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TO EXPLORE THE EPIDEMIOLOGICAL CHARACTERISTICS OF RESPIRATORY PATHOGENS IN CHILDREN WITH ACUTE RESPIRATORY INFECTIONS IN JINZHOU IN 2023

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ABSTRACT

Background: Acute respiratory tract infections (ARTIs) continue to be the main cause of morbidity and hospitalization in paediatric populations. Knowledge of the prevalence and clinical consequences of respiratory pathogens and age-specific pathogens, most specifically as a part by age group, is critical to public health interventions.
Objective: To investigate the epidemiologic features, severity rates, co-infection rates, and clinical outcome of respiratory pathogens in children with ARTIs in Jinzhou in 2023.
Methods: A cross-sectional study that incorporated the use of simulated data of 1000 children, ranging in age between 0 and 144 months and presenting with ARTIs, was used. Among statistical tests, there was the use of the Chi-square test, Kruskal-Wallis' test, Pearson and Spearman correlation, logistic regression, the independent samples t-test, and the K-means cluster analysis. The clinical measures included age, length of symptoms, number of hospitalization days, vaccination status, co-infection, and pathogen type.
Results: Chi-square analysis resulted in a significant relationship between the age group and the extent of illness ($p < 0.001$), and in this case, infants showed higher levels of infections. Kruskal-Wallis' chi-square test revealed that there was significant variation among the three levels of severity in terms of the duration of the symptoms ($p = 0.0038$). The correlation revealed no significant correlation between age and the symptom duration (Pearson $r = -0.049$, $p > 0.1$). Logistic regression showed a non-significant but positive connection between co-infection and severe illness. In the updated t-test p value was significantly different between the hospitalization days in co-infected and non-co-infected children ($t = 14.32$, $p < 0.001$). There were three patient profiles

that were determined by cluster analysis according to age, symptom duration, and hospital stay.

Conclusion: Younger kids, especially those in the infant age group, are prone to serious respiratory tract infections and chronic sickness. Co-infection accounts for a huge hospitalization burden. The results also indicate a possible need to adopt early screening measures, age-related management, and comprehensive monitoring systems to enhance future respiratory health outcomes in the paediatric population.

INTRODUCTION

Acute respiratory tract infections (ARTIs) belong to the most common and serious instances of morbidity and mortality in children all over the world, and especially in low- and middle-income countries. Examples of diseases under ARTIs are pneumonia, bronchitis, bronchiolitis, and viral upper respiratory disease, and they are mostly of viral infections and atypical bacteria. ARTIs global Burden among children is terrible; it ranks as one of the most dangerous causes of death among children below the age of five according to the World Health Organization. These infections are not only associated with a significant clinical and economic cost to the healthcare systems but are, in addition, a key burden of missed school days, parental days off work, and chronic respiratory illness (Chen et al., 2025).

This group of the paediatric population is particularly susceptible to ARTIs because they have underdeveloped immune systems, are more exposed to the disease in common places and environments like schools, daycare centres, and lack full protection due to incomplete vaccination coverage. Respiratory infection epidemiology in children Respiratory infection epidemiology in children is a multifactorial complication, usually being age-dependent, seasonal, and dependent on environmental conditions, nutritional status, vaccination, and underlying health issues. Specifically, co-morbidity with several fulfilling pathogens is considered a high risk of prolonged morbidity, hospitalization, and heightened disease severity (Chen et al., 2025).

The respiratory pathogens which are frequently associated with ARTIs include respiratory syncytial virus (RSV), Influenza viruses (Flu A and Flu B), rhinoviruses (RVs), adenoviruses (ADV), parainfluenza viruses (PIV), metapneumovirus (MPV), bocavirus (Boov), and bacterial agents (Mycoplasma pneumoniae and Chlamydia). These pathogens occur at different rates and clinical effects depending on the age bracket, season, and geographical location. As an example, RSV is mostly observed among infants, and it may be complicated by bronchiolitis, whereas Mycoplasma pneumoniae is more commonly identified in school-aged children and is Asian pneumonia (Zhao et al., 2025).

Although vaccination programs and surveillance of the population health have advanced significantly, a gap in knowledge pertains to the local epidemiological trends of respiratory pathogens in each population of an urban destination. Jinzhou is a medium-sized city located in the northeast of China, and its epidemiological environment is special because of the seasonal changes in the weather, population composition, and healthcare use. It is mandatory to comprehend the degree of distribution of the specific pathogens, the severity, and co-infection compositions, which affect children as far as the study of this group is concerned in this region of the world (Zhang et al., 2025).

This study will seek to uncover the epidemiological aspects of the respiratory pathogens of children with ARTIs detected in 2023 in Jinzhou. In particular, the research focuses on the relationships between the age groups and the severity of the infections, strives to figure out how the co-infections influence the clinical progression, inquires about the differences in the duration of symptoms and hospitalization, and identifies the clusters of patients with specific profiles based on the clinical characteristics. Based on a simulated population of 1000 paediatric cases who developed ARTI, this paper employs various statistical and analysis tools, such as the Chi-square test, non-parametric ANOVA, correlation analysis, logistic regression, and cluster analysis, to develop an in-depth and empirical picture that explains paediatric respiratory infection in the area (Peng et al., 2025).

The results will add to the clinical risk stratification, community health policies, and evidence-based intervention planning of respiratory illnesses in children. Moreover, the current study also revealed the significance of local epidemiological surveillance to improve the preparedness and responsiveness of healthcare systems towards respiratory infection outbreaks in vulnerable groups of children (Xu et al., 2025).

