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# Prevalence of Respiratory Bacterial Pathogens Among Patients With Acute Respiratory Infections Visiting the Outpatient Department of Ayub Teaching Hospital, Abbottabad

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## Abstract

***Background:*** Acute respiratory infections (ARIs) are among the most common causes of illness and outpatient healthcare visits worldwide. Although many ARIs are caused by viruses, bacterial pathogens remain important causes of respiratory tract infections and may require appropriate antimicrobial treatment. The prevalence and distribution of bacterial pathogens can vary according to geographical region and healthcare setting. ***Objective:*** To determine the prevalence and distribution of respiratory bacterial pathogens among patients with acute respiratory infections attending the outpatient department (OPD) of Ayub Teaching Hospital, Abbottabad. ***Methods*:** A hospital-based descriptive cross-sectional study was conducted at the OPD of Ayub Teaching Hospital, Abbottabad, from 15 June 2025 to 15 December 2025. A total of 150 patients presenting with clinical features of acute respiratory infection were included. Respiratory specimens, including sputum and throat swabs, were collected using standard aseptic techniques and processed in the microbiology laboratory. Bacterial pathogens were identified by direct microscopy, culture, colony morphology, Gram staining, and relevant biochemical tests. Frequencies and percentages were calculated to determine the prevalence and distribution of bacterial isolates. ***Results:*** Among the 150 patients, 68 (45.3%) specimens showed bacterial growth, whereas **82** (54.7%) showed no significant bacterial growth. Males constituted 87 (58.0%) of the participants and females 63 (42.0%). Among the culture-positive specimens, Staphylococcus aureus was the most frequently isolated pathogen, accounting for **21 (30.9%)** isolates, followed by Streptococcus pneumoniae 17 (25.0%), Klebsiella pneumoniae 12 (17.6%), Pseudomonas aeruginosa 10 (14.7%), Haemophilus influenzae 5 (7.4%), and Moraxella catarrhalis 3 (4.4%). ***Conclusion*:** Bacterial pathogens were identified in a substantial proportion of patients with acute respiratory infections attending the OPD of Ayub Teaching Hospital. Both Gram-positive and Gram-negative organisms were isolated, with *S. aureus* and *S. pneumoniae* being the most frequently detected pathogens. Routine microbiological investigation and local surveillance of respiratory bacterial pathogens may provide useful information for diagnosis, antimicrobial selection, and antimicrobial stewardship.

**Keywords:** Acute respiratory infections, bacterial pathogens, respiratory tract infection, bacterial culture, prevalence, Staphylococcus aureus, Streptococcus pneumoniae, Abbottabad, Pakistan.

## INTRODUCTION

Acute respiratory infections (ARIs) are among the most common infectious diseases affecting humans and represent an important cause of morbidity and healthcare utilization worldwide.1 They involve the respiratory tract and may affect either the upper respiratory tract, including the nose, pharynx, tonsils, and larynx, or the lower respiratory tract, including the trachea, bronchi, bronchioles, and lungs.2 Patients with acute respiratory infections commonly present with symptoms such as cough, fever, sore throat, nasal discharge, sputum production, chest discomfort, wheezing, and difficulty in breathing.3 Although many respiratory infections are self-limiting, some may progress to severe disease, particularly in young children, elderly individuals, and patients with underlying medical conditions.

Acute respiratory infections can be caused by a broad range of microorganisms, including viruses, bacteria, and, less commonly, fungi. Viral agents are responsible for a large proportion of respiratory infections; however, bacterial pathogens remain important causes of clinically significant respiratory disease.4 Common bacterial pathogens associated with respiratory infections include Streptococcus pneumoniae, Haemophilus influenzae,

Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, and Moraxella catarrhalis.5 The relative frequency of these organisms varies according to age, geographical region, clinical setting, underlying disease, environmental conditions, and previous exposure to antimicrobial agents.

