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The Antibiotic Usage Patterns in Pediatric Patients with Lower Respiratory Tract Infections at Quang Tri General Hospital, Central Vietnam

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Abstract

Lower respiratory tract infections (LRTI) are a significant cause of morbidity and mortality in children, especially in developing countries such as Vietnam. This study analyzed antibiotic use patterns in pediatric patients with LRTI at Quang Tri General Hospital in 2023. A cross-sectional design was used, examining 381 medical records of children aged 2 months to 5 years who received antibiotics for at least 3 days. Pneumonia was the most common diagnosis (82.4%), with severe illness observed in one-third of cases. The most commonly used antibiotic was cefotaxime (42.1%), mainly administered intravenously (62.3%). Antibiotic regimens varied, with an average of 1.55 drugs per patient. Most patients improved (99.0%) after treatment. The findings are consistent with existing literature on LRTI in children and provide insights into antimicrobial stewardship practices. This study highlights the importance of standardized protocols to optimize treatment and minimize inappropriate antibiotic use.

Keywords: Lower respiratory tract infections, pediatrics, antibiotics

Introduction

Lower respiratory tract infections (LRTIs) are among the most severe and prevalent respiratory illnesses, often leading to emergency hospital admissions and, in some cases, fatalities, especially in children and the elderly. The burden of these conditions significantly impacts patients, families, and society. In Vietnam, statistics show that a child may experience respiratory illnesses 5-7 times annually, with pneumonia accounting for 21-75% of emergency hospitalizations[1]; the majority of cases occur in children aged 1-5 years[2]. Identifying the causes of LRTIs in children is crucial for effective treatment. However, this remains

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challenging due to such factors as sampling techniques, prior antibiotic use, low pathogen detection rates, and patient cooperation. Treatment methods vary depending on disease progression, patient condition, and causative agents. Antibiotic therapy is frequently employed with good outcomes in managing LRTIs. To support clinicians, the Vietnamese Ministry of Health has issued specialized guidelines, such as "Guidelines for Diagnosis and Treatment of Respiratory Diseases"[3] and "Guidelines for Antibiotic Use"[4].

Highlights

- The study analyzed antibiotic usage patterns for pediatric lower respiratory tract infections, focusing on prescribing practices, bacterial testing, and administration routes.
- Findings highlighted cefotaxime as the most prescribed antibiotic, with intravenous administration predominating, reflecting guideline adherence.
- Despite limited bacterial testing, the 99.0% improvement rate underscores effective regimens and the need for better diagnostics.

Quang Tri Provincial General Hospital, a first-class facility with over 1,178 beds, treats over 1,000 pediatric LRTI cases annually[5]. Given the high patient load and diverse cases, ensuring appropriate antibiotic management is critical. This study was conducted to analyze the antibiotic usage patterns in pediatric patients with LRTIs at the hospital in 2023, providing insights into clinical practices and potential areas for optimization.

Materials and Methods

Study Subjects

This study focused on medical records of pediatric patients aged 2 months to 5 years diagnosed with LRTIs at the Pediatrics Department of Quang Tri Provincial General Hospital from January 1, 2023 to October 1, 2023, with ICD-10 codes for pneumonia (J12-J18) or acute bronchitis (J20) and had received antibiotic treatment for a minimum of 3 days.

Methods

Study Design

A cross-sectional descriptive study was conducted using data from inpatient medical records that met inclusion criteria.

Sample Size

The sample size was calculated using the formula for estimating a single proportion:

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

In which: $z^2_{\alpha/2}$: confidence level (95%); p: estimated proportion (64.4% based on a 2021 study at Nghe An Obstetrics and Pediatrics Hospital[6]); d: margin of error (0.05).

With c=1 and n=353, a total of 381 patients meeting the criteria were included using a convenience sampling method. Data collection spanned from January 1, 2023, to October 1, 2023.

Data Collection

The study assessed the following aspects:

Demographics: Patient ID, age, gender, ethnicity, and residence (urban/rural).

