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ATYPICAL INFECTIONS IN ACUTE RESPIRATORY FAILURE IN CHILDREN

Roxana-Elena Bogdan-Goroftei[1], Raisa Eloise Barbu[2]*, Monica Marinescu[3], Iuliana Petruta Moraru[1], Pompiliu-Mircea Bogdan[1], Cristian Guțu[1], Diana-Andreea Ciortea1,2 , Anca Ștefanopol1,2

[1]Faculty of Medicine and Pharmacy, Dunarea de Jos University of Galati, Galati;
[2]Emergency Clinical Hospital for Children, "St. Ioan", Galati;
[3]Military Emergency Hospital "Dr. Aristide Serfioti" Galati.
Corresponding author – Raisa Eloise Barbu – raisauibariu@gmail.com

Abstract

This article aim to identify the main agents and biologicals within the pediatric population hospitalized in the Emergency Clinical Hospital for children, "Sfântul Ioan", Galati. In order to achieve this goal, we conducted a retrospective study on a group of 102 pediatric patients admitted into our clinic, between January 2018 and November 2020, being a cohort type.

Respiratory infections, especially opportunistic infections, are often seasonal. Especially increased in the cold months due to seasonal immune depression. The influenza virus H. influenzae is a pathogen with a higher prevalence in the winter months.

In order to assess the susceptibility to infections, according to season and age the cross-frequency table and the chi-square test have been performed, and there is no statistically relevant dependence relationship between these variables.

Of the 102 patients, 74.51% had a history of respiratory ailments. The most frequent conditions encountered in the antecedents, within this group, were an acute respiratory failure (29.4%) and pneumonia (33.3%).

For our study group, in the case of the type of therapy used, a quasi-symmetrical distribution could be observed, where 49.02% of the subjects benefited from double or triple antibiotic therapy, while 50.98% benefited from mono antibiotic therapy.

Key words: respiratory infections, children, respiratory failure, bronchiolitis, hypoxia

Introduction

Globally, an important cause of morbidity and mortality with an estimated incidence of approximately 3.5 million deaths, an area of acute respiratory infection. (Murray and Lopez, 1997; WHO, 1999).

According to a strict definition, respiratory insufficiency includes all respiratory tract infections.

A percentage of 20% of the deaths of preschool children globally are caused by **ARI,** with pneumonia being the predominant cause of these deaths, with a percentage of 90%.

In terms of risk factors for severe **ARI**, low birth weight, lack of breastfeeding, malnutrition, low socio-economic status, HIV infection, and immunodeficiency are mentioned, all of these factors is found especially in developing countries (Hinman, 1998; Simoes, 2003; Peat, Keena, Harakeh and Marks, 2001).

Among the etiology of respiratory infections, the most common is bacterial etiology, while the most common microorganisms are Streptococcus pneumoniae and Haemophilus influenza. The differentiation of an ARI of bacterial etiology from an ARI of viral etiology cannot be made following radiological investigations or clinical manifestations.

Multiple pathogens responsible for ARI such as Coronaviruses, Human Metapneumovirus, and Human Bocavirus, are reported according to the specialized literature (van den Hoogen et al., 2001; van der Hoek et al., 2004; Pyrc, Berkhout and van der Hoek, 2007; Allander et al., 2005).

Regarding the treatment of pathogens causing ARI in children under 5 years of age, respiratory syncytial virus (RSV), hMPV, rhinoviruses (RV), and parainfluenza viruses (PIV) were predominantly encountered. Seasonal peaks and infections with multiple viral pathogens have been observed occurring in 4–33% of children (Brunstein, Cline, McKinney, and Thomas, 2008; Sung et al., 2008; Regamey et al., 2008).

A correlation between the severity of the disease and certain viruses has been demonstrated by very few southerners. Similarly, few studies have examined the viral causes of clinical conditions in children under 5 years of age. (Midulla et al., 2009)

The purpose of the article

This article aim to identify the main agents and biologicals within the pediatric population hospitalized in the Emergency Clinical Hospital for children, "Sfântul Ioan", Galati.

