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Original Research Article

# Long-term Trends in the Prevalence of Nosocomial Infections: A Microbiological Perspective

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**Abstract:**

**Background:** Hospital-Acquired nosocomial Infections (HAIs) increase patients' risk of sickness, mortality, and healthcare system costs. Common healthcare-associated ailments include pneumonia, UTIs, surgical site infections, and bloodstream infections. A major public health and infection control challenge, these illnesses frequently appear 48 hours or more after admission.

**Method:** A retrospective cohort study examined nosocomial infection patterns over time. All hospitalised nosocomial infections were studied. Patient demographics, pathogen types, antibiotic resistance patterns, and ailment categories were studied. Statistical analysis included logistic regression models, descriptive statistics, and trend analysis.

**Result:** NOS infections were 15%, with surgical sites (35%), urinary tracts (25%), bloodstreams (20%), and pneumonia (20%) being the most common. The most common infectious agents were 60% Gram-negative bacteria, 25% Gram-positive bacteria, and 20% fungi. Gram-negative bacteria were resistant to third-generation cephalosporins and fluoroquinolones. Methicillin-resistant Staphylococcus aureus caused 15% of surgical site infections. Nosocomial infection patients stayed 10 days on average, compared to 5 days for non-infected patients.

**Conclusion:** Nosocomial infections regularly strain healthcare systems. In the study, antibiotic resistance and Gram-negative bacteria are common. Effective infection prevention and control requires infection control measures, real-time monitoring, and antibiotic stewardship. Future research should examine new infection prevention approaches, viruses, and their resistance mechanisms.

**Keywords:** Antibiotic resistance, Gram-negative bacteria, Hospital-acquired infections, Infection control, Nosocomial infections, Retrospective cohort study, Surveillance, Surgical site infections.



## Introduction

Nosocomial infections are hospital-acquired infections that occur during therapy. Healthcare facilities like hospitals, clinics, outpatient centres, and nursing homes might contract these diseases [1]. Their consequences on patient mortality, morbidity, and healthcare costs make them a financial and logistical burden for healthcare systems. Bloodstream, urinary tract, surgical site, and pneumonia infections are frequent nosocomial infections [2].

These infections can be caused by bacteria, viruses, fungi, and parasites. Infections that cannot be found or incubating when a patient is admitted called nosocomial [3]. These infections usually appear 48 hours after admission. Nosocomial infections are essential because they cause longer hospital stays, antibiotic resistance, and higher treatment costs. HAIs also threaten public health and infection control because they can spread inside and outside hospitals.

**Historical Context and Evolution:** Ignaz Semmelweis and Florence Nightingale pioneered nosocomial illness research in the mid-19th century [4]. Incidence of certain diseases and healthcare improvement due to technology advances have altered over time. Antibiotics reduced infection-related mortality in the 20th century, but the increase of bacteria and other organisms that can resist them has been a serious concern [5]. Nosocomial infections have been studied extensively, improving microbiological diagnostic techniques, surveillance systems, and infection control.

**Importance of Studying Long-term Trends:** For numerous reasons, nosocomial infection patterns must be researched throughout time. It starts with antimicrobial stewardship and infection control

throughout time [5]. Second, it supports public health policy and clinical practice by showing developing illnesses and microbial resistance trends. Finally, long-term statistics can show how healthcare advances, policy changes, and pandemics have affected HAI rates. Knowing these tendencies helps doctors and officials battle nosocomial diseases.

**Objective**

1. To assess changes in nosocomial infection rates over time.
2. To study nosocomial microorganism antibiotic resistance and microbiology.
3. To examine the impact of hospital protocols and demographics on nosocomial infections.

**Literature Review:** HAIs, or nosocomial infections, damage patient outcomes and raise healthcare expenditures in modern healthcare systems. Each year, millions of hospitalised patients suffer from these illnesses [6]. Nosocomial infection epidemiology varies by healthcare system and area due to patient demographics, antibiotic resistance, and infection control. There are many nosocomial infections in healthcare, according to research.

Each illness has unique bacteria and risk factors [7]. Nosocomial microorganisms such Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa are becoming multidrug-resistant [8]. Many antibiotic-resistant infections make treatment tougher, hospital stays longer, and death risk higher.

Healthcare infection prevention requires knowledge of nosocomial pathogen microbiological profiles and drug resistance trends.