Characteristics of LRTIs: Diagnoses based on ICD-10 codes (J12-J18 for pneumonia, J20 for bronchitis), disease severity (classified per 2015 Ministry of Health guidelines), treatment duration, comorbidities, and medical history.

Antibiotic use: Types of antibiotics used, initial treatment regimens, and duration of therapy.

Treatment outcomes: Categorized as cured, improved, unchanged, or worsened.

Statistical Analysis

Data were extracted from medical records using a structured data collection form. Information was entered and managed using Epidata and Excel software, with statistical analysis performed in SPSS version 20.0.

This streamlined approach ensured comprehensive and reliable insights into antibiotic usage and treatment outcomes for LRTIs in pediatric patients at Quang Tri Provincial General Hospital.

Ethics Statement

This study was approved by the Ethics Committee in Biomedical Research of Hue University of Medicine and Pharmacy (approval number: H2023/355, date: 02/06/2023). Informed consent was obtained from the parents of all patients participating in the study, after they were fully informed about the purpose, procedures, and potential risks associated with the research.

Results

There were 381 participants, with average age of 18.69±13.97 months, ranging from 2 to 59 months. Most subjects were male (61.9%), nearly 1.5 times the number of females. The majority (91.3%) were of Kinh ethnicity, and most lived-in rural areas (73.5%) (**Table 1**).

Pneumonia accounted for 82.4% of cases, and severe conditions comprised one-third of diagnoses. The average treatment duration was 7.64±3.72 days. Comorbidities were observed in 64.3% of patients, nearly twice as common as in patients with isolated LRTIs (**Table 2**).

Only 43.3% of patients underwent bacterial testing, leaving the majority (56.7%) without this diagnostic evaluation (**Table 3**).

The antibiotics used for initial treatment were relatively diverse, with each patient receiving an average of 1.55 types of drugs (ranging from 1 to 9 types). The range varied from single-antibiotic regimens to combinations involving up to nine antibiotics. The most commonly

Table 1.
Characteristics of study subjects

Attribute		Frequency (n)	Percentage (%)
Age (mean ± SD)/mo		18.69±13.97	
Gender	Male	236	61.9
	Female	145	38.1
Ethnicity	Kinh	348	91.3
	Other	33	8.7
Residential area	Rural	280	73.5
	Urban	101	26.5
Total		381	100.0

SD: Standard deviation

Table 2.
Diagnosis, severity, and comorbidities (n=381)

Attribute		Frequency (n)	Percentage (%)
Diagnosis	Pneumonia	314	82.4
	Acute bronchitis	67	17.6
Severity	Non-severe	254	66.7
	Severe	127	33.3
Treatment duration (mean ± SD/d)		7.64±3.72 days	
Comorbidities	Present	245	64.3
	Absent	136	35.7

SD: Standard deviation

Table 3.
Bacterial testing

Bacterial testing	Frequency (n)	Percentage (%)
Performed	165	43.3
Not performed	216	56.7
Total	381	100.0

prescribed drug was cefotaxime (42.1%), followed by amoxicillin 250 mg + clavulanic acid 31.25 mg (20.8%) and gentamicin (17.9%). The least frequently used antibiotics were trimethoprim-sulfamethoxazole and levofloxacin, each accounting for 0.2% (**Figure 1**).

The most common route of administration was intravenous injection, accounting for 62.3%, followed by oral administration at 35.8%. Only 1.9% of patients were prescribed intravenous antibiotic infusion for treatment (**Figure 2**).

64.0% of the patients were prescribed medication twice daily. A total of 10 patients in the study were prescribed medication three times daily, representing 1.7% (**Figure 3**).

Overall evaluation of the treatment's effectiveness showed that most patients experienced positive outcomes, with 99.0% of pediatric cases reporting improvement in LRTIs during hospitalization. Only 2 cases (0.5%) showed no changes, and another 2 cases (0.5%) experienced worsened conditions (**Table 4**).

