

Prevalence of Bacterial Isolates Causing Respiratory Infections among Patients at Tay Nguyen University Hospital, Vietnam, 2025

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Abstract
Objective: To determine the prevalence of respiratory tract infections and the bacterial isolation profile from throat swab specimens of patients at Tay Nguyen University Hospital.
Materials and Methods: A descriptive cross-sectional study was conducted on 278 patients aged ≥10 years who were clinically diagnosed with respiratory tract infections from March to May 2025. Throat swab specimens were cultured and bacterial identification was performed using standard microbiological techniques.
Results: The overall culture-positive rate was 61.2% (170/278). The predominant isolates included *Streptococci* (24.1%), *Escherichia coli* (18.2%), *Pseudomonas aeruginosa* (16.5%), *Staphylococcus aureus* (12.4%), *Streptococcus pneumoniae* (10%), fungi (7.1%), and other bacteria (11.8%). A higher infection rate was observed in patients aged ≥60 years (75.4%, $p<0.01$).
Conclusion: *Streptococci*, *P. aeruginosa*, and *S. aureus* were identified as the main causative agents. This study provides essential evidence for surveillance and guiding treatment strategies of respiratory tract infections.

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Keywords: Respiratory Tract Infections, *Streptococci*, *Staphylococcus Aureus*, *Pseudomonas Aeruginosa*

Introduction

Respiratory tract infections are among the most prevalent diseases worldwide and represent a leading cause of morbidity and mortality, particularly in children, the elderly, and patients with chronic comorbidities [1]. According to the World Health Organization, approximately 4.25 million deaths annually are attributed to acute respiratory infections, accounting for a considerable proportion of overall mortality due to infectious diseases [2]. In Vietnam, respiratory infections constitute a major burden among medical admissions, especially in cases of pharyngitis, bronchitis, and pneumonia. The most common microbial pathogens include *Streptococci*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Haemophilus influenzae*, *Klebsiella pneumoniae*, along with several other Enterobacteriaceae [3]. The isolation and identification of bacterial pathogens play a crucial role in diagnosis, therapeutic decision-making, and epidemiological control.
However, in the Central Highlands region of Vietnam, research on the bacterial etiology of respiratory tract infections remains limited. Therefore, this study was conducted to determine the prevalence and bacterial spectrum of respiratory tract infections among patients at Tay Nguyen University Hospital in 2025, providing practical data for clinical management and prevention strategies.

Materials and Methods

Study population

Patients aged 10 years and above who presented to or were admitted at Tay Nguyen University Hospital and were clinically diagnosed with acute respiratory tract infection during the study period.

Study setting and period
The study was conducted at Tay Nguyen University Hospital, Vietnam from March 2025 to May 2025.
Study design A descriptive cross-sectional design was applied.
Sampling method A convenient sampling method was used.
Sample size
The required sample size n was estimated using the single-proportion formula:

$$n = Z^{2}_{(1-\alpha/2)} \frac{p(1-p)}{d^2}$$

where
$Z^{2}_{(1-\alpha/2)}$=1.96 for a 95% confidence level, the allowable margin of error d=0.05, and the expected prevalence p=0.231 based on Pham Ngoc Toan (2019) [4]. The minimum required sample size was calculated to be 272. In practice, the study successfully collected 278 clinical samples.

Specimen collection
Throat swabs were collected using sterile cotton swabs, preserved in Stuart's transport medium, and transferred to the Microbiology Laboratory, Faculty of Medicine and Pharmacy, Tay Nguyen University.

Laboratory techniques
Bacterial culture was performed on blood agar, chocolate agar, Brain Heart Infusion (BHI) broth, and MacConkey agar. Identification of bacterial isolates was based on colony morphology, Gram staining, specific biochemical reactions, and diagnostic antisera when necessary.

Data management and statistical analysis
Data were entered in Microsoft Excel and analyzed using SPSS 22. The chi-square ($\chi 2$) test was applied to assess associations between categorical variables. Statistical significance was set at $p<0.05$.

Ethical considerations
The study was conducted with the consent of the patients and the hospital, ensuring confidentiality of personal information and the voluntary participation of all subjects.

Results
Bacterial culture rate.

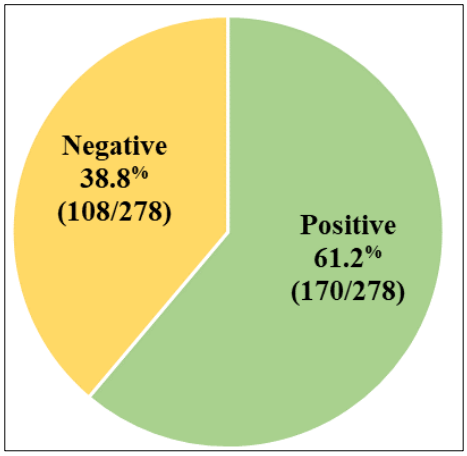


Fig 1: Bacterial culture rate.

Among 278 throat swab specimens, 170 yielded positive cultures, accounting for 61.2%, while 108 were negative, accounting for 38.8%.

Bacterial identification in respiratory tract infections

Table 1: Distribution of bacterial isolates in clinical specimens

Bacteria	Number (n)	Percentage (%)
Streptococci	41	24.1
Staphylococcus aureus	21	12.4
Pseudomonas aeruginosa	28	16.5
Escherichia coli	31	18.2
Streptococcus pneumoniae	17	10.0
Fungi	12	7.1
Other bacteria	20	11.8
Total	170	100

Among the 170 positive culture samples, the predominant bacterial isolates included: *Streptococci:* 41 strains (24.1%); *Escherichia coli:* 31 strains (18.2%); *Pseudomonas aeruginosa:* 28 strains (16.5%); *Staphylococcus aureus:* 21 strains (12.4%).

