Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379

Assessing Nosocomial Infection Rate In Public And Private Hospitals

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Keywords: Nosocomial infections, hospital-acquired infections, public hospitals, private hospitals, infection control, surgical site infection, catheter-associated urinary tract infection, ventilator-associated pneumonia, patient safety, healthcare-associated infection.

Received on 14 June 2025
Accepted on 12 July 2025
Published on 14 July 2025

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Abstract

Nosocomial infections, commonly referred to as hospital-acquired infections (HAIs), are infections that develop after a patient is admitted to a healthcare facility and were not present at the time of admission. These infections contribute significantly to increased patient morbidity, prolonged hospital stays, higher treatment costs, and elevated mortality rates. In developing countries like Pakistan, differences in infrastructure, resource availability, and infection control practices between public and private hospitals may lead to variations in infection prevalence. Despite their clinical and economic impact, nosocomial infections often remain underreported and inadequately addressed, highlighting the urgent need for systematic evaluation and targeted interventions. Methodology: A cross-sectional survey study was conducted in Public and Private hospitals of Lahore. A total of 92 patients were selected using a convenience

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sampling technique from various hospitals in Lahore. The study was conducted over a period of six months. Among the selected patients, 53 were from public hospitals, 33 from private hospitals, and 6 from rural healthcare facilities. This distribution provided a basis for comparing nosocomial infection rates across different hospital types, particularly in terms of infection control practices and patient load. Descriptive statistical tools, including frequencies and percentages, were applied to examine the distribution of infection types and contributing risk factors. Results: The study found that nosocomial infections were more prevalent in public hospitals compared to private ones. Surgical Site Infections (43.5%) were the most common, followed by Catheter-Associated Urinary Tract Infections (28.3%) and Ventilator-Associated Pneumonia (14.1%). Risk factors included invasive procedures, longer hospital stays, and underlying conditions like diabetes and hypertension. Conclusion: The study concludes that nosocomial infections remain a significant challenge, particularly in public hospitals due to resource constraints and higher patient loads. Effective infection control policies, regular staff training, and improved hospital infrastructure are essential to reduce infection rates. Strengthening these measures can enhance patient safety and overall healthcare quality.

INTRODUCTION

Nosocomial infection" is an infection that develops after a patient is admitted to hospital. The infection-causing germs, especially bacteria, become more dangerous when they become resistant to commonly used antibiotics and more so with the medicines that are routinely given in the hospital. "Nosocomial infections include bloodstream infection, urinary tract infection, pneumonia, surgical wound infection, and infectious diarrhea. (1) The National Healthcare Safety Network, in collaboration with the Centers for Disease Control, has divided nosocomial infections into 13 subtypes of infection types for surveillance, involving about 50 infection sites. These classifications are made based on biological and clinical standards. Common causes of hospital-acquired infections include various types of streptococci, Escherichia coli, and enterococci. Pseudomonas aeruginosa, coagulase-negative staphylococci, and Staphylococcus aureus also cause these infections. Other important pathogens

include Bacillus cereus, Legionella, and Enterobacteriaceae such as Proteus mirabilis, Klebsiella pneumoniae, Escherichia coli, and Serratia marcescens. (2)

Gram-positive bacteria are the most common cause of nosocomial infections, with Staphylococcus aureus being the first and most commonly found pathogen in this category. There has been an increase in the incidence of antibiotic-resistant bacteria due to nosocomial infections in the ICU. Bacteria develop resistance when they acquire new genetic material. Prescribing or using antibiotics incorrectly paves the way for such resistant bacteria (3) As the number of nosocomial infections is on the rise, so are prolonged hospital stay, lack of complete preparedness in case of need, greater advantage of bacteria over antibiotics and an increase in social and physical problems. All these together improve the mortality rate. But it has to be said with regret that there is no complete knowledge regarding the real burden of nosocomial infections as surveillance systems are still not fully advanced and methods of infection control are also not completely available. (4)Community-acquired infection is present within 48 hours of admission and present at the acute stage but not at time of arrival so these are considered to be infections of the acute stage.(5) This introduction was made in 1987 in hospitals included in the CDC National Nosocomial Infections Surveillance System (NNIS), and the definitions were then revised based on comments and control of nosocomial infections.(6)