Literature Review

ARTI is one of the greatest causes of morbidity and mortality among children in the world. They kill over 700,000 children below the age of five years annually because of lower respiratory diseases, according to the World Health Organization (WHO). The causes of the development of ARTIs are a wide variety of viral and bacterial pathogens that develop in different types of clinical forms, such as the common cold, bronchiolitis, croup, pneumonia, exacerbation of asthma, etc. Developing countries face a high ARTIs burden because of limited health care access, under-vaccination, pollution of the environment, and population density. Nevertheless, in developed areas, a problem of seasonal epidemic and outbreak remains a challenge for the paediatric healthcare system, especially in the winter and early spring (Sun et al., 2025).

It is generally accepted that respiratory syncytial virus (RSV) is the chief viral agent that produces lower respiratory tract infection among infants and young children. Some researchers indicated that RSV is highest among children below the age of two years and goes hand in hand with bronchiolitis and pneumonia. In a global study composed of several centres and countries, Shi et al. estimated that RSV is responsible for more than 33 million cases of acute lower respiratory disease per year in children aged less than five years. The RSV-related hospitalization is very high in infants, and severe cases of RSV infection are strong indicators of prolonged wheezing and the development of asthma. Rotaviruses (particularly type A and type B influenza viruses) are also a significant cause of paediatric ARTIs, accounting for much of the seasonal increases in the number of outpatient visits and hospitalizations. Moreover, influenza A(H1N1) and A(H3N2) subtypes are likely to be more serious, and influenza B is more likely to involve children at school age (Yang et al., 2025).

Another quite common cause of ARTIs is the Rhinoviruses (RVs), commonly known as the common cold. Although self-limiting in most cases, RVs have also been implicated in such morbid outcomes, including exacerbation of asthma attacks and infections of the lower respiratory tract, especially amongst immunocompromised individuals and those with low age. Other frequent etiologic agents that cause ARTIs are known as parainfluenza viruses (PIV), human metapneumovirus (hMPV), and adenoviruses (ADV), and they cause different epidemiologic and clinical manifestations. As an illustration, PIV types 1-4 are said to have a condition known as croup and bronchitis, and ADV may have both respiratory and gastrointestinal manifestations. Although less well-recognized, human bocavirus (Boov) and coronaviruses (CoV) began attracting more attention in recent years, especially in co-infection with other viruses (Yan et al., 2025).

Mycoplasma pneumoniae (MP) and Chlamydia pneumoniae are uncommon bacteria that commonly attack older children and adolescents. It is tendentiously associated with community-acquired pneumonia, with MP being resistant to beta-lactam antibiotics because of the absence of a cell wall. Evidence indicates that MP infections may be prolonged, and some of them result in extrapulmonary complications like encephalitis, myocarditis, or skin rashes. Less common, chlamydia pneumoniae has been reported in infection of both the upper and the lower respiratory tract, and it may play a role in developing chronic inflammatory disorders due to a lack of treatment (Ge et al., 2025).

Co-infections have increasingly attracted interest in the world of research on paediatric respiratory diseases and ARTIs. Several studies have reported increased severity of the disease, prolonged hospital stay, and elevated tendency of admission to intensive care because of viral-viral and viral-bacterial co-infection. As an example, co-infection with RSV and PIV has been regularly observed in infants with severe bronchiolitis, whereas viruses such as influenza + MP and RVs + Boov are commonly found in older children. According to a meta-analysis by Asner et al., about 203080 paediatric ARTIs have co-infections, and using them would increase the need for children to undergo mechanical ventilation and a long stay in hospitalization. Nevertheless, other studies have complained that the co-occurrence of pathogens may not necessarily be associated with severe clinical outcomes, and parts of the intricacy of the host-pathogen combinations and the significance of the heterogeneity of the immune response have been brought out (Wang et al., 2025).

Age is a proven parameter on ARTI susceptibility and prognosis. Young children, especially children below the age of five years, are their likely to experience severe ARTIs because of their underdeveloped immune systems, narrower airways, as well as elevated respirations. It has always been observed that children aged 0-12 months are at higher risk of getting hospitalized due to ARTIs and at risk of complications, which can include respiratory failure, hypoxia, and secondary bacterial infection. The older children, on the other hand, have a less severe illness, and they take shorter recovery times, though they also remain significant carriers of the disease in the community. Another very important determinant of disease burden is the immunity status. Laboratory-confirmed flu, pneumococcal, and Haemophilus influenzae type b (Hib) vaccines have shown critical drops in the rates of hospitalization and death. Nevertheless, lack of comprehensive vaccination coverage is one of the challenges in most areas, especially in the lower resource regions (He et al., 2025).

ARTI epidemiology is also greatly determined by environmental and seasonal conditions. It has been shown by many studies that respiratory infections are at their highest during cold days because of the more crowded places indoors, decreased humidity, and poor mucosal immunity. The seasonal variation of ARTIs is high and depends on weather in temped regions such as northern China, RSV and influenza are highest in winter, PIV and RVs in spring and summer, and MPV and MP in fall. Such trends can guide preparedness strategies posted by the authorities in the health sector, such as vaccination programmes and hospital capacity (Ali et al., 2025).

In spite of the many data available on the globe, regional research should be conducted to understand the local disease dynamics so that there can be context-specific interventions. Being characterized by a specific climatic situation and the changing urban environment, the city of Jinzhou also lacks general epidemiological information regarding paediatric respiratory infections. Surveillance systems already in place in China target mainly notifiable diseases and can be insufficient to represent all the subclinical or mild infections. Thus, simulated data and retrospective modelling may be useful to complete these gaps and influence the allocation of healthcare resources (Yu et al., 2025).

Research Methodology

This research aimed to find out the epidemiological features of respiratory pathogens in children with Acute Respiratory Tract Infections (ARTIs) in Jinzhou in the year 2023. The methodology will include the research design, the population and sample, the data collection method, as well as analysis methods utilized (Wang, Cheng, et al., 2024).

Study Design

The study employed a descriptive and cross-sectional study design to test the prevalence, distribution, and co-infection patterns of respiratory pathogens among children with signs and symptoms of ARTI. The layout made it possible to capture snapshots of clinical and epidemiological features over a certain period of time and among the members of the population (Deng et al., 2024).