Objectives of the article

The objectives of this article, numerous to count, have been divided as follows:
Main objective:

- Prevalence of cases that presented co-infection
- Identification of antibiotics used in the treatment of infections
- Evaluation of the number of intern days, such as the statistical distribution and their average value.
- Evaluation of the seasonal frequency of admissions

Secondary objective

- Evaluation of the distribution of the research group according to gender, background, and age group.
- Identification of community and family cases
- Identification of subjects' vaccination status

Material and Method

Description of the research group

The article was carried out retrospectively, the study was carried out on 102 pediatric subjects from the Emergency Clinical Hospital for Children, "Sfântul Ioan", Galati, between January 2018 and November 2020, being a cohort type.

The observation sheets of pediatric patients who, upon admission or discharge, presented the diagnosis of respiratory insufficiency, or a diagnosis equivalent to a respiratory infection, were used.

Several inclusion and exclusion criteria were imposed on this batch such as:

Inclusion criteria

- Pediatric patients with a diagnosis of infection or respiratory failure
- Age between 0 and 18 years.
- The presence of antibiotic therapy used

Exclusion criteria

- Incomplete records in observation sheets, such as lack of treatment, lack of etiological agent, as well as lack of collection in all diagnostic methods.

Description of the research instrument

The information necessary to achieve the goal and the objectives proposed in this study were collected through the individual observation sheets of the patients, archived in the Children's Emergency Clinical Hospital, "Sfântul Ioan", Galati.

The evaluation of the chosen therapy, the prevalence of etiological antibiotics, and the main symptoms in the pediatric population was carried out with the help of observation sheets that include both the diagnosis of ARI in internal medicine and the typical symptoms of respiratory pathologies such as cough, rhinorrhea, wheezing, dyspnea.

The final triage of the collected data was based on the aforementioned inclusion and exclusion criteria, with the final form of the study including 102 subjects.

The data collection was carried out following the following key points:

- Socio-demographic data of the subjects
- Internal diagnosis
- Personal pathological antecedents
- Pharmacological therapy used
- The main etiological agents

Data processing, collection, and analysis procedures

For the elaboration of these works, the collected data that were considered relevant were entered into a database and subjected to a triage to eliminate variables that are not necessary for the evaluation of the studied pathology.

Also, within the database, variables were coded and grouped, thus facilitating the development of statistical analysis.

The statistical evaluation in this work was carried out using several statistical methods. Pie or bar graphs were used, as well as histograms for the graphical representations, with the help of which the lot distribution and its deviation from the norm, known in the histogram as the Gaussian curve, were evaluated.

In addition, contingency tables were made and the non-parametric chi-square test ($\chi 2$) was applied to evaluate the degree of dependence of the studied variables and their degree of statistical significance. Statistical significance was evaluated by the statistical significance index p, it should not be $p<0.005$.

The linear dependence of two variables was assessed using the Pearson correlation coefficient which can have several values such as:

- $r>0$, positive linear correlation, increasing the value of the first variable is associated with or increases the level of the second.
- $r=0$, the degree of dispersion is too high, there is no linear correlation
- $r<0$, negative linear correlation, the increase in the value of one variable is associated with a decrease in the level of the other.

After applying all the criteria, the data obtained were in a final centralizing table, with the help of which the database necessary for the elaboration of the statistical results of these works was created.

The data processing and evaluation program is SPSS v26, within which the activity variables were co-coded, and the answer is associated with a figure.

Result

This research work was carried out on a group of 102 subjects, pediatric patients from the Emergency Clinical Hospital for Children, "Sfântul Ioan", Galati.

In terms of gender distribution, in the case of our study group, the majority of subjects were male (63.7%), while 36.27% were female (*Figure 1*).

Following the age group distribution of the study group, it could be observed that in the age group between 1 year and 5 years, there are the most subjects, more precisely 53.92% (*Figure 2*).