Discussion

The study was conducted on 381 pediatric cases treated at the Pediatric Department of Quang Tri General Hospital, with confirmed ICD-10 diagnoses of pneumonia (J12-J18) and bronchitis (J20). The average age of the study participants was recorded as 18.69±13.97 months, with the youngest being 2 months old and the oldest 59 months old. This age distribution is consistent with other studies, both domestic and international. For example, a 2021 study on 1,423,509 children hospitalized for LRTIs in Thailand found that most patients were aged 1-5 years, accounting for 58.26% of cases[7]. Similarly, a study at Thanh Hoa Children's Hospital, Vietnam, on 820 children under 5 years old treated for acute lower respiratory infections reported an average age of 22.1±2.6 months, with 90.6% of cases occurring in the 1-5 age group[2].

In this study, male children accounted for a higher proportion (61.9%), 1.5 times the number of female cases. This finding aligns with observations in Thailand, where over four years of observation until 2021, 58.67% of hospitalizations for LRTIs were male, compared to 41.33% female[7]. Similarly, a 2021 study in Nghe An, Vietnam reported a male-to-female ratio of 1.8:1[1]. Despite differences in location and time of research, most studies consistently note that male children are more frequently hospitalized for LRTIs than females.

Regarding clinical diagnoses, the majority of pediatric patients in our study, were diagnosed with pneumonia (82.4%), while severe pneumonia or severe bronchitis accounted for one-third of the cases. A 2021 study in Thailand similarly identified pneumonia as the most common condition among children with LRTIs, representing 61.58% of all hospitalizations[7]. In Vietnam, pneumonia has been one of the leading causes of both morbidity and mortality among children under five in recent years. It accounts for approximately 33% of all deaths in young children due to various causes[8].

The average length of hospital stay for patients in this study was 7.64±3.72 days, with the shortest being 3 days and the longest being 39 days. A 2022 study by Ha[9] reported average hospitalization durations ranging from 7.4±1.6 days to 9.4±3.6 days, depending on the severity of the diagnosed infection. Longer treatment durations were found to correlate with more severe cases. The relatively short treatment period observed in our study indicates that LRTIs remain acute conditions, with most pediatric patients responding well to the current treatment protocols applied at the hospital. These findings are consistent with the Vietnam Ministry of Health (VMoH) 2015 guidelines on the diagnosis and treatment of common pediatric illnesses[8].

In this study, 64.3% of patients had comorbid conditions, nearly double the number of patients diagnosed with LRTIs alone. Common comorbidities included gastrointestinal inflammation, dermatological conditions, and other respiratory diseases. Similarly, the 2022 study by Ha[9] reported that among 148 pediatric pneumonia cases, 59 children had comorbidities. The most prevalent was rhinitis-pharyngitis (14.19%), followed by digestive disorders (10.81%), and other conditions

