (EU/EEA) from 2016 to 2017. Based on the country-weighted prevalence, researchers calculated that 3.9% of residents in LTCF and 6.5% of patients with ACH experienced at least one HAI after national validation. Every day, 129,940 residents in LTCF and 98,166 patients with ACH experienced a health-related infection. A total of 8.9 million HAI episodes were estimated annually; 4.5 million (95% confidence interval: 2.6-7.6 million) in ACH and 4.4 million in LTCF; 3.8 million patients in ACH were estimated to have a HAI per year. Approximately 31.6% of ACH and 28.0% of LTCF showed antimicrobial resistance (AMR) to certain AMR indicators. Research has

shown that there are many healthcare institutions in the EU/EEA that have HAIs every year, and it also suggests that AMR in HAI in LTCF may have equalled that of ACH (6).

A 2011 TA point-prevalence survey in the US revealed that 4% of hospitalized patients acquired an infection related to their medical care. In 2015, another round of surveys was conducted. Compared with 2011, there was a decrease in the frequency of infections linked to healthcare in 2015. Preventive measures against pneumonia and *C. difficile* infection should be strengthened to keep making progress in the prevention of such diseases (7). Seasonality is inherent in most viral respiratory and gastrointestinal diseases associated with healthcare-associated infections (HCAIs), as viruses are often brought into hospitals during periodic population outbreaks. Some seasonal HCAIs include surgical wound infections, which have summer peaks in Finland and winter peaks in the USA; central line-associated bloodstream infections (BSIs) in pediatric oncology and hematology outpatients; and dialysis-associated peritonitis (8). Owing to inadequate resources and infrastructure, low- and middle-income countries have a higher overall frequency of healthcare-associated infections (HAIs), with a higher incidence of HAIs among newborns and children. The prevalence of HAIs is very high when newborns and children are admitted to medical facilities in Pakistan. It is important to implement infection prevention and control strategies to prevent future HAIs (9). It is possible to prevent a significant percentage of HAI using efficient infection prevention and control (IPC) strategies. To successfully manage antimicrobial resistance and prevent HAI, including outbreaks of highly transmissible infections, through high-quality care within the framework of universal health coverage, improvements in IPC are essential, both nationally and at the institution level. In light of the dearth of evidence-based guidelines and standards for IPC, the World Health Organization (WHO) has opted to provide global recommendations on the essential elements of successful IPC initiatives at the national and acute care facility levels (10).

Limitations: The study's limitations include its retrospective design, which is based on historical data, and may contain incomplete or incorrectly recorded information. Furthermore, the study focused on a single tertiary care institution in Pakistan, restricting the applicability of the findings to other healthcare settings or geographies. Furthermore, although seasonal variations in infection rates were identified, the study did not

investigate the underlying causes of these oscillations. Finally, the study emphasized the necessity of infection prevention and control measures but did not offer any specific recommendations or actions. Future research should address these limitations to expand our understanding of nosocomial infections and to provide better patient treatment.

Conclusion:

This study offers insights into the high prevalence of nosocomial infections in a Pakistani tertiary care hospital, as well as the seasonal fluctuations in infection rates. While providing useful information about the incidence of various infection types and their associated death rates, it also emphasizes the crucial significance of efficient infection prevention and control techniques. Future research should focus on providing more thorough insights and tailoring strategies to combat nosocomial infections and improve patient safety in hospital settings.

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