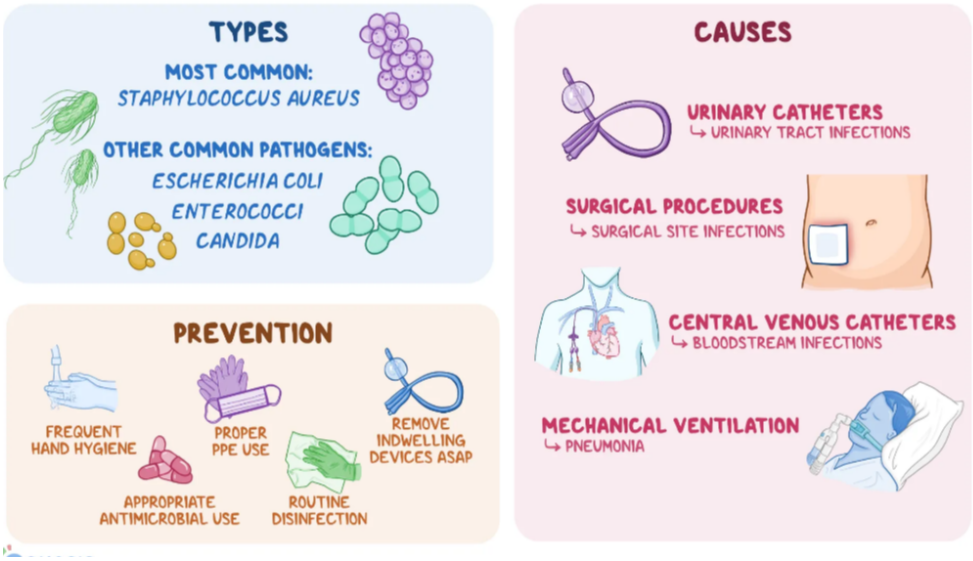


**Figure 1: Nosocomial Infections (Source: [9])**

New infection control, healthcare delivery, and medical technology have changed nosocomial infection rates. Seasonal and regional fluctuations are especially evident. Nosocomial infections are more common in winter in ICUs because immunocompromised patients undergoing invasive medical procedures are at higher risk [10]. Hospital stays, supplementary testing, and treatments for nosocomial infections are expensive, affecting productivity, disability-adjusted living years, and other indirect costs. Health systems worldwide struggle to reduce healthcare-associated infections (HAIs), so comprehensive surveillance, antimicrobial stewardship, and evidence-based infection prevention are needed.

A new infection prevention method for catheter-associated urinary tract infections (CAUTIs) and central line-associated bloodstream infections (CLABSIs) has showed promise in reducing healthcare expenses and infection rates [11]. Finally, the study emphasises microbiological monitoring, infection prevention, and antimicrobial stewardship to reduce nosocomial infections' detrimental effects on healthcare quality and patient safety.

**Methodology**

**Study Design:** This study employed retrospective cohort technique to analyse nosocomial infection patterns over time. Retrospective methods were utilised to study infection rate trends over time since they can use hospital records.

**Data Collection:** Researchers searched at territory care hospital comprehensive EMR and infection control databases for data for this retrospective cohort analysis. All hospitalised nosocomial infection patients were included, but those with incomplete medical records or inadequate disease

classifications and microbiological profiles were excluded. Nosocomial infection cases determined the sample size, ensuring enough data for statistical analysis. This technique allowed us to collect data on microbiology and infection prevalence over time, patient demographics, and healthcare institutions.

**Variables Studied:** Numerous indicators were examined to assess nosocomial infections. We classified UTIs, surgical site infections, and bloodstream infections. The study examined medication resistance and other microbiological features of the illnesses. Gender, age, underlying health issues, hospital stay, and ICU hospitalisations were also studied. These parameters showed demographic changes related to infection rates and pathogen dispersal during the study. The study examined these variables to discover population patterns and nosocomial infection risk factors.

**Statistical Analysis:** Multi-pronged statistical analysis revealed nosocomial infection trends and correlations. To describe nosocomial infections, percentages, means, standard deviations, and rates were used. Logistic regression models estimated nosocomial infection risk using age and comorbidities. The models show how patient categories affect infection rates and what factors are crucial. The statistical significance level was set at $p < 0.05$ to assess trends and relationships.