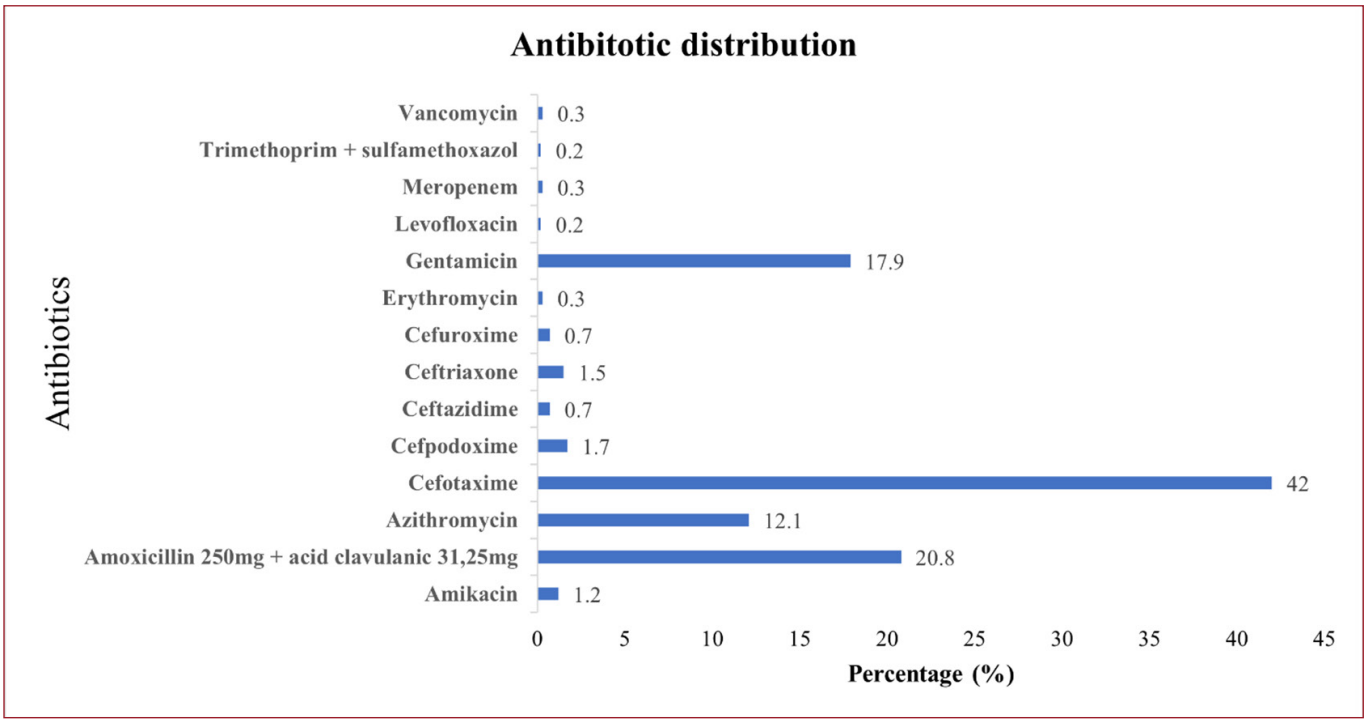

Figure 1. The use of antibiotics in initial regimens

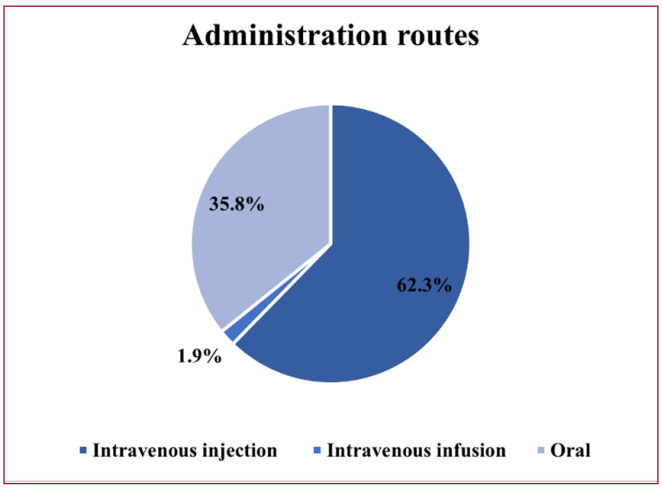

Figure 2. Administration routes

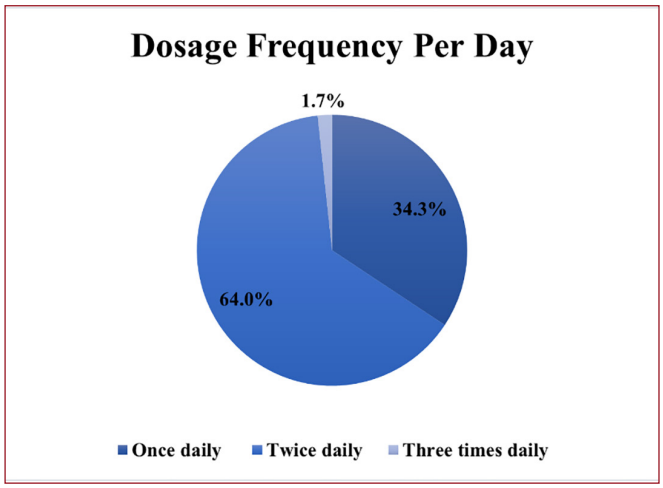

Figure 3. Frequency of medication administration

such as anemia and laryngitis (6.76%). Bacterial testing was conducted for 43.3% of patients, while most of the remaining group did not undergo this examination. However, no specific pathogens were identified.

Table 4.
Treatment outcomes

Treatment outcomes	Frequency (n)	Percentage (%)
Improved	377	99.0
Unchanged	2	0.5
Worsened	2	0.5
Total	381	100.0

Among the antibiotics prescribed in initial treatment regimens, cefotaxime was the most frequently used (42.1%), followed by amoxicillin-clavulanic acid (20.8%) and gentamicin (17.9%). Less commonly used antibiotics included trimethoprim-sulfamethoxazole and levofloxacin (both 0.2%). Subsequent adjustments in treatment showed that azithromycin was most frequently prescribed during the first modification (28.4%), while ceftriaxone and amikacin were prominent in the second. This differs slightly from previous studies, such as one by Thuy and Lien[10], conducted in Hau Giang, Southern Vietnam, (2018), where Amoxicillin was the most commonly used antibiotic (24.6%). However, the findings align with the VMoH guidelines recommending cefotaxime for severe pneumonia in children. A 2021 study conducted at Nghe An Obstetrics and Pediatrics Hospital found that ceftriaxone was the most commonly used antibiotic, prescribed for 44.4% of patients (36 out of 81)[6]. Similarly, a 2022 study in Lao Cai, Northern Vietnam by Ha[9] reported that penicillin was the most frequently used antibiotic group, accounting for 68.93% of cases. Second- and third-generation cephalosporins were used in 7.77% of cases, aminoglycosides in 13.11%, macrolides in 8.74%, and cotrimoxazole in just 1.46%. Cefotaxime, a third-generation cephalosporin, is a broad-spectrum antibiotic used for its antimicrobial properties, with cefotaxime sodium as its main component. It is formulated as injectable powders and solutions, primarily prescribed for respiratory tract infections like bronchitis, and pneumonia. The