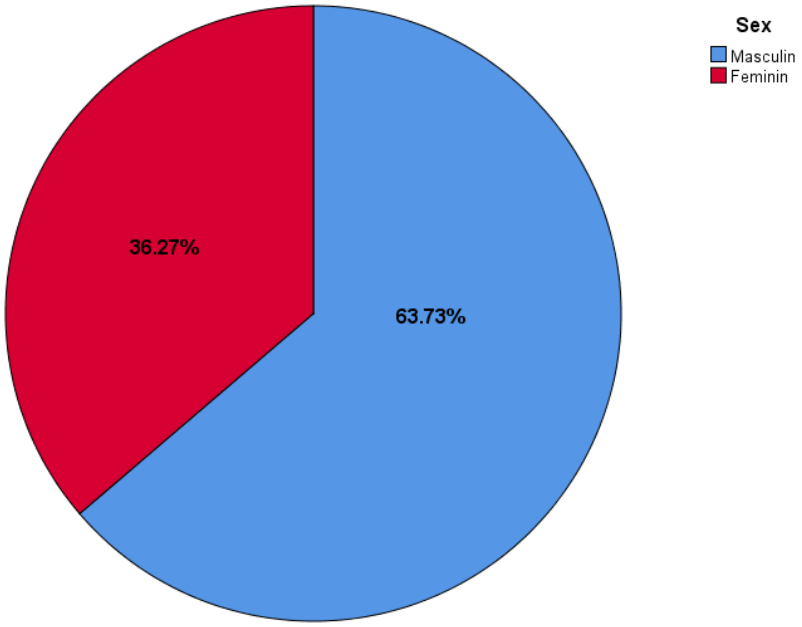

Figure 1 Gender Distribution Of Tthe Research Group

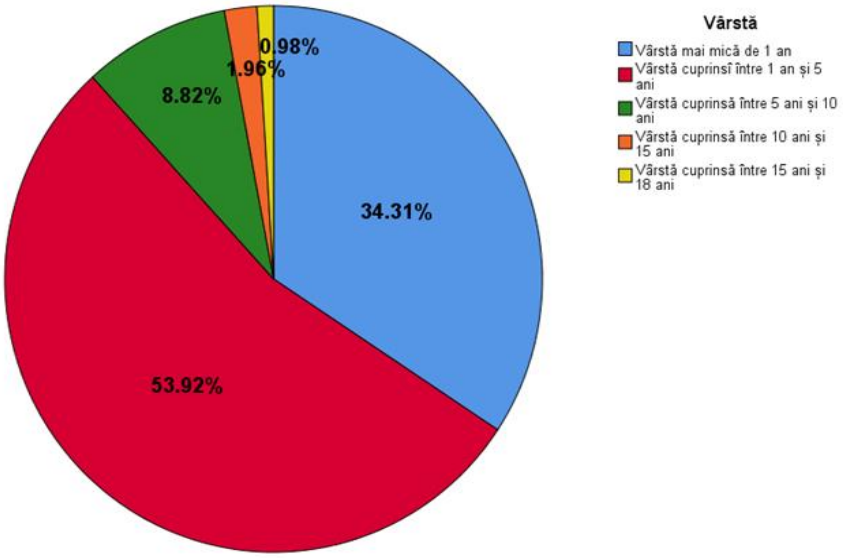

Figure 2 Dstribution By Age Category Of The Research Group

The importance of knowing the environment of origin is due to the variations in care between urban and rural areas. Another reason is the fact that at the level of disadvantaged or weak areas from an economic point of view, there are increased incidents of pathologies due to access to specialized medical care.

In our group of patients, 61.76% come from the urban environment and 38.24% from the rural environment (*Figure 3*).