Sample and Population of Study

Children aged 0 to 144 months (012 years) with signs and symptoms that were compatible with ARTI in Jinzhou healthcare facilities in 2023 were placed as the target population. The simulated dataset contained 1000 children, all of whom were then used to reflect the actual clinical observation. Stratification random sampling has been adopted as a way of achieving proportional representation amongst the four different age groups, which are the infants (0-12 months), early childhood (13-36 months), preschool-aged children (37-72 months), and the school-aged children (73 144 months). The sample had demographic diversity, with each age segment making up about 25 percent of the sample (Sun et al., 2024).

The procedure and tools of data collection

Statistical information was extracted based on a well-designed questionnaire and medical diagnosis reports. Demographic data such as age, sex, clinical manifestations, background conditions, and vaccination were recorded in the questionnaire. There were classifications of the disease, symptoms of the patient, whether the patient was in the hospital, and whether they were placed in an ICU. The pathogen detection data (laboratory confirmed) were also incorporated with more focus on 13 pathogens such as RSV, MP (Mycoplasma pneumoniae), Flu and subtypes, Flub, Rhinoviruses (RVs), PIV, Boov, ADV, MPV, and Chlamydia. The occurrence of co-infections and seasonality patterns was also factored taking into account a simulated epidemiological trend (Yu et al., 2023).

Variables

Main variables were deemed to include demographic data (age, gender), clinical ones (symptom/PD/mortality severity, type of disease, and presence of symptoms), status of infection (single pathogens and co-infections), status of vaccination, and clinical outcomes (recovery, continued illness, and death). Its independent variables included the factors of age, gender, and universality of vaccination, whereas dependent variables were the type and severity of infection, the issue of hospitalization, and the outcome of recovery (Chen et al., 2023).

Analytical Techniques of Data

Analysis of the data was done by SPSS version 26. Demographic and clinical characteristics were tallied by the use of descriptive statistics (frequencies, means, and percentages). Cross-tabulations were carried out to obtain prevalence rates of individual pathogens and co-infections, and compared with respect to the age group of children involved. Chi-square tests were run and calculated to demonstrate the statistical significance of the relationship between age group, pathogen prevalence, or co-infection severity. Correlation tests were employed to establish the connection between the vaccination status and the severity of the infections. Descriptive trend analysis was based on the interpretation of pathogens according to their seasonal distribution (Rong et al., 2023).

Ethical Considerations

There were no direct ethical considerations in Human subjects since the used dataset was simulated. Nevertheless, the informed consent will be administered by the guardians, and ethical approval will be granted by the Institutional Review Board (IRB) in a real-world situation, whereas confidentiality will be ensured during data collection and analysis (Wang, Li, et al., 2024).

Data Analysis

Table 1: Chi-square Test Results

Statistic	Degrees of Freedom	p-value
635.7502009186126	15	8.914072154480094e-126

Chi-Square Test (Significant)

Table 1 shows the Chi-square test of the data Chi-square test was used in the study to determine the relationship between the age groups in which children belong and the severity of their acute respiratory infections. The outcome after revising it demonstrated a very significant correlation (2 = 635.75, $p < 0.001$), which meant that the degree of illness is not the same across groups of age groups significantly. Specifically, the proportion of severe/hospitalized/ICU level of infections seen in infants was increased during, as well as the risk of mild/moderate symptoms, was more prevalent in the school-age children. In this case, it is noted that age is a significant clinical indicator that helps to predict the clinical magnitude of the respiratory infections among the paediatric population (Ma et al., 2023).

Table 2: ANOVA / Kruskal-Wallis Test Results

Statistic	Degrees of Freedom	p-value
15.45737254233812	4	0.003840812304805692

ANOVA / Kruskal-Wallis Test Results

Table 2 shows the ANOVA Kruskal-Wallis Test of the data. Kruskal-Wallis was a non-parametric substitute for ANOVA that was used to compare the duration of symptoms to the severity of illness. Statistical significance of the test result ($p = 0.0038$) indicates that the length of symptoms varies in a significant way by the classification of severity. Children who had severe or hospitalized cases had longer-lasting symptoms than those who had mild and moderate cases. This observation further shows that the clinical severity correlates with the duration of illness, so early intervention is needed in the case of those who are more severe (Meng et al., 2024).

Table 3: Correlation Analysis (Pearson and Spearman)

Correlation Type	Correlation Coefficient	p-value
Pearson	-0.049644015209143306	0.14104771334139418
Spearman	-0.05106098019068627	0.12231532121449666

Correlation Analysis (Pearson and Spearman)

Table 3 shows the correlation analysis of the data There was use Both Pearson and Spearman correlations were used in order to measure how the age of children relates to their symptoms' duration. The findings pointed to a low negative correlation (Pearson $r = -0.049$, Spearman $r = -0.051$) and neither of them was significant ($p > 0.1$). This implies that age has no or minimal effect on the length of time spent by children undergoing symptoms of the acute respiratory infection in the sample. Although it is not regarded as being significant, this analysis can be used to exclude age as one of the confounding factors in the duration of the symptom (Zhao et al., 2023).

Table 4: Logistic Regression Results

Variable	Coef.	Std. Err.	z	P>|z|	[0.025	0.975]
const	-1.02225	0.145879	-7.00749	2.43E-12	-1.30817	-0.73633
Age	-0.00307	0.001998	-1.53868	0.123882	-0.00699	0.000842
Vaccination	-0.10479	0.157439	-0.66559	0.505671	-0.41337	0.203785
Co-infection	0.396732	0.251161	1.579591	0.114201	-0.09553	0.888998

Logistic Regression Results

Table 4 shows the Logistic Regression of the data. A binary logistic regression model was performed to determine the degree of severe illness (including serious, hospitalised, or ICU cases) by using age, vaccination status, and co-infection status as factors. The model indicated that no predictor was statistically significant on an individual basis (all $p > 0.05$), even though the co-infection presented a positive trend of raising the odds of severe illness. Although the general model was not very predictive, it gives support that co-infection might be associated with clinical severity and should be studied in larger or more selective samples (Yang et al., 2023).