Bacterial respiratory infections can range from mild upper respiratory tract infections to serious lower respiratory tract diseases such as bacterial pneumonia.6 Streptococcus pneumoniae is an important respiratory pathogen and has historically been associated with community-acquired respiratory infections and pneumonia.7 Haemophilus influenzae can cause respiratory tract infections, particularly in individuals with underlying respiratory disease.8 Staphylococcus aureus may cause respiratory infections ranging from relatively uncomplicated infections to severe pneumonia.9 Gram-negative organisms such as Klebsiella pneumoniae and Pseudomonas aeruginosa are also important respiratory pathogens, particularly among hospitalized patients and individuals with chronic diseases or previous healthcare exposure.10

The diagnosis of bacterial respiratory infections is based on a combination of clinical assessment and laboratory investigations.11 Clinical symptoms alone may not reliably distinguish bacterial infections from viral infections. Microbiological examination of respiratory specimens can provide important information regarding the presence and identity of bacterial pathogens.12 Specimens such as sputum and throat swabs can be examined using Gram staining and bacterial culture. Culture remains an important conventional laboratory method because it allows isolation and identification of bacterial organisms and, when followed by antimicrobial susceptibility testing, provides information that can assist in selecting appropriate antimicrobial therapy.

The inappropriate use of antibiotics is an important concern in the management of respiratory infections.13 Antibiotics are frequently prescribed empirically when the causative organism has not been identified. While empirical treatment may be appropriate in certain clinical circumstances, unnecessary antibiotic use can contribute to antimicrobial resistance, treatment failure, adverse drug reactions, and increased healthcare costs. Knowledge of the local distribution of bacterial respiratory pathogens can therefore provide useful information for clinicians when developing empirical treatment approaches. Surveillance of bacterial pathogens is particularly important because the prevalence of individual organisms and their antimicrobial susceptibility patterns can change over time.

The epidemiology of respiratory bacterial infections is influenced by several host and environmental factors.14 Age is an important determinant because children and older adults may be more susceptible to respiratory infections. Underlying conditions such as chronic obstructive pulmonary disease, asthma, diabetes mellitus, cardiovascular disease, and immunosuppression may also increase the risk of bacterial respiratory infection. Smoking, indoor air pollution, overcrowding, poor ventilation, and close contact with infected individuals may further contribute to transmission. Seasonal variation may also influence the occurrence of respiratory infections, with changes in temperature, humidity, and patterns of human interaction potentially affecting the transmission of respiratory pathogens.

In developing countries, respiratory infections remain an important cause of illness and healthcare attendance. Several factors, including population density, environmental pollution, limited healthcare resources, delayed diagnosis, self-medication, and inappropriate antibiotic use, may complicate the management of respiratory infections. In Pakistan, patients with respiratory symptoms frequently seek treatment at outpatient departments of hospitals and healthcare facilities. However, the bacterial pathogens responsible for respiratory infections may vary between different regions and healthcare settings. Therefore, local studies are necessary to determine the organisms circulating within a particular population.

Ayub Teaching Hospital, Abbottabad, is a major tertiary-care healthcare facility providing medical services to patients from Abbottabad and surrounding areas of Khyber Pakhtunkhwa. Patients with respiratory symptoms frequently attend its outpatient department for diagnosis and treatment. Despite the clinical importance of respiratory infections, information regarding the prevalence and distribution of bacterial respiratory pathogens among OPD patients in this setting may be limited. Determining the bacterial profile of respiratory infections in this population can provide useful local epidemiological information and establish a baseline for future studies.

The identification of respiratory bacterial pathogens is also important from a public-health perspective. Understanding which organisms are commonly associated with acute respiratory infections can assist healthcare professionals in interpreting clinical presentations and selecting appropriate diagnostic investigations. Furthermore, establishing the local prevalence of bacterial pathogens may help support antimicrobial stewardship by reducing unnecessary antibiotic administration and encouraging evidence-based treatment.

## MATERIAL AND METHODOLOGY

**Study Design**: A hospital-based descriptive cross-sectional study was conducted to determine the prevalence of respiratory bacterial pathogens among patients with acute respiratory infections.

**Study Setting and Duration**: The study was conducted at the Outpatient Department (OPD) of Ayub Teaching Hospital, Abbottabad**,** over a period of six months, from 15 June 2025 to 15 December 2025**.**

**Sample Size and Study Population:** A total of 150 patients presenting to the OPD with clinical signs and symptoms of acute respiratory infection, such as cough, fever, sore throat, sputum production, and difficulty in breathing, were included in the study.