General Characteristics of the Study Population

Table 2: Selected general characteristics

Characteristics		n	Positive (%)	Negative (%)	p-value
Gender	Male	92	56 (60.9%)	36 (39.15%)	> 0.05
	Female	186	114 (61.3%)	72 (38.7%)	
Age (years)	< 18	37	13 (35.1%)	24 (64.9%)	< 0.01
	18 - 30	58	38 (65.5%)	20(34.5%)	
	31 - 45	48	30 (62.5%)	18 (37.5%)	
	46 - 60	66	37 (56.1%)	29 (43.9%)	
	< 60	69	52 (75.4%)	17 (24.6%)	
Dân tộc	Kinh	236	147 (62.3%)	89 (37.7%)	> 0.05
	Ede	25	14 (56%)	11 (44%)	
	Gia - rai	4	3 (75%)	1 (25%)	
	Mnong	1	1 (100%)	0 (0%)	
	Xo đang	1	0 (0%)	1 (100%)	
	Others*	11	5 (45.5%)	6 (54.5%)	

*Others include: Thai, Tay, Nung, Co Ho, and Muong.

The study was conducted on 278 patients aged ≥10 years, of whom 33.1% were male and 66.9% were female. The rate of positive bacterial cultures was 60.9% in males and 61.3% in females, with no statistically significant difference ($p > 0.05$). The age group ≥60 years had the highest rate of positive cultures (75.4%), and the differences among age groups were statistically significant ($p < 0.01$).

Discussion
Prevalence of common bacterial pathogens in respiratory tract infections
In our study, the number of culture-positive specimens reached 170 out of 278, accounting for 61.2%. The predominant isolated pathogens included *Streptococci* (24.1%), *Pseudomonas aeruginosa* (16.5%), and *Staphylococcus aureus* (12.4%).
Compared with the study by Nguyen Ngoc Lan (2016–2017), the culture-positive rate was higher (69.8%), with *Streptococci* (16.62%), *P. aeruginosa* (11.57%), and *S. aureus* (12.02%) [1]. This indicates a similar trend in the prevalence of *S. aureus*, whereas the proportions of *Streptococci* and *P. aeruginosa* in our study were

considerably higher.

In contrast, the study conducted by Nguyen Van An (2022) reported a markedly lower positive rate (32.7%), with *P. aeruginosa* accounting for only 1.3% and *S. aureus* 9.8% [5]. On the other hand, the findings of Lai Thi Quynh (2018–2020) demonstrated a positive culture rate of 38.5%, in which *P. aeruginosa* exhibited a high prevalence (25.54%) [6].

These variations reflect the heterogeneity among studies on respiratory tract infections, which may arise from differences in geographical settings, study periods, patient population characteristics, and sampling criteria. Additionally, in the course of our research, several other bacterial species were also isolated, though they were not within the primary scope of this study.

Prevalence of Respiratory Infections by Gender

Our findings revealed an overall prevalence of respiratory tract infections of 61.2%. Among these, the prevalence in females was 61.3%, slightly higher than in males (60.9%). This result is consistent with the study conducted by Nguyen Van An *et al*. (2022) at Yen Bai Provincial General Hospital, which reported prevalence rates of 34% in females and 31.7% in males [5]. However, in our study, the difference in prevalence between the two gender groups was not statistically significant ($p > 0.05$).

Prevalence of Respiratory Infections by Age Group

At Tay Nguyen University Hospital, respiratory infections were observed across all age groups, with a statistically significant difference ($p < 0.01$). The group under 18 years of age showed the lowest positivity rate (35.1%), which may reflect a more effective immune response or lower exposure frequency. In contrast, the group over 60 years exhibited the highest positivity rate (75.4%), higher than that reported by Nguyen Thi Thu Thuy (58.7%) [7]. The elevated rate in the elderly may be attributed to immunosenescence, the presence of comorbidities such as COPD, diabetes, and cardiovascular diseases, as well as reduced cough reflex and impaired pulmonary clearance mechanisms.

The 31–60 age group also recorded a relatively high positivity rate (56–62%), indicating a considerable risk. Common risk factors include occupational stress, exposure to pollution, smoking, and frequent contact with respiratory pathogens. These factors not only increase the likelihood of acute respiratory infections but may also contribute to severe complications such as pneumonia and even progression to lung cancer.

Respiratory infection rate by ethnicity

Findings from the study at Tay Nguyen University Hospital indicated that although Dak Lak province is home to 49 ethnic groups, only a number of them had patients with respiratory tract infections included in the analysis. Among these, the Kinh group accounted for the largest proportion with a positivity rate of 62.3%, while positivity rates among minority groups varied widely, ranging from 0% to 100%. However, these differences were not statistically significant ($p > 0.05$).

Some minority groups exhibited relatively high infection rates, which may be associated with specific characteristics such as living habits, suboptimal housing and sanitation conditions, as well as early exposure to risk factors, particularly tobacco smoking. This indicates that disparities in respiratory infection rates among ethnic groups are not attributable to differences in innate immunity but primarily reflect levels of exposure and the influence of environmental risk factors.

Conclusion

The study recorded a positive bacterial culture rate of 61.2% from throat swab specimens of patients with respiratory infections. The main pathogens included *Streptococci* (24.1%), *E. coli* (18.2%), *Pseudomonas aeruginosa* (16.5%), and *Staphylococcus aureus* (12.4%). The highest infection rate was observed in the ≥60 age group, indicating that the elderly represent a high-risk population.

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