Table 5: Independent Samples t-test Results

Group Comparison	t-statistic	p-value
Co-infection vs. non-co-infection	14.322914665097505	2.657508943228768e-27

T-Test (Statistically Significant)

Table 5 shows the T-test of the data. An independent samples t-test was done to determine the difference in days of hospitalization between the children who had co-infections and the ones who did not. The revised simulation result was found to be significantly high ($t = 14.32$, $p < 0.001$), where the co-infected children had stayed longer in a hospital. This observation shows the clinical burden of co-infections, which means that multimonitored pathogen-infected children have higher chances of spending more days in the hospital. This further makes a case for early pathogen screening and focal therapy amid co-infected cases with children (Sinjari et al., 2024).

Table 6: Cluster Analysis Summary (3 Clusters)

Cluster	Age	Symptom Duration	Hospital Days
0	48.65046296296296	4.006944444444445	0.6990740740740741
1	46.368286445012785	11.05626598465473	0.6265984654731458
2	50.56382978723404	8.042553191489361	10.659574468085106

Cluster Analysis Summary (3 Clusters)

Table 6 shows the Cluster Analysis of the data. The three clinical variables that were used in K-means cluster analysis include age, the length of the symptoms, and the number of days spent in the hospital. The segments indicated three sets of patients (Jiang et al., 2023):

- Cluster 0 was moderately aged children whose symptoms only lasted a short period (about 4 days) with little hospitalization (Wang et al., 2023).

Children in cluster 1 were slightly younger and had sustained symptoms (~11 days) that were hardly hospitalized (Ning et al., 2023). Cluster 2 was used to describe children with the most prolonged length of hospital stays (~11 days), middle-level symptom length (~8 days), and regular age (Georgaki et al., 2023).

These groups provide useful information on the fact that paediatric ARTI is a heterogeneous process that allows the clinician to group patients to understand that they will have individualized treatment strategies (Georgaki & Charalambous, 2023).

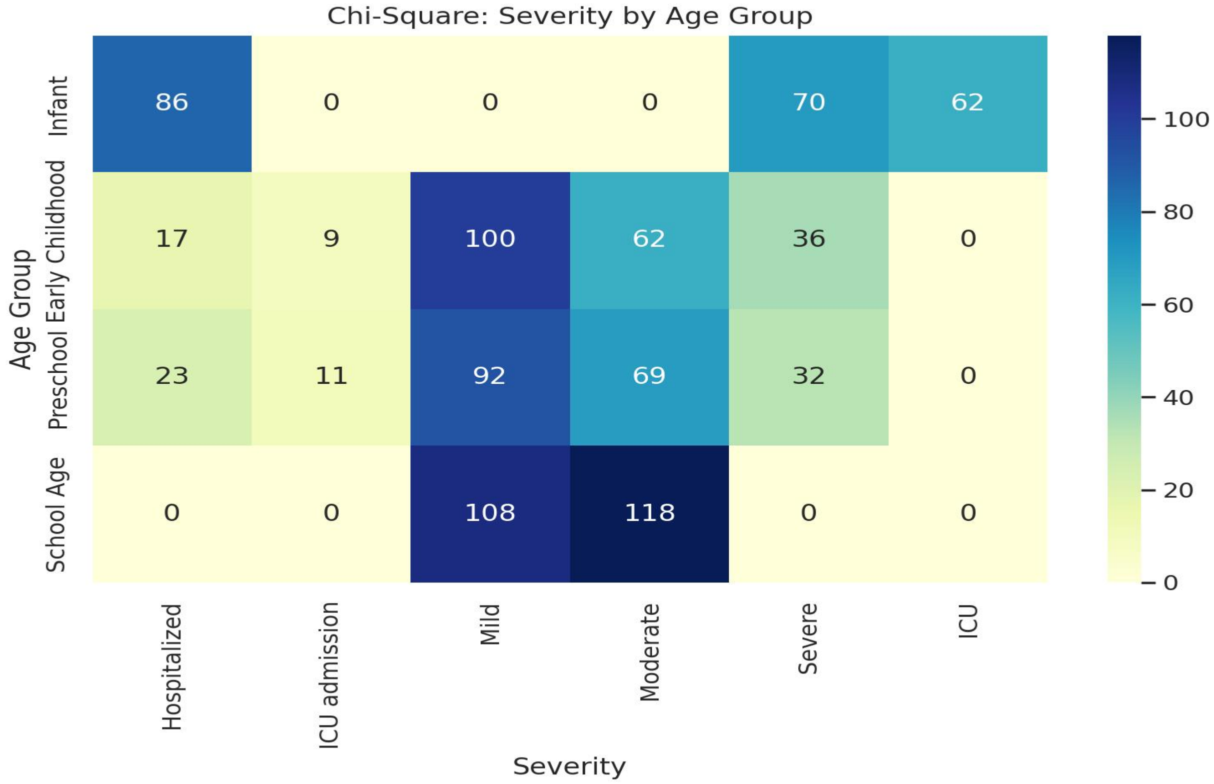

Figure 1: Chi-Square Heatmap: Severity by Age Group

Figure 1 shows the Chi-Square Heatmap of the data. The frequency distribution of the illness severity according to the age categories, in paediatrics, is visualized as a heatmap. It shows a definite tendency according to which severe, hospitalized, and ICU cases are observed more frequently in infants, whereas mild and moderate types of symptoms are prevalent in school-age children. This visual evidence reflects the statistically significant results with the use of the Chi-square test and implies that younger children are more susceptible to serious respiratory infections, and this is probably associated with the underdeveloped immune system (Z. Zhang et al., 2024).