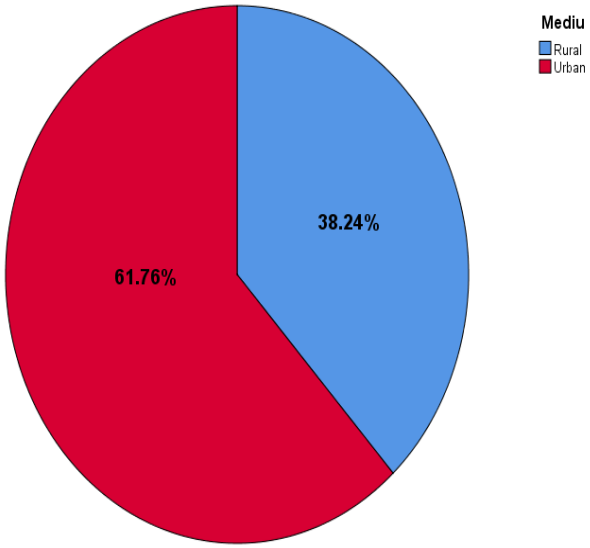

Figure 3 Distribution According To The Environment Of Origin Of The Research Group

Mean length of hospital stay and distribution of the cohort according to it.

The duration of hospitalization in this group was evaluated statistically using descriptive statistics, through statistical and graphic evaluation of frequency.

The average duration of hospitalization is 7.31 (mean= 7.31), with a standard deviation from the mean of 0.482. Also, the maximum number recorded within this variable is 33, while the minimum number is 2.

The index of asymmetry, or skewness, has a value of 2.395, which means that the distribution of this batch according to the days of the internal shows a positive asymmetry. The kurtosis index evaluates the degree of curvature of the histogram, the value of 8.276, the distribution is leptokurtic (*Figure 4*). This positive asymmetric and leptokurtic distribution can also be observed within the histogram in *Figure 5*, where it is observed that the peak of the histogram is more marginal to the left, and to the right this presentation called "heavy tail", specific to the positive asymmetric distribution.

Statistics

Zile_internare

N	Valid	102
	Missing	0
Mean		7.13
Std. Error of Mean		.482
Median		6.00
Std. Deviation		4.866
Variance		23.677
Skewness		2.395
Std. Error of Skewness		.239
Kurtosis		8.276
Std. Error of Kurtosis		.474
Minimum		2
Maximum		33

Figure 4 Statistical Evaluation Of The Frequency Of The Number Of Days Of Hospitalization

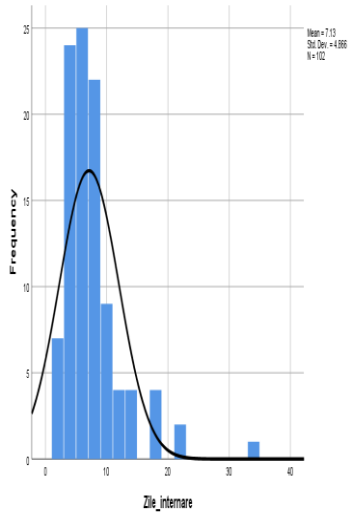

Figure 5 Positive Asymmetric Leptokurtic Histogram, Representing The Distribution Of Internal Days Within The Batch

Seasonal prevalence of hospitalizations and association with the etiological agent

Respiratory infections, especially opportunistic infections, are often seasonal.

The increased incidence of respiratory infections is increased in the cold months due to seasonal immune depression. The influenza virus H. influenzae is a pathogen with a higher prevalence in the winter months.

The highest incidence in this study group of acute respiratory infection cases was recorded in autumn (36.3%), followed by the incidence in winter (35.3%). The summer period had the lowest prevalence, with only 9.8% of infections occurring in this activity (*Figure 6*).