Nosocomial infections are commonly observed in hospital settings, with surgical wound infections, urinary tract infections (UTIs), respiratory infections, gastroenteritis, and meningitis being among the most frequent. However, with the growing use of invasive procedures for both diagnostic and therapeutic purposes, as well as advancements in cancer treatments, immunotherapy, and organ transplants, there has been a shift in the patterns of nosocomial infections over time.(7) Nosocomial infections are an even greater concern in the 21st century, and there are several reasons for this. These include the large numbers of sick people in hospitals who often have weakened immune systems,

hospitalized patients are generally sicker, many medical procedures bypass the body's natural protective barriers, medical staff move between patients, increasing the risk of spreading germs, and inadequate hygiene practices regarding uniforms, equipment cleaning, washing, and other precautions are either ignored by hospital staff or are too careless to protect patients from infection.(8)The type of medical procedure also plays a critical role in the development of hospital-acquired infections. Surgeries, catheterizations, and organ transplants are associated with higher risks of infection because they often involve breaching the body's natural defense barriers (9). For instance, surgical wounds and central venous catheters provide entry points for pathogens, particularly when sterile techniques are not strictly followed. Additionally, hospital-associated pathogens, such as *Methicillin-resistant Staphylococcus aureus* (MRSA) and *Clostridium difficile*, are commonly transmitted through contaminated surfaces, medical equipment, or healthcare workers' hands (10). Hospitals differ significantly in their resources, infrastructure, and infection control measures. Public and private hospitals represent two distinct types of healthcare facilities, each facing unique challenges in managing nosocomial infections. Government hospitals usually have a high number of patients and suffer a shortage of resources, which increases the risk of spreading infection there. Particularly in low and middle -income countries, these hospitals are often handled by more patients, staff, and sometimes the devices are old or inadequate. (11)

In addition, there are various background patients in public hospitals, many of whom are from a low -income class. They are more likely to infect infection due to pre -existing health problems. (12)On the contrary, private hospitals usually provide facilities to individuals who are financially good. Such hospitals often have better resources, such as modern medical technology, new and effective equipment, and more staff than a patient. These facilities can enforce more stringent principles of private hospital infections, including

regular hand wash monitoring, methods of gastrointestinal tract, and a special system to monitor the spread of infection. (13) A study by Smith and his colleagues reviewed the rate of nosocomal infections in public and private hospitals. According to this research, the overall infection rate in private hospitals was low, mainly due to the strict sanitation principles and better protective procedures in these hospitals. However, research also revealed that private hospitals faced specific challenges due to modern and complex medical treatment, which needed more attention to the prevention of infection. (14)

On the other hand, public hospitals have more difficulty in controlling infection due to high number of patients and limited resources. The difference between these two types of hospitals indicates that a variety of strategies should be adopted keeping in view the needs of each hospital so that infection can be effectively controlled. (15) The aim of this research is to understand the different factors that contribute to nosocomial infections by focusing on these two areas and to develop specific solutions for their prevention.

MATERIAL AND METHODS

A cross-sectional survey study was conducted in Public and Private hospitals of Lahore. A total of 92 patients were selected using a convenience sampling technique from various hospitals in Lahore. The study was conducted over a period of six months. Among the selected patients, 53 were from public hospitals, 33 from private hospitals, and 6 from rural healthcare facilities. This distribution provided a basis for comparing nosocomial infection rates across different hospital types, particularly in terms of infection control practices and patient load. Descriptive statistical tools, including frequencies and percentages, were applied to examine the distribution of infection types and contributing risk factors.

RESULTS

The study revealed that procedural factors, length of hospital stay, and underlying conditions significantly influenced nosocomial infection rates. Public hospitals reported higher infection frequencies compared to private hospitals.