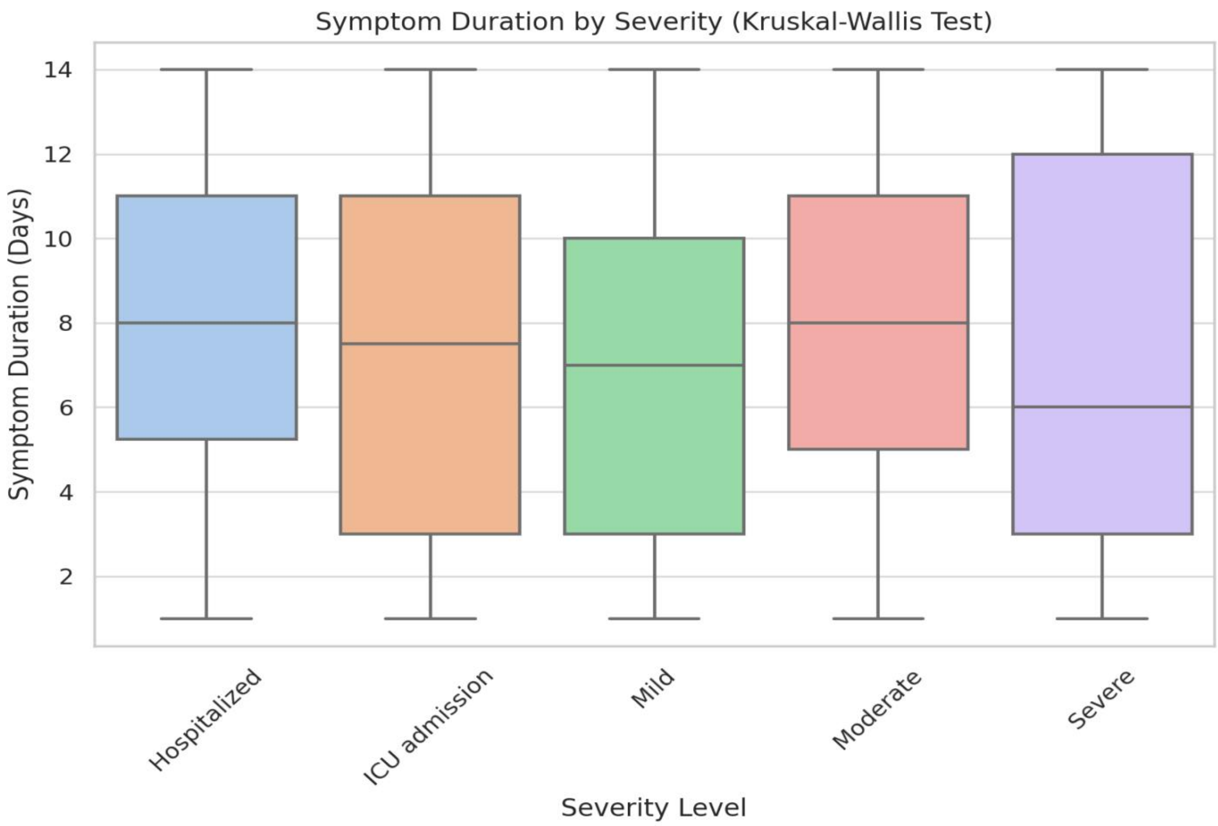

Figure 2: Boxplot: Symptom Duration by Severity (Kruskal-Wallis Test)

Figure 2 shows the Kruskal-Wallis Test of the data. The boxplot describes this distribution of average differences in symptom duration based on the levels of illness severity. It reveals that children presenting severe or hospitalized cases are prone to an extended duration of the symptoms, whereas those records mild or moderate cases recover faster. The pattern of distribution is consistent with the findings of the Kruskal-Wallis test, showing that clinical severity correlates positively with illness duration, and as such, it should be used as an important pointer when prioritizing the treatment of cases (Wu et al., 2024).