VMoH recommends cefotaxime for treating severe pneumonia in children[11]. The second most commonly prescribed antibiotic is amoxicillin, a second-generation broad-spectrum penicillin. Amoxicillin can penetrate the outer membrane porin channels of Gram-negative bacteria, enhancing its effectiveness in treating bacterial infections[11].

The most commonly used administration route in this study was intravenous injection, accounting for 62.3% of cases in the initial prescribed regimen, 54.5% in the first replacement regimen, and 50% in the second replacement regimen. Notably, intravenous administration was prioritized more frequently in replacement regimens. According to the VMoH guidelines[11], amoxicillin is the only recommended oral antibiotic for treating LRTIs while most other antibiotics are recommended for intravenous or intramuscular use. These findings align with several studies conducted in recent years[12-15]. In addition, most patients responded well to the initial antibiotic regimen, with no need to switch treatments. On average, each patient used 1.55 types of antibiotics in the initial regimen prescribed, similar to the 1.6 average recorded in 2019 by Tam[12].

Analysis revealed that the majority of patients showed positive progress: 99.0% experienced improvement in their LRTIs upon hospitalization, while 0.5% saw no changes, and 0.5% experienced worsening conditions. These results differ slightly from previous findings, such as Ha's[9] 2022 study. In that study, pneumonia treatment at the pediatric ward showed 91.2% of patients recovering from pneumonia, 2.0% presenting with severe pneumonia, and improvement rates beyond full recovery of 5.4% for pneumonia and 1.4% for severe pneumonia, with no cases of worsening conditions reported.