TABLE 1: DISTRIBUTION OF HOSPITALS BY CLASSIFICATION, FACILITY TYPE, AND BED CAPACITY ALONG WITH THEIR FREQUENCIES, PERCENTAGES, AND CUMULATIVE FREQUENCIES

Hospital Classification	Frequency	Cumulative frequency	Percentage
Public	53	53	57.61
Private	33	86	35.87%
Rural	6	92	6.52%
Type of Facility	**Frequency**	**Cumulative Frequency**	**Percentage**
Primary Care	53	53	58.24
Secondary Care	25	78	27.47
Tertiary Care	13	91	14.29
Number of Beds	**Frequency**	**Cumulative Frequency**	**Percentage**
<50	35	35	38.89
50–100	32	67	35.56
101–200	14	81	15.56
>200	9	90	10.00

Table 1 presents data on the types of hospitals, their facilities, and the number of beds. According to this data, the highest proportion of hospitals was government (57.61%), followed by private (35.87%), and rural hospitals had the lowest proportion (6.52%). In terms of facility type, primary care centers were

found to have the highest number (58.24%), while tertiary care hospitals were found to have only 14.29%. In terms of the number of beds, hospitals with less than 50 beds were the highest (38.89%), while hospitals with more than 200 beds were the lowest (10%). The total number column shows the increasing numbers in each category, which helps in understanding the data.

TABLE 2: REPORTS OF DIFFERENT TYPES OF NOSOCOMIAL INFECTIONS, WITH THEIR NUMBERS, PROPORTIONS, AND TOTAL NUMBERS

Types of Nosocomial Infections	Frequency	Cumulative frequency	Percent
Catheter-Associated Urinary Tract Infections	26	26	28.3
Surgical Site Infections (SSI)	40	66	43.5
Ventilator-Associated Pneumonia (VAP)	13	79	14.1
Other	13	93	14.1

This table shows the frequency and percentage of different types of nosocomial infections in hospitals. The most common are surgical site infections (SSI), which number 40 and account for 43.5% of the total cases. This is followed by catheter-related urinary tract infections, which number 26, which is equivalent to 28.3%. The rate of ventilator-associated pneumonia (VAP) is 14.1%, with 13 cases reported. Finally, the number of other infections is also 13 and their percentage is also 14.1%. This table shows that surgical site infections are the most prevalent infection among hospital-acquired infections, and the total number of all infections has reached 93 cases.

PIE GRAPH 1 DISTRIBUTION OF MONTHLY REPORTED NOSOCOMIAL INFECTION CASES

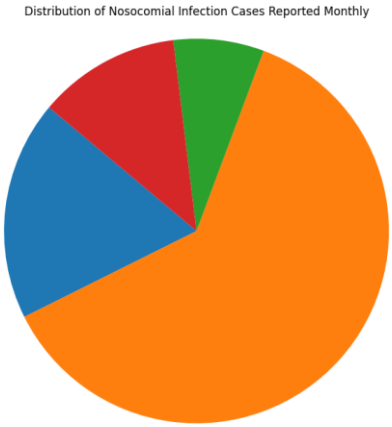
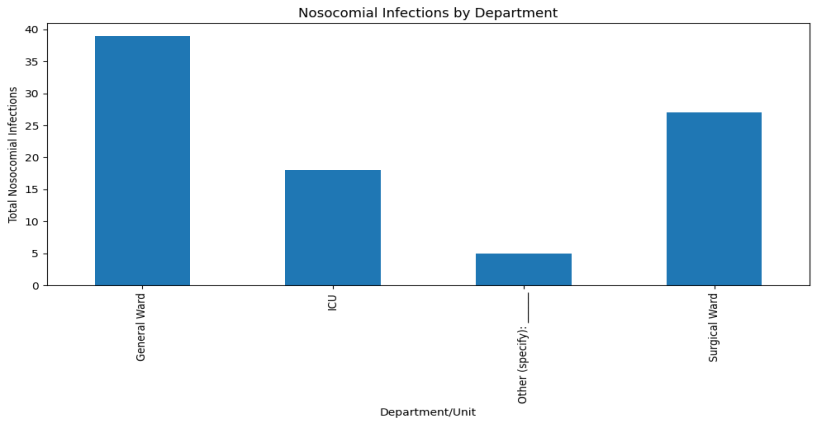


Chart 1 shows a segment is the largest, it means that the highest number of nosocomial infection cases were reported in that month. Although the chart does not list percentages or names of months, the difference in colors gives us an idea of the overall trend. This chart can be helpful for hospital administrators and health analysts to know which months have the highest number of infections, and to take more preventive measures during those months.

