

CROUP IN CHILDREN AND RISK FACTORS

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ABSTRACT

Croup is a common respiratory illness in children under 5 years, primarily caused by viral infections. Symptoms include inspiratory stridor, barking cough, and hoarseness due to inflamed vocal cords. Diagnosis is based on symptoms difficulty breathing, stridor, chest in-drawing voice changes and head nodding. Severity ranges from mild to severe cases. This study aimed to explore variations in croup and factors contributing to its recurrence in children. This retrospective longitudinal study analyzed health records from the Pediatric Practice "Vitalino" in Veles, North Macedonia, from 2016 to 2022. It included children aged 0-5 years who had croup at least once. The sample was substantial and representative, allowing for a thorough examination of potential correlations and trends in croup occurrence. Among 707 studied children, 254 had croup, with a prevalence of 35.9% over seven years or 5.1% per year. Females had lower odds of recurrent croup, while males had higher odds, but the differences were not statistically significant. Atopic dermatitis and bronchiolitis exposure were significantly associated with croup in both genders. The study provides insights into the prevalence, distribution of croup and associated