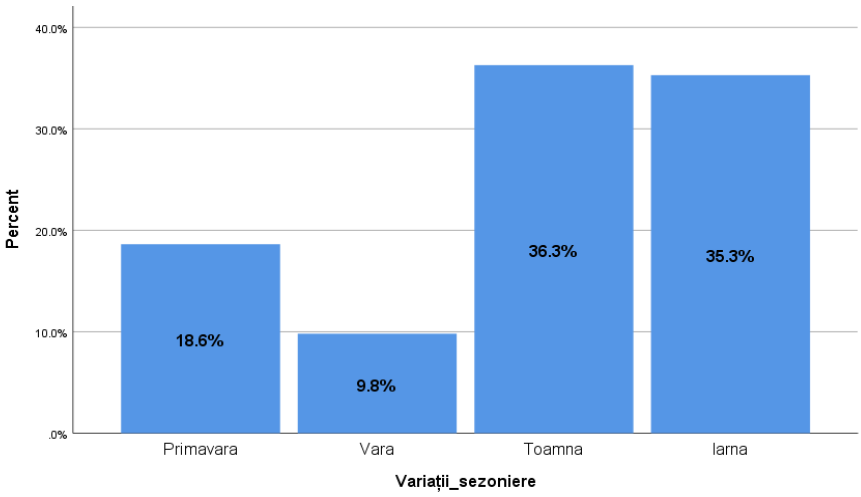

Figure 6 Prevalence Of Infections According To Season

The assessment of susceptibility to infections according to season and age was performed and statistically analyzed using the cross-frequency of these two variables. Later, using the cross-frequency table and the chi-square test performed on these two variables, the following conclusions were drawn.

- Most patients aged one year developed respiratory infections in winter (n=17).
- The majority of subjects aged 1 to 5 years developed respiratory infections in the fall (n=24)(*Figure 7*).
- There is no statistically significant dependence relationship between these variables. The minimum number expected by the tests is less than 5 in 65% of cases, and the minimum number counted is 0.1 and p=0.006 (*Figure 8*).

Variații_sezoniere * Vârstă Crosstabulation

Count

		Vârstă					
		Vârstă mai mică de 1 an	Vârstă cuprinsî între 1 an și 5 ani	Vârstă cuprinsă între 5 ani și 10 ani	Vârstă cuprinsă între 10 ani și 15 ani	Vârstă cuprinsă între 15 ani și 18 ani	Total
Variații_sezoniere	Primavara	12	7	0	0	0	19
	Vara	1	8	0	1	0	10
	Toamna	5	24	6	1	1	37
	Iarna	17	16	3	0	0	36
Total		35	55	9	2	1	102

Figure 7 Cross-frequency Table Between Seasonal Variations And Age Of Subjects

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	27.549[a]	12	.006
Likelihood Ratio	30.267	12	.003
N of Valid Cases	102		

a. 13 cells (65.0%) have expected count less than 5. The minimum expected count is .10.

Figure 8 Chi-square Test Of Independence Between Seasonal Variations And Subjects' Age

Evaluation of the subjects' personal history of respiratory pathology and the relationship of this history with previous hospitalizations.

To assess the susceptibility of subjects to dementia, the enrichment of personal pathological antecedents is necessary.

More than 74.51% of the subjects included in the study group had a history of respiratory diseases, compared to 25.49% who did not have such an antecedent (*Figure 9*).