BAR GRAPH: 01 NOSOCOMIAL INFECTIONS BY DEPARTMENT



Graph 01 Shows the number of nosocomial (hospital-acquired) infections in different hospital departments. According to the chart, the highest number of infections were reported in the general ward, followed by the surgical ward and the ICU. The lowest number of infections was reported in the "Other (specify):" category. The chart shows departments on the horizontal axis and the total number of infections on the vertical axis. This visualization identifies

departments where the infection control system needs to be improved.

TABLE 3: PROPORTION OF PREVENTIVE PRACTICES AND AVAILABILITY OF INFECTION CONTROL EQUIPMENT RELATED TO THE PREVENTION OF NOSOCOMIAL INFECTIONS IN THE HOSPITAL

Hospital Practices	frequency	cumulative	percentage
Daily	43	43	46
Weekly	25	68	27
Monthly	15	83	16
Never	9	92	9.7
Availability of Infection Control Equipment	**Frequency**	**Cumulative**	**Percent**
Always	44	44	47
Sometime	32	76	38
Rarely	11	87	12
never	5	92	5.4

Table 3 shows that 46% of hospitals conduct daily infection control surveys, while 27% conduct weekly, 16% monthly, and about 10% do not conduct these surveys at all. This indicates that some institutions still lack continuity of safety measures, which may increase the risk of nosocomial infections. Similarly, when the availability of infection control equipment was examined, it was found that in 47% of hospitals, these equipment were always available, in 38% occasionally, and in the remaining institutions, this facility was rare or non-existent. Due to this unavailability, patients and staff may face increased risks of nosocomial infections. This analysis emphasizes that conducting safety drills consistently and the constant availability of infection control equipment are very important factors in preventing nosocomial infections.

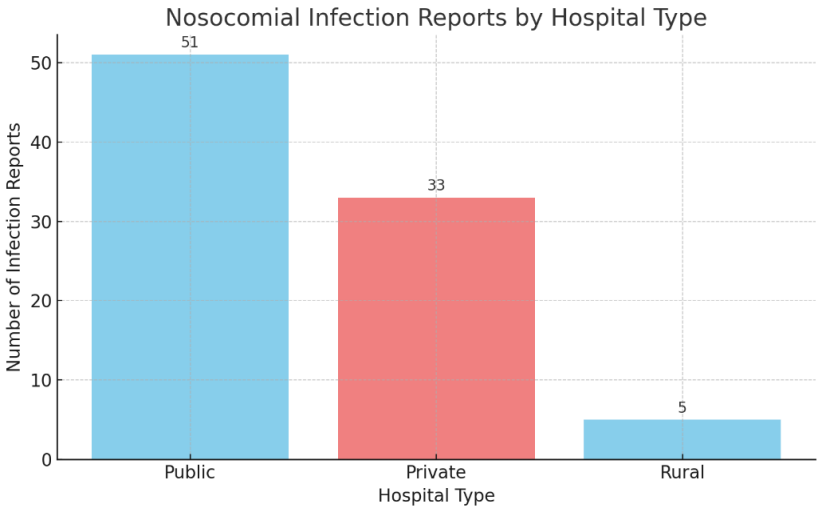
TABLE : 04 RISK-FACTORS INFLUENCING THE LIKELIHOOD OF HOSPITAL-ACQUIRED INFECTIONS

Procedural Factors	Frequency	Cumulative Frequency	Percent
10–25%	48	48	52
<10%	26	74	28
26–50%	12	86	13
>50%	6	92	6
Invasive Procedures	**Frequency**	**Cumulative Frequency**	**Percent**
<10%	26	29.21	86
10–25%	48	53.93	48
26–50%	12	13.48	60
>50%	3	3.37	89
Average Length of Patient Stay	**Frequency**	**Percent**	**Cumulative Frequency**
<5	35	38.89	87
5–10	41	45.56	52
11–15	11	12.22	11
>15	3	3.33	90
Common Underlying Conditions	**Frequency**	**Percent**	**Cumulative Frequency**
Diabetes	29	32.22	29

Hypertension	21	23.33	50
Immunocompromised State	16	17.78	66
No underlying condition	13	14.44	79

Table 4 shows that various factors that affect the likelihood of hospital infection have been analyzed in detail. Among procedural factors, the highest number of patients had an infection rate between 10 and 25% (52%), while those with 26–50% were 13% and those with >50% were only 6%, which fall into the low-risk category. When examining invasive procedures such as surgery or catheter use, it was found that 53.93% of patients had an infection rate between 10–25%, while those with <10% were 29.21%.