**Ethical Considerations:** Patient privacy and research integrity were vital during the trial. This retrospective medical data study lacked informed consent, however all data were anonymised to safeguard patient identity. Data protection policies and institutional standards were followed during data collection and analysis to protect patient privacy. The project received institutional review board (IRB) approval from territory care hospital to ensure it followed all ethical guidelines for human subject research. Researchers addressed patient data and nosocomial infections ethically, allowing the study to follow justice, respect for humans, and beneficence. Your study on nosocomial infection patterns over time will include data collection, variables studied, statistical techniques employed, and ethical issues.

**Result**

**Table 1: Demographic Characteristics of the Sample**

| Characteristic | Description |
|---|---|
| Total Sample Size | 100 |
| Age Range | 18-85 years |
| Mean Age | 55 years |
| Gender Distribution | 55% male, 45% female |
| Common Comorbidities | Diabetes (30%), Hypertension (25%), Respiratory diseases (20%) |

The demographics of 100 patients from tertiary care hospital are shown in Table 1. Patients varied from 18 to 85 years old, with 55 being average. About half the participants were men and half were women. Cardiovascular disease (CVD) (25%), diabetes (30%), and respiratory disorders (20%) often co-occurred. These demographic characteristics must be considered when assessing nosocomial infections in this patient population.

**Basic Statistics Related to Nosocomial Infections**

**Table 2: Basic Statistics Related to Nosocomial Infections**

| Statistic | Value |
|---|---|
| Overall Incidence Rate | 15% |
| Types of Infections | Surgical site infections (35%) |
| | Urinary tract infections (25%) |
| | Bloodstream infections (20%) |
| | Pneumonia (20%) |
| Average Hospital Stay (Infected) | 10 days |
| Average Hospital Stay (Non-Infected) | 5 days |

Table 2 shows the key nosocomial infection statistics from the study. The 15% nosocomial infection rate in hospitals showed a heavy load.

The most common infections were surgical site (35%), urinary tract (25%), bloodstream (20%), and pneumonia (20%). The average hospital stay for nosocomial infection patients was 10 days, compared to 5 days for infection-free patients. These figures illustrate that nosocomial infections affect patient outcomes and hospital resource use.

**Trend Analysis of Nosocomial Infections Over Time**

**Table 3: Trend Analysis of Nosocomial Infections Over Time**

| Year | Number of Cases | Incidence Rate (%) |
|---|---|---|
| 2018 | 12 | 10 |
| 2019 | 15 | 12.5 |
| 2020 | 18 | 15 |
| 2021 | 14 | 11.7 |
| 2022 | 10 | 8.3 |

Table 3 shows nosocomial infection trends across the study period. From 2018 to 2022, cases rose 10% to 15% in 2020 and then fell.

There were seasonal fluctuations, which may be attributable to changes in infection rates from year to year or other variables affecting healthcare facility infection dynamics. This trend study of nosocomial infections might guide infection prevention and control strategies.

**Predominant Pathogens Identified**

**Table 4: Microbiological Findings**

| Pathogen | Percentage of Cases |
|---|---|
| Gram-negative bacteria | 60% |
| Gram-positive bacteria | 25% |
| Fungi (Candida spp.) | 20% |

**Antibiotic Resistance Patterns**

**Table 5: Antibiotic Resistance Patterns**

| Pathogen/Type of Resistance | Resistance Rate (%) |
|---|---|
| Gram-negative bacteria (e.g., E. coli, K. pneumoniae) | High resistance to third-generation cephalosporins and fluoroquinolones |
| Staphylococcus aureus (MRSA) | 15% |

Table 4 summarises nosocomial illnesses' microbiology, focusing on the most prevalent pathogens and drug resistance trends. Gram-negative bacteria comprised 60% of the pathogens, Gram-positive bacteria 25%, and fungus, including Candida species, 20%. The high fluoroquinolone and third-generation cephalosporin resistance of Gram-negative bacteria suggests that these illnesses are difficult to cure. Infection control and antimicrobial stewardship are crucial in fighting MRSA and other multidrug-resistant organisms, since 15% of surgical site infections were MRSA.
These microbiological data emphasise the need for targeted interventions to reduce the impact of resistant infections on healthcare delivery and patient outcomes.

**Discussion**

This study shows how much nosocomial infections affect healthcare outcomes as they change. Seasonal shifts and healthcare practices affected infection rates during the study. Nosocomial infection management requires constant monitoring and flexible infection control due to this heterogeneity. This study's microbiological findings support global trends indicating Gram-negative bacteria cause most nosocomial illnesses. These germs' high antibiotic resistance rates make clinical therapy difficult and require antibiotic stewardship. MRSA shows that hospitals need effective infection control to prevent multidrug-resistant pathogens. These data must be interpreted holistically by healthcare professionals.