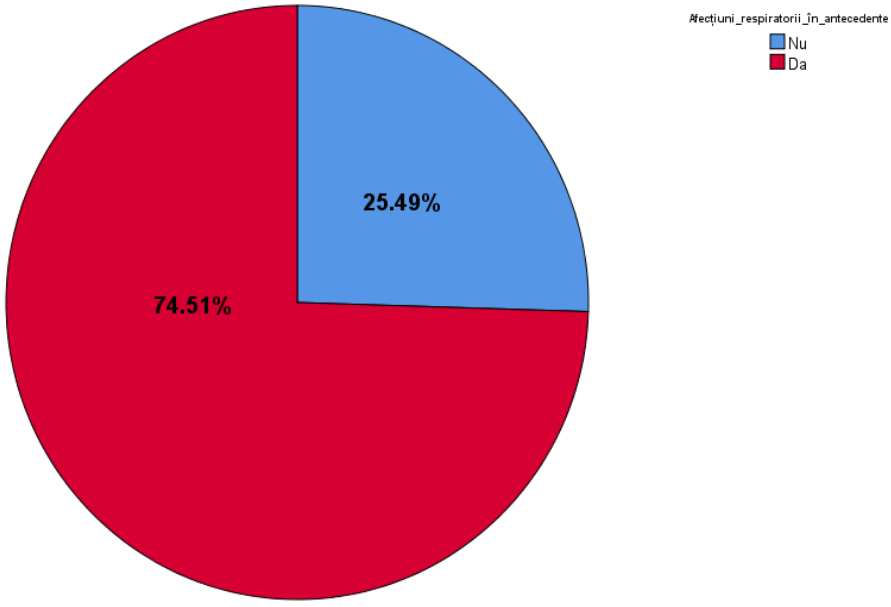

Figure 9 Prevalence Of Respiratory Diseases In The Antecedents

Respiratory infections have antibiotic therapy as the therapy of choice, which can consist of a single antibiotic that is mostly broad-spectrum, or of several antibiotics. Antibiotic therapy is dependent on the etiologic agent and sensitivity to common broad-spectrum antibiotics.

For our study group, in the case of the type of therapy used, a quasi-symmetrical distribution could be observed, where 49.02% of the subjects benefited from double or triple antibiotic therapy, while 50.98% benefited from mono antibiotic therapy (*Figure 10*).

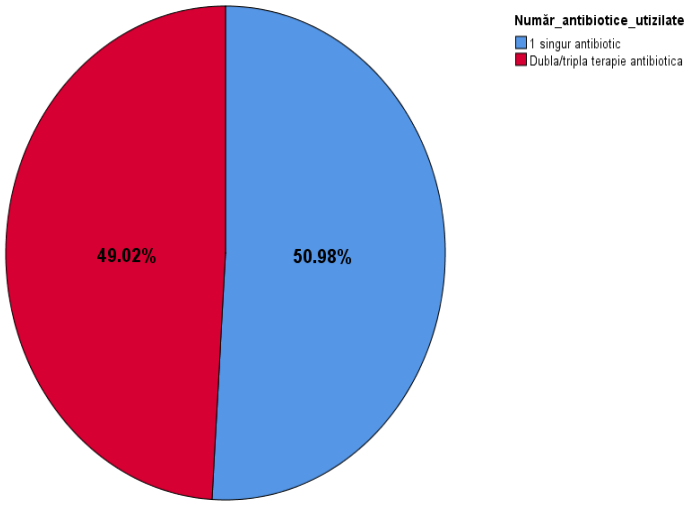

Figure 10Prevalence Of Type Of Antibiotic Therapy Within The Study Group

The most common combination of antibiotics used in our study group was that between gentamicin and other antibiotics (31.4%), while the most frequently used antibiotic in mono-antibiotic therapy was amp plus (18.6%). Ampiplus was also used in drug combinations, with this combination accounting for 5.9% of treatment types. (*Figure11*),