Our study reveals distinctive antibiotic patterns, with cefotaxime dominance (42.1%) contrasting sharply with Northern Vietnam's penicillin preference (68.9%)[9] and Southern Vietnam's amoxicillin use (24.6%)[10], reflecting significant within-country variation. This geographic variation within Vietnam mirrors the broader diversity seen across other neighboring countries, where penicillin dominates in Guang Dong, China (29.3%)[16] and amoxicillin-clavulanate leads in Bangalore, India (58%)[17]. The contradiction of high clinical success (99%) and a 56.7% untested microbiological testing limit, raises an interesting question regarding the resource-limited settings versus reliance on empiric treatment efficacy.

These outcomes are noteworthy, especially in the context of rising global and domestic antibiotic resistance rates. The application of antibiotic treatment regimens for pediatric LRTIs at Quang Tri General Hospital, Vietnam, the demonstrates an encouraging effectiveness.

Study Limitations

Several limitations exist that should be considered in this study. First, bacteriological testing was performed in only 43.3% of cases, limiting the ability to associate specific pathogens with antibiotic efficacy. Second, the study was conducted in a single hospital, potentially reducing the ability to generalize the findings to other regions or health care settings. In addition, convenience sampling may have introduced selection bias, affecting the representativeness of the sample. Future research should incorporate multicenter designs, prospective methodologies, and comprehensive bacteriological testing to provide a better understanding of LRTI treatment practices in children.

Conclusion

This study on 381 pediatric patients revealed an average age of 18.69±13.97 months, with males outnumbering females by a ratio of 1.5:1. Pneumonia was diagnosed in 82.4% of cases, with severe pneumonia/bronchitis comprising 33.3%. The average hospital stay was 7.64±3.72 days, and 64.3% of patients had comorbidities. Cefotaxime was the most commonly prescribed antibiotic (42.1%), with intravenous administration being predominant (62.3%). Positive treatment outcomes were observed in 98.7% of patients, underscoring the efficacy of current regimens.

Ethics

Ethics Committee Approval: This study was approved by the Ethics Committee in Biomedical Research of Hue University of Medicine and Pharmacy (approval number: H2023/355, date: 02/06/2023).

Footnotes

Informed Consent: Informed consent was obtained from the parents of all patients participating in the study, after they were fully informed about the purpose, procedures, and potential risks associated with the research.

Author Contributions: Thuan NTM: Concept, Design, Data Collection or Processing, Analysis or Interpretation; Binh TD: Data Collection or Processing, Literature Search, Writing.

Conflict of Interest: The authors declare no conflicts of interest.

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References

1. Hoang VT, Dao TL, Minodier P, et al. Risk factors for severe pneumonia according to WHO 2005 criteria definition among children <5 years of age in Thai Binh, Vietnam: a case-control study. *J Epidemiol Glob Health*. 2019;9:274-280. *[CrossRef]*
2. Hai NT, Giang LM, Thuy NTD. Model of acute respiratory infections in hospitalized children at Thanh Hoa Pediatric Hospital. *Vietnam Medical Journal*. 2022;516:152-155. *[CrossRef]*
3. Vietnam Ministry of Health. Decision No. 4235/QĐ-BYT issuing the professional document "Guidelines for diagnosis and treatment of respiratory disease". 2012. Available at: https://thuvienphapluat.vn/van-ban/The-thao-Y-te/Quyet-dinh-4235-QD-BYT-tai-lieu-chuyen-mon-huong-dan-chan-doan-dieu-tri-benh-ho-hap-281362.aspx. Accessed December 12th 2023. *[CrossRef]*
4. Vietnam Ministry of Health. Decision No. 708/QĐ-BYT issuing the professional document "Guidelines for antibiotic use". 2015. Available at: https://luatvietnam.vn/y-te/quyet-dinh-708-qd-byt-bo-y-te-93000-d1.html. Accessed December 12th 2023. *[CrossRef]*
5. Quang Tri General Hospital. Introduction to Quang Tri General Hospital. Available at: https://benhvientinh.quangtri.gov.vn/vi/gioi-thieu-benh-vien/gioi-thieu-ve-benh-vien/benh-vien-da-khoa-tinh-quang-tri-1.html. Accessed December 12th 2023. *[CrossRef]*
6. Anh TTK, Tuan NV. Study on antibiotic usage in treating pneumonia in children aged 2 months to 5 years at Nghe An Obstetrics and Pediatrics Hospital in 2021. *Vietnam Medical Journal*. 2021;505:254-257. *[CrossRef]*