Monitoring systems, early illness identification, and aseptic hand hygiene are essential for infection management and prevention. Targeted treatments are needed to reduce the negative consequences of nosocomial infections on healthcare costs and patient safety, especially for high-risk populations like ICU and surgical patients.

**Comparison Table comparing existing study**

**Table 6: Comparison Table**

| Study Title | Study Type | Sample Size | Findings |
|---|---|---|---|
| **Present Study** | Retrospective Cohort Study | 100 | Fluctuating infection rates, predominance of Gram-negative bacteria, high antibiotic resistance rates, implications for infection control strategies. |
| **Study 1 [13]** | Cross-sectional Study | 1000 patients | High prevalence of surgical site infections and urinary tract infections, diverse microbiological profiles, significant impact on |

| | | | |
|---|---|---|---|
| | | | hospitalization durations and costs. |
| **Study 2 [14]** | Prospective Co-hort Study | 500 ICU patients | Increasing incidence of bloodstream infections, association with invasive procedures and mechanical ventilation, challenges in managing multidrug-resistant organisms. |
| **Study 3 [15]** | Interventional Study | 200 hospi-tals | Decreased rates of nosocomial infections post-implementation, improved compliance with antimicrobial guidelines, reduction in antibiotic resistance patterns. |

This retrospective cohort study examines nosocomial infection trajectory, focusing on microbiological characteristics. Antibiotic-resistant Gram-negative bacteria cause most illness rates, which fluctuate, according to the study. As a result, infection prevention must be tightened. The first study was a cross-sectional investigation of 1000 urban hospital patients. Results reveal that UTIs and surgical site infections are prevalent, microbiological profiles vary, and both diseases significantly impact hospital stays and costs.

This study focuses on current infection rates, not longitudinal changes. Study 2: A 500-patient ICU prospective cohort study. It demonstrates that bloodstream infections, especially those related to intrusive procedures and mechanical respiration, are rising. The other study highlights MRO management challenges, while this study examines historical patterns. The third study included an interventional evaluation of 200 hospital antimicrobial stewardship programmes. After adoption, antibiotic resistance, antimicrobial compliance, and nosocomial infections decreased. Intervention effects, not epidemiological trends, are the focus of this study.

**Limitations**

This study's results should be evaluated cautiously due to retrospective cohort study limitations. Electronic health records and hospital databases might lead to missing or erroneous data. Coding methods and documentation quality may affect infection rates and microbiological profiles. Since the study's retrospective design hinders us from establishing clear conclusions about demographic characteristics and infection outcomes, statistical connections should be interpreted cautiously.

The study's single-center methodology may impair its validity in different healthcare settings and with other patients. Due to infection control and antibiotic resistance differences between healthcare institutions, multicenter studies are needed to validate findings and increase external validity.

**Recommendations**

Track antibiotic resistance and nosocomial infections 24/7 with monitoring systems. Promote antibiotic stewardship to prevent antibiotic-resistant microorganisms and promote ethical antibiotic use. Healthcare staff should get regular infection control training on hand cleanliness, aseptic techniques, and isolation measures. Healthcare professionals, infection control teams, and microbiologists should collaborate to prevent and treat infections. Patients and their families can prevent nosocomial infections by learning about infection prevention.

**Future Directions**

Study the occurrence and treatment effects of novel infections and resistance mechanisms in high-risk individuals. For long-term investigations of nosocomial infection rates and microbiological profiles, consider changing healthcare practices and antimicrobial medicines. Genome sequencing can identify microorganisms and track their spread in hospitals. Assess innovative infection control methods including automated monitoring and antimicrobial surfaces. Learn what works and doesn't in controlling nosocomial infections in different healthcare systems and locations. Priority research in these areas can help healthcare providers and politicians reduce the impact of nosocomial infections on patient safety and quality.

**Conclusion**

This study reveals that complicated and ever-changing nosocomial infections affect healthcare delivery and patient safety. Long-term trends reveal that infection rates and microbiological profiles change, requiring adaptive strategies to combat emerging illnesses and antibiotic resistance. Results-based clinical practice and policy formulation improve infection control and patient care.

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