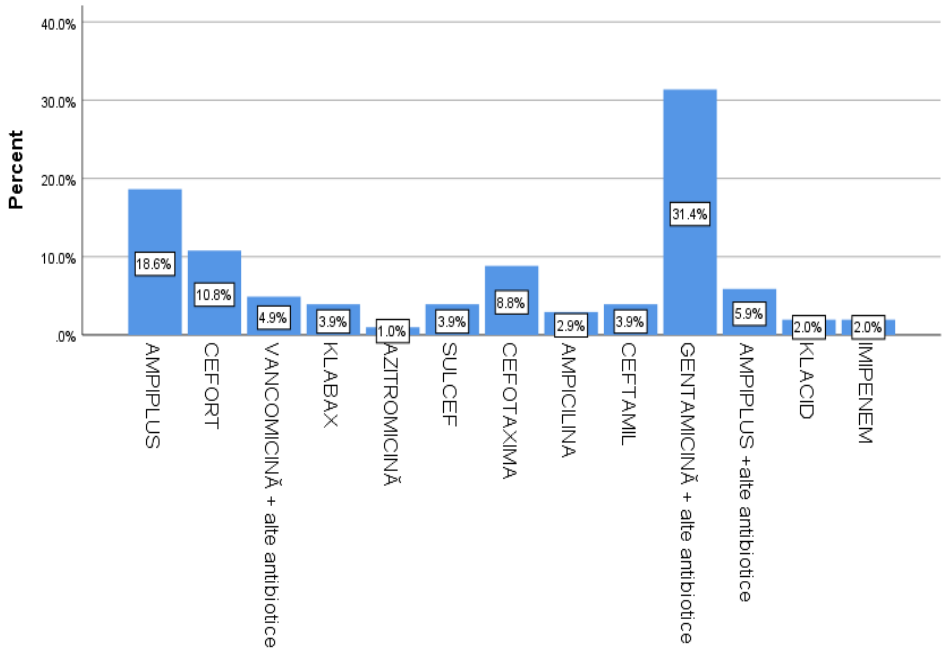

Figure 11 Rate Of Antibiotic Use In The Study Group

Prevalence of main etiological agents and co-infection cases

The most common etiological agent encountered in our study group is Staphylococcus aureus, in a percentage of 45.54% of the 102 patients, followed by Streptococcus pneumoniae in a percentage of 22.77% (*Figure 12*).

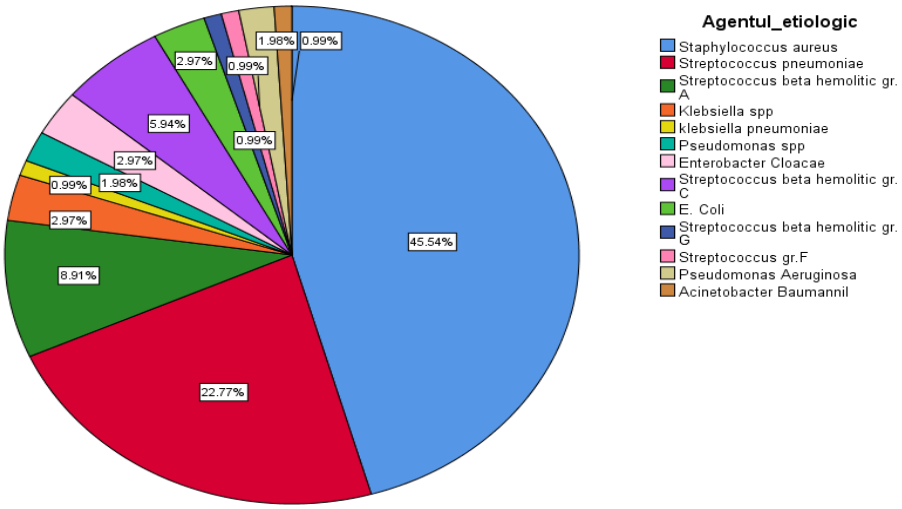

Figure12 Etiological Agents In The Research Group

Also of significant importance is knowing the co-infection rate with other pathogens. The most frequent cases of co-infection were identified in cases where the etiological agent is Staphylococcus aureus, Streptococcus pneumonia, and Group C beta-hemolytic Streptococcus, all representing a percentage of 5.88%. (*Figure 13*).