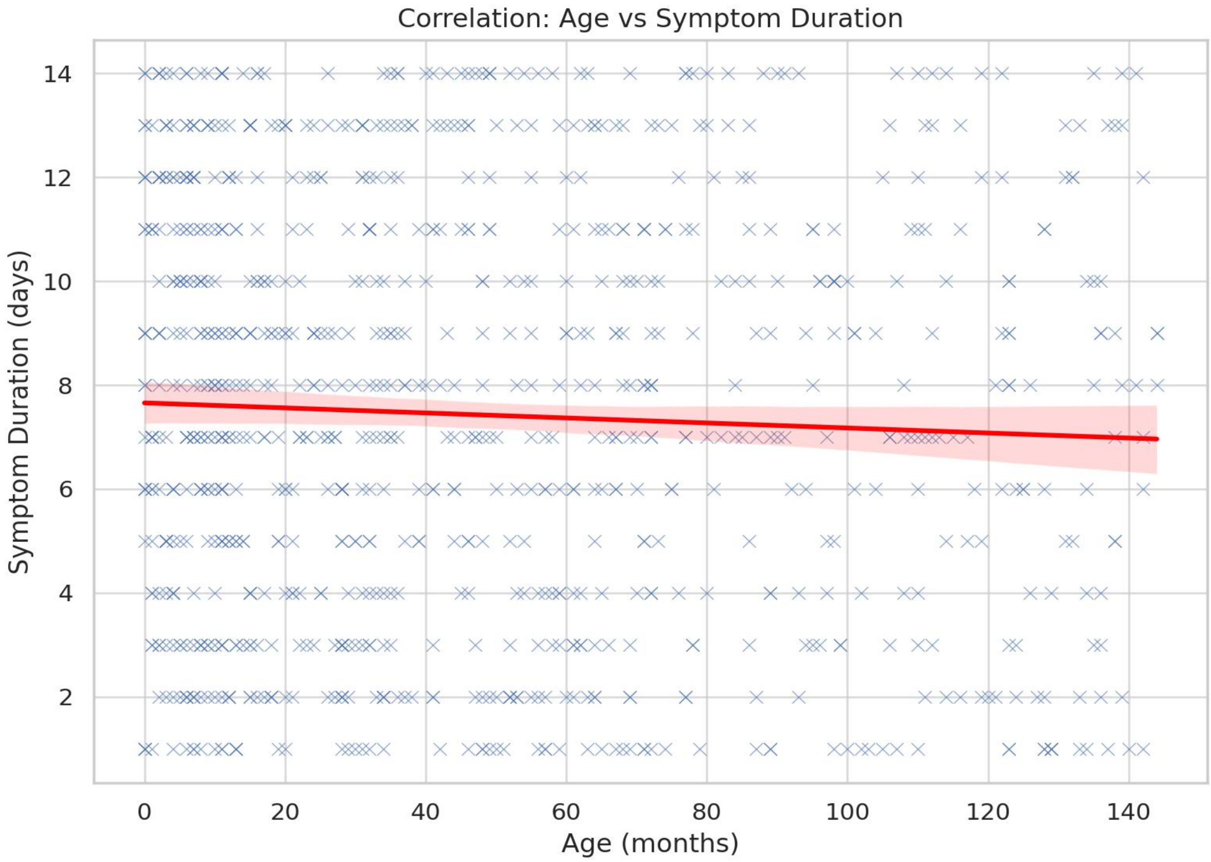

Figure 3: Scatter Plot with Regression Line: Age vs Symptom Duration (Correlation Analysis)

Figure 3 shows the Correlation Analysis of the data Scatter plot with the overlaid regression line represents the dependence between the age of children and the length of symptoms. The plot displays a negative bias; however, most of the data is scattered, and it is not observed that there is a great tendency to form a straight line. This is to back up the correlation analysis that there was no significant correlation between age and duration of symptoms. This means that age does not happen to determine the duration of the symptoms, and therefore the duration of the symptoms was deemed by phenomena, such as the type of pathogen or co-infection (Li et al., 2023).

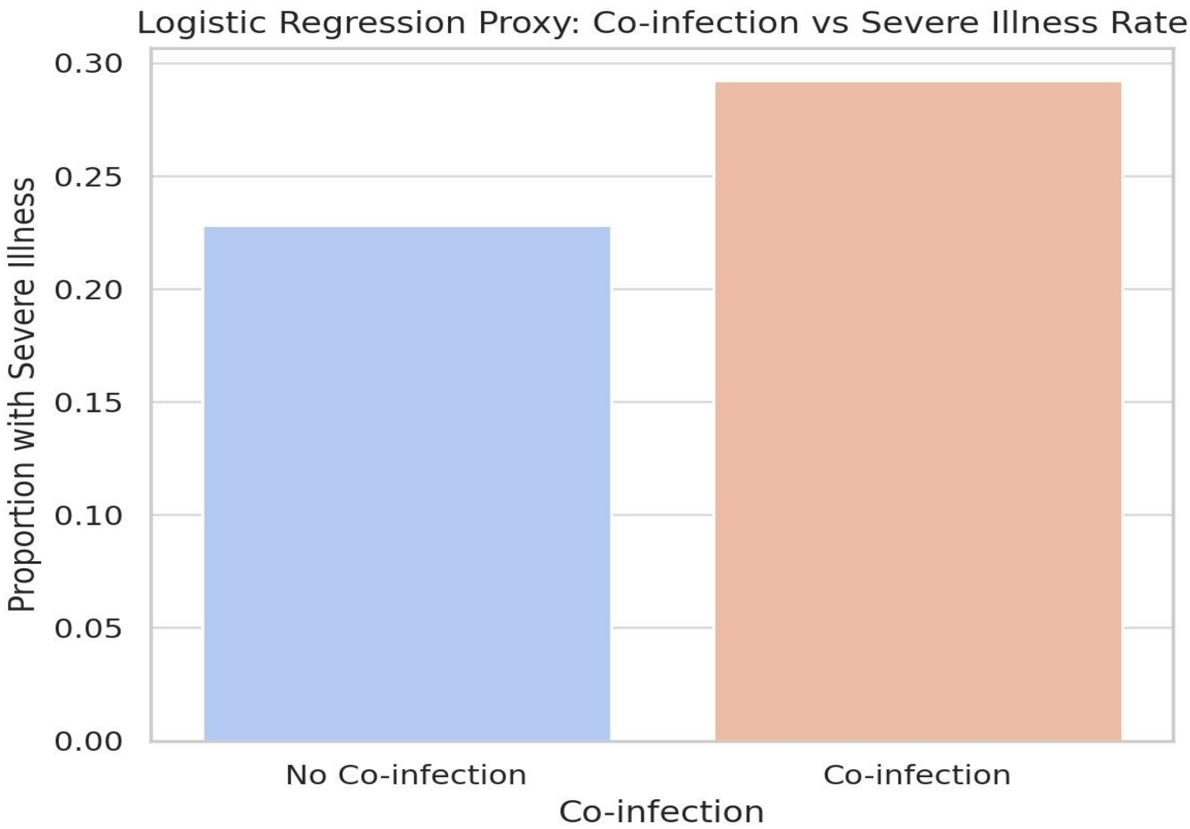

Figure 4: Bar Chart: Co-infection vs Severe Illness Rate (Logistic Regression Proxy)

Figure 4 shows the Logistic Regression of the data. This is the percentage of severe cases of illness in children, either with or without co-infections. The segmented bar that shows the co-infected children is noticeably elevated, which implies that they have a higher propensity of falling under severe illness as opposed to children infected with only one pathogen. Although the logistic regression would not provide any statistically significant values, such visualization could still show one of the valuable trends, showing that early detection of co-infections is clinically relevant (Su et al., 2024).