GRAPH 2: NOSOCOMIAL INFECTION REPORTS BY HOSPITAL TYPE



This bar chart compares the number of nosocomial (i.e. hospital-acquired) infections reported in public and private hospitals. The data shows that the number of infection cases reported in public hospitals is higher than in private hospitals.

DISCUSSION

The aim of this study was to compare the rates of nosocomial infections in public and private hospitals and to examine what factors contribute to their

prevalence. The results of the study revealed that the rates of nosocomial infections were higher in public hospitals than in private hospitals, which is also consistent with several previous studies. Possible reasons for this include limited resources, high patient load, and poor infection control measures, which are common in public hospitals. (16) The most commonly reported infection in the study was surgical site infection (SSI), with a rate of 43.5%. This was followed by catheter-associated urinary tract infection (CAUTI), ventilator-associated pneumonia (VAP), and other types of infections. A study by Khan and colleagues (2022) also found similar results, with SSI being the most common infection in low-resource hospitals. (17)According to Gupta et al. (2020), sterilization, sanitation, and surgical care are also crucial to prevent infection during invasive procedures increase the risk of infection. (18)

In this study, the highest number of infections was observed in patients with comorbidities such as diabetes, hypertension, or immunosuppression. These findings are consistent with those of Samuel et al. who identified comorbidities as important risk factors for nosocomial infections. Furthermore, the availability of infection control resources and regular audits of cleanliness in the hospital have a positive impact on infection rates. In hospitals where infection control resources were always available and handwashing was monitored on a daily basis, infection rates were significantly lower. Erasmus et al. (2010) also observed the same in their studies. (19)The difference between public and private hospitals is clearly reflected in infection control strategies. Private hospitals were more effective in preventing infections due to better trained staff, adequate medical equipment, and better patient-to-patient ratios. This observation is also consistent with the research of Khan et al. (20) It is a multidimensional problem that is linked to the patient's medical condition, the hospital environment, procedures, and safety measures. Sustainable measures, training, and resource provision are essential to reduce this risk, especially in public hospitals. A comparison between public and private hospitals has shown

that infection rates are relatively low in private hospitals. A major reason for this may be that private institutions have better medical resources, limited patient populations, and more formally trained staff. While in public hospitals, lack of financial resources, training gaps, and high patient burden hinder infection control. (21)

Staff training and awareness were identified as important factors in this study. Hospitals where staff were regularly trained in infection control had lower rates of infection among patients. This suggests that trained staff not only maintain high standards of hygiene but also prioritize patient safety. Age is also a factor to consider. Studies have shown that older patients, especially those with pre-existing medical conditions, are more susceptible to infections. In addition, newborns and infants are also at increased risk of infection due to their weakened immune systems. This suggests that specific protective measures are needed for vulnerable age groups. (22)

Based on this research, it can also be said that medical facilities and training alone are not enough to reduce nosocomial infections, but hospital management will have to adopt a comprehensive strategy, in which cleaning, supervision, training, and patient screening should be continuously improved. Better contact with patients, strict adherence to infection control policies, and timely use of modern equipment can be helpful in reducing this problem. (23)

CONCLUSION

This study demonstrates that the occurrence of infections in hospitals is closely related to various administrative, facility, and clinical factors. The research highlighted that certain types of medical interventions and the quality of facilities play a significant role in the spread of infections. The findings of this study provide a solid foundation for future improved medical practices and policy-making, which can help reduce the rate of hospital-acquired infections. The research findings not only highlight the weaknesses of health systems at the local level, but also indicate that a coordinated strategy is needed at the

global level to prevent such infections.Hospital cleanliness, staff precautions, and providing a safe environment for patients are not just an option, but a necessity. If these aspects are not addressed in time, they can negatively impact not only the health of patients, but also the entire public health system. Therefore, policymakers and hospital management should take these findings seriously and take measures accordingly.

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