**Sample Collection and Processing**: Appropriate respiratory specimens, including sputum and throat swabs, were collected from eligible patients using standard aseptic techniques. The specimens were transported promptly to the microbiology laboratory and processed using standard bacteriological methods. Samples were inoculated onto appropriate culture media and incubated under suitable conditions.

**Identification of Bacterial Pathogens**: Bacterial isolates were identified on the basis of colony morphology, Gram staining, and relevant biochemical tests. The isolated organisms were recorded and classified according to standard microbiological procedures.

**Data Analysis**: The collected data were entered and analyzed using appropriate statistical methods. Frequencies and percentages were calculated to determine the prevalence and distribution of bacterial respiratory pathogens among the study participants.

**Ethical Considerations:** Ethical approval was obtained from the relevant institutional authority, and informed consent was obtained from the participants. Confidentiality of patient information was maintained throughout the study.

## RESULTS

A total of 150 patients with clinical features of acute respiratory infections were included in the study during the period from 15 June 2025 to 15 December 2025. Of the total participants, **87** (58.0%) were males and 63 (42.0%) were females. The largest proportion of patients belonged to the 31–45 years age group, followed by the 15–30 years age group.

Respiratory specimens were collected from all 150 patients and processed for bacterial culture. 68 (45.3%) specimens showed bacterial growth, whereas 82 (54.7%) showed no significant bacterial growth. Among the culture-positive specimens, *Staphylococcus aureus* was the most frequently isolated organism, followed by *Streptococcus pneumoniae*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Haemophilus influenzae*.

Table 1. Demographic characteristics of the study participants (n=150)

| Age group (years) | Male n (%) | Female n (%) | Total n (%) |
|---|---|---|---|
| ≤15 | 12 (8.0) | 10 (6.7) | 22 (14.7) |
| 16–30 | 20 (13.3) | 16 (10.7) | 36 (24.0) |
| 31–45 | 24 (16.0) | 18 (12.0) | 42 (28.0) |
| 46–60 | 18 (12.0) | 11 (7.3) | 29 (19.3) |
| >60 | 13 (8.7) | 8 (5.3) | 21 (14.0) |
| **Total** | **87 (58.0)** | **63 (42.0)** | **150 (100)** |

Table 2. Culture results among patients with acute respiratory infections (n=150)

| Culture result | Frequency (n) | Percentage (%) |
|---|---|---|
| Positive bacterial culture | 68 | 45.3 |
| No significant bacterial growth | 82 | 54.7 |
| **Total** | **150** | **100.0** |

Table 3. Distribution of isolated respiratory bacterial pathogens (n=68)

| Bacterial pathogen | Number of isolates (n) | Percentage (%) |
|---|---|---|
| *Staphylococcus aureus* | 21 | 30.9 |
| *Streptococcus pneumoniae* | 17 | 25.0 |
| *Klebsiella pneumoniae* | 12 | 17.6 |
| *Pseudomonas aeruginosa* | 10 | 14.7 |
| *Haemophilus influenzae* | 5 | 7.4 |
| *Moraxella catarrhalis* | 3 | 4.4 |
| **Total** | **68** | **100.0** |

## DISCUSSION

The present study investigated the prevalence of respiratory bacterial pathogens among 150 patients with acute respiratory infections attending the OPD of Ayub Teaching Hospital, Abbottabad, during the period from 15 June 2025 to 15 December 2025. In our study, 68 (45.3%) respiratory specimens showed bacterial growth, while 82 (54.7%) showed no significant bacterial growth. The relatively lower proportion of culture-positive samples may reflect the fact that acute respiratory infections include both bacterial and non-bacterial illnesses. Viral infections are common causes of acute respiratory disease, and therefore a negative bacterial culture does not necessarily indicate the absence of respiratory infection.

In the present study, Staphylococcus aureus was the most frequently isolated pathogen (30.9%), followed by Streptococcus pneumoniae (25.0%), Klebsiella pneumoniae (17.6%), Pseudomonas aeruginosa (14.7%), Haemophilus influenzae (7.4%), and Moraxella catarrhalis (4.4%). The predominance of S. aureus in our study is consistent with findings from Pakistan showing that this organism is an important respiratory and clinical bacterial pathogen. A large antimicrobial-surveillance study in Punjab reported S. aureus as the most frequently isolated organism overall, although that study included multiple specimen types rather than respiratory samples alone (15).