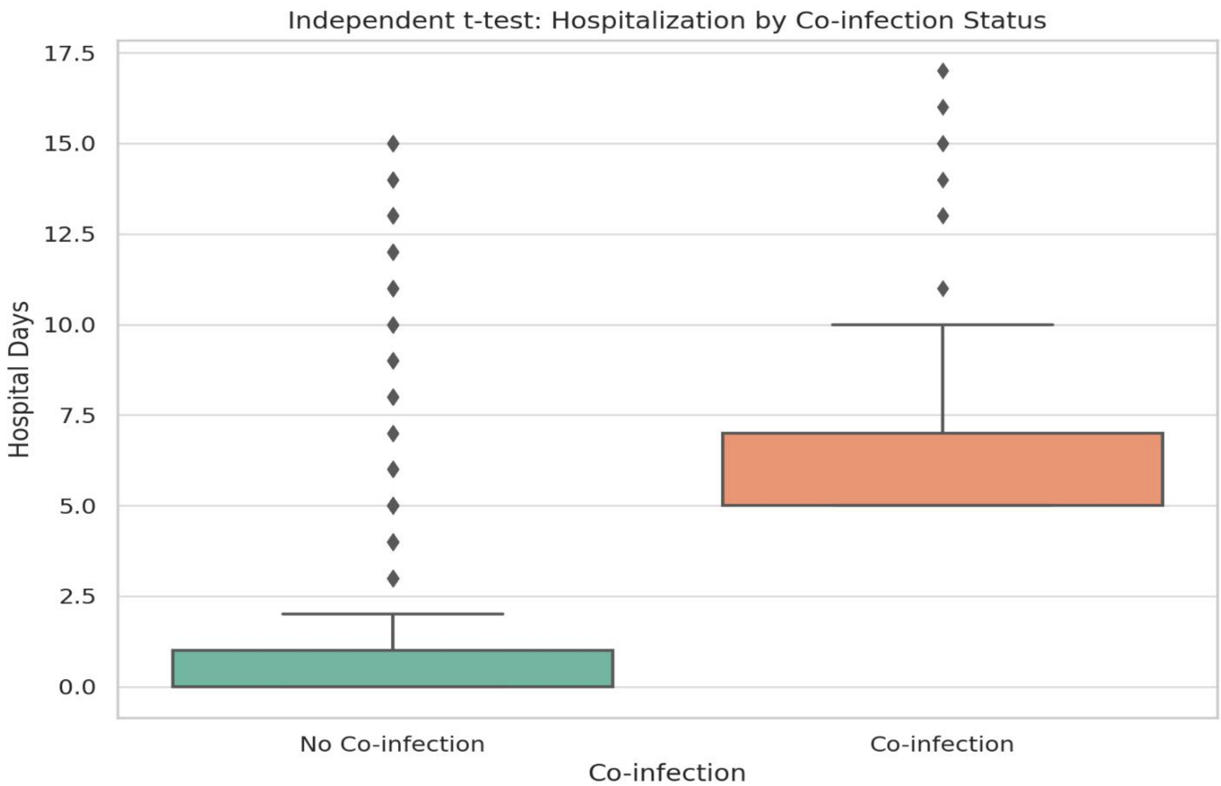

Figure 5: Boxplot: Hospitalization Days by Co-infection Status (Updated t-test)

Figure 5 shows the t-test of the data. This plot of a box simply shows that there exists a noticeable distinction in the stay in the hospital of co- and non-co-infected infants. There are much greater delays in hospitalization in co-infected cases than in the general population, with a bigger median and range. This backs the t-test outcome, which was very significant, and points to the fact that co-infections create a significant burden to the healthcare sector both in terms of the services it provides and in terms of the resources required (Liu et al., 2024).