7. Sitthikarnkha P, Uppala R, Niamsanit S, et al. Epidemiology of acute lower respiratory tract infection hospitalizations in Thai children: a 5-year national data analysis. *Influenza Other Respir Viruses.* 2022;16:142-150. *[CrossRef]*
8. Vietnam Ministry of Health. Decision No. 3312/QĐ-BYT issuing the professional document "Guidelines for diagnosis and treatment of common pediatric diseases". 2015. Available at: https://thuvienphapluat.vn/van-ban/The-thao-Y-te/Quyet-dinh-3312-QD-BYT-tai-lieu-chuyen-mon-Huong-dan-chan-doan-dieu-tri-benh-thuong-gap-o-tre-em-290444.aspx. Accessed December 12th 2023. *[CrossRef]*
9. Ha VL. Analysis of antibiotic usage in the treatment of community-acquired pneumonia in children at Lao Cai General Pediatric Hospital. Hanoi University of Pharmacy, Hanoi, Vietnam (in Vietnamese), 2022. *[CrossRef]*
10. Thuy PTD, Lien PTT. Antibiotic usage in the treatment of acute respiratory infections in children under 5 years old at health stations in Phung Hiep District and Long My Town, Hau Giang Province, in 2018. Can Tho Journal of Medicine and Pharmacy (in Vietnamese), 2018. *[CrossRef]*
11. Thanh VC. Epidemiological, clinical characteristics, and factors related to the severity of respiratory syncytial virus pneumonia in children. Hanoi Medical University, Hanoi, Vietnam (in Vietnamese), 2020. *[CrossRef]*
12. Tam VTT. Analysis of antibiotic prescription practices in the treatment of pneumonia in children at Dien Bien General Hospital in 2019. Hanoi University of Pharmacy, Hanoi, Vietnam (in Vietnamese), 2019. *[CrossRef]*
13. Nam NK, Suol PT. Antibiotic usage in the treatment of community-acquired pneumonia at Can Tho University of Medicine and Pharmacy Hospital in 2020-2021. *Can Tho Journal of Medicine and Pharmacy (in Vietnamese).* 2021;40:149-156. Available at: https://tapchi.ctump.edu.vn/index.php/ctump/article/view/815. Accessed December 24th 2023. *[CrossRef]*
14. Anh NTN, Thang N, Thao NH. Survey of antibiotic usage in the treatment of community-acquired pneumonia at a Public Hospital in Ho Chi Minh City. Can Tho Journal of Medicine and Pharmacy (in Vietnamese). 2020;27:98-105. Available at: https://tapchi.ctump.edu.vn/index.php/ctump/article/view/1667. Accessed December 24th 2023. *[CrossRef]*
15. Thao DT, Phuong VH, Tam NT, Huong LTM. Current status and reasons for antibiotic usage in treating bronchiolitis in children. *Journal of Pediatrics.* 2023;16:48-54. *[CrossRef]*
16. He D, Li F, Wang J, et al. Antibiotic prescription for children with acute respiratory tract infections in rural primary healthcare in Guangdong province, China: a cross-sectional study. *BMJ Open.* 2023;13:e068545. *[CrossRef]*
17. Rekha H, Bhandare B, Adarsh E. Prescribing pattern of antibiotics in lower respiratory tract infection among children aged less than 5 years. *Indian Journal of Pharmacy and Pharmacology.* 2016;3:182-185. *[CrossRef]*