Our finding of 25.0% for S. pneumoniae is also comparable with previous Pakistani respiratory studies demonstrating the importance of this organism. A study from North Waziristan reported S. pneumoniae in 26.7% of bacterial respiratory isolates, which is very close to the 25.0% observed in the present study. However, that study reported P. aeruginosa as the predominant organism (42.8%), whereas S. aureus was only 5.9%(16). This difference may be related to variations in study population, clinical setting, specimen characteristics, geographical location, and patient selection.

The prevalence of Pseudomonas aeruginosa (14.7%) in our study was considerably lower than the 42.8% reported in the North Waziristan study. Similarly, a study conducted in a tertiary-care hospital in Peshawar found P. aeruginosa in 71 of 354 culture-positive respiratory samples (20.1%). The lower proportion in our study may be explained by the fact that our participants were OPD patients, whereas studies involving hospitalized or more severely ill patients may contain a greater proportion of healthcare-associated and chronic respiratory infections, in which P. aeruginosa is more frequently encountered.

In the present study, Klebsiella pneumoniae accounted for 17.6% of the bacterial isolates. This finding demonstrates that Gram-negative organisms also constituted an important proportion of respiratory pathogens. Recent Pakistani data from Karachi identified K. pneumoniae and S. aureus as major respiratory pathogens in mortality-associated cases, with K. pneumoniae detected in 42.8% and S. aureus in 40.3% of cases (17). However, direct comparison should be made cautiously because the Karachi study examined mortality cases, representing a substantially different and more severe population than the OPD patients included in our study.

The prevalence of Haemophilus influenzae (7.4%) in the present study was lower than that of S. pneumoniae. Previous Pakistani research has established both H. influenzae and S. pneumoniae as important respiratory pathogens. In an earlier hospital-based study of children with acute lower respiratory tract infections in Rawalpindi and Islamabad, H. influenzae and S. pneumoniae were identified in 9.6% and 9.9% of cases, respectively(18). A more recent Pakistani study of children with pneumonia found S. pneumoniae to be the most frequent culture isolate (41.0%), followed by H. influenzae (23.1%). Differences between these studies and the present findings may be attributable to differences in age groups, disease severity, specimen types, vaccination status, and laboratory methods.

The isolation of Moraxella catarrhalis (4.4%) in the present study further demonstrates the diversity of bacterial organisms associated with respiratory illness. Although its prevalence was relatively low, M. catarrhalis is recognized as an important respiratory pathogen, particularly in

patients with underlying respiratory conditions. Recent Pakistani surveillance of respiratory mortality cases also identified M. catarrhalis among the detected respiratory pathogens. (19)

The male predominance (58.0%) observed in our study may reflect differences in healthcare-seeking behavior, occupational exposure, smoking, environmental exposure, or the underlying distribution of respiratory disease. (20) However, the present study was not designed to determine whether sex was independently associated with bacterial infection. Therefore, the observed difference should be interpreted descriptively rather than as evidence of a causal relationship.

Overall, comparison with previous Pakistani studies shows that the bacterial profile of respiratory infections varies substantially between populations. Studies involving hospitalized or severely ill patients have reported greater proportions of Gram-negative organisms such as P. aeruginosa and K. pneumoniae, whereas our OPD-based study found S. aureus and S. pneumoniae to be the predominant isolates. Such differences emphasize the importance of generating local, setting-specific microbiological data rather than relying exclusively on results from other hospitals or regions.

The findings also have implications for antimicrobial stewardship. Pakistani surveillance studies have documented considerable antimicrobial resistance among respiratory pathogens, including S. pneumoniae and other bacterial organisms. Therefore, identification of the causative organism followed by antimicrobial susceptibility testing can provide more appropriate information for treatment decisions and may help reduce unnecessary empirical antibiotic use.

# Conclusion

he findings indicate that both Gram-positive and Gram-negative bacteria contribute to respiratory infections in the studied population. Identification of bacterial pathogens through appropriate microbiological investigation is important for accurate diagnosis and rational antimicrobial treatment. Regular surveillance of respiratory bacterial pathogens and antimicrobial susceptibility patterns is recommended at Ayub Teaching Hospital to support appropriate antibiotic selection and help control the development and spread of antimicrobial resistance.

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