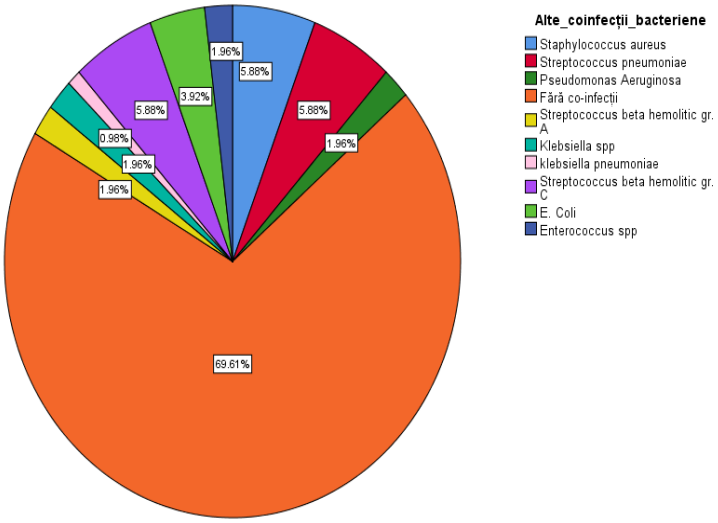

Figure 13Co-infection Rate In The Studied Group

Identification of subjects' vaccination status

For the study group of 102 subjects, the MS vaccination rate was assessed.

Thus, according to figure 55, a very small number of subjects (5.88%) were not vaccinated for MS, while 94.12% of subjects performed between vaccinations. (*Figure 14)*

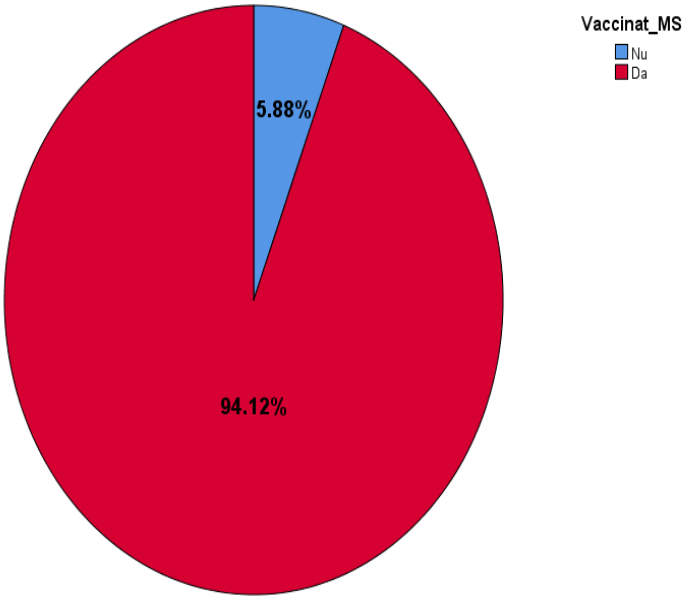

Figure 14 Prevalence Of MS Vaccination In The Cohort.

Discussions

Of the study group, the majority of subjects are male (63.73%), with the highest age prevalence within the 1-5 years group.

The environment of origin is predominantly urban, the lower distribution in rural areas may be due to the absence of medical institutions.

Regarding the distribution according to the seasons in which the infection occurred, there is an almost equal distribution between the winter and autumn seasons, with an increased prevalence during the period of low temperatures.

Of the 102 patients, 74.51% had a history of respiratory ailments. The most frequent conditions encountered in the antecedents, within this group, were an acute respiratory failure (29.4%) and pneumonia (33.3%).

Gentamicin along with other antibiotics (31.4%) represented the treatment of choice for respiratory infections, while the preferred antibiotic in mono antibiotic therapy was ampiplus (18.6%) of the cases.

The etiologic agent with the highest percentage (45.54%) is Staphylococcus aureus, followed by Streptococcus pneumoniaat 22.77%.

Conclusions

In conclusion, based on the results and statistical analysis presented above, the following can be stated:

- the batch is made up mainly of male patients, from the urban environment.
- The highest incidence of cases is in the age group between 1 and 5 years.
- Diagnosis at admission was an acute respiratory failure in almost all cases.
- The personal pathological antecedents of the subjects were related to respiratory insufficiency which is a manifestation.
- The preferred treatment is multi-antibiotic type
- The main etiological agent is Staphylococcus aureus

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