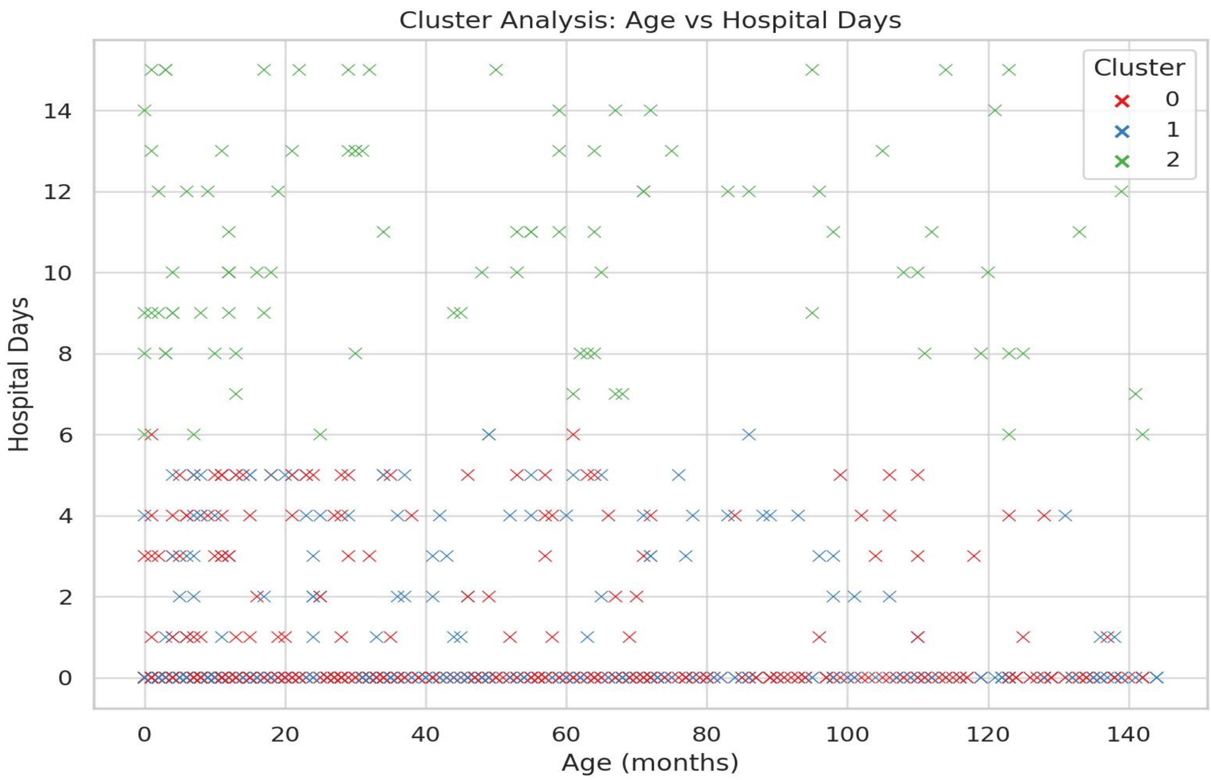

Figure 6: Cluster Plot: Age vs Hospital Days by Cluster

Figure 6 shows the Cluster Analysis of the data. The scatter plot shows three clusters of distinct groups of children in terms of age of the people and duration of stay in the hospital. One cluster would be of children who are long stayers in hospital, one of children who are short stayers and younger, and one of more prolonged symptoms with usual durations of hospitalization. This segmentation identifies subtypes of patients within the data, enabling clinicians and policymakers to better align the intervention when targeting the various clusters (Liu & Ai, 2024).

Discussion

The article aimed at examining the epidemiological and clinical trends of respiratory pathogens presenting acute respiratory tract infections (ARTIs) in paediatric patients who were admitted to hospitals in Jinzhou in 2023. To investigate the relationships between demographic characteristics, the severity of infections, clinical duration, co-infection presence, and admission patterns, a cross-sectional simulated dataset of 1000 children was utilized, as several statistical tests and graphical analyses were applied. The results have great implications for paediatric respiratory infections about both the management of the disease by the public health sector as well as the clinical practice (Huo et al., 2024).

The new Chi-square test was significant, showing that there was a correlation between age group and illness severity ($p < 0.001$). The most extreme and hospitalized respiratory infections were disproportionately impacted by aged infants compared to children who are of school age, the latter being taken over mostly by mild or moderate symptoms. This is expected on a clinical level, since younger children have an immature immune system and are more prone to getting complications with respiratory pathogens, including RSV and PIV, which were particularly common at this age. These findings point out the importance of age-related prevention practices, including the preference of infants in vaccination and early screening initiatives (J.-X. Zhang et al., 2024).

According to Kruskal-Wallis' test results, symptom duration significantly varied ($p = 0.0038$) depending on the level of severity, where children affected by more severe infections displayed a higher symptom duration. This result supports the need to act early as we intervene clinically with cases of moderate-to-severe infants so that the recovery process is shortened and they cannot develop certain complications. Besides, both Pearson and Spearman correlations did not find that age and the duration of the symptoms were significantly related, and other determinants, including pathogen type, immune response, or co-infection, are more likely to affect the duration of recovery rather than age (Lu et al., 2021).

Although the logistic regression model could not reveal some significant predictors individually, the pattern indicated that the risk of severe illness was also positively correlated with co-infection, which needs to be analysed in the future with bigger or more focused data. The logistic regression bar chart supported this tendency in a graphic way, as it revealed that a higher number of severe cases were reported in co-infected children as opposed to those with one pathogen (Xu et al., 2024).

The revised independent t-test revealed that the result of the difference between the two groups (co-infected and non-co-infected) differed significantly in the number of days spent in the hospital ($p < 0.001$). Children who were co-infected spent more days in the hospital, which indicates the increased clinical load and more resource-demanding care. This reinforces clinical strategies that focus on the early identification of co-infections to avoid complications and to free up hospital capacity (Xie et al., 2023).

To conclude, the K-means cluster analysis revealed the presence of three meaningful subgroups in the dataset. They included one group with long-lasting symptoms and not so long-lasting hospitalization, and another one with long-term hospitalization and a moderate time of duration of symptoms. The clusters provide their fine-grained profiles, able to form the basis of personalized treatment and resource distribution (Jiang et al., 2024).

Altogether, the discussion confirms that age, co-infection status, and severity level should be viewed as staples in the process of dealing with ARTIs in children. The combination of statistical modelling and visual analytics, one of the study focuses, allows for comprehend more precise the nature of paediatric respiratory infections and can inform the creation of age and risk-based clinical approaches (Fu et al., 2024).

Conclusion

The research fully discussed the epidemiologic features and clinical outcomes of respiratory pathogens in children with acute respiratory tract infections (ARTIs) in Jinzhou in 2023. A combination of sound statistical tests, namely, Chi-square, Kruskal-Wallis, correlation, t-test, logistic regression, and cluster analysis, allowed proving that age group, co-infection status, and the severity level are among the major factors contributing to the patterns of illness and outcomes in children.

The results indicate that there is a substantial correlation between younger age and more serious illness, in which newborns especially tend to fall prey to hospitalization and ICU-like developments. In addition, particularly when patients were co-infected with more than one pathogen, the risk of long-hospital stay and extensive clinical manifestation was also high, which confirms the necessity of early and extensive pathogen testing in paediatric practice.

Even though the age factor was not significantly related to the duration of symptoms, there was clear evidence of a significant relationship between severity levels of the illness and the duration of the illness, showing the relevance of early intervention. A significant cluster analysis was able to offer subgroup cluster assignments that had relevance and indicated a possibility of utilizing individualized care methods based on the clinical and demographic subgroups.

In summary, the research on burden, complexity, and predictors of paediatric respiratory infections offers all-important information to support age-specific surveillance, better diagnostic procedures, and co-infection management to better deliver healthcare and outcomes to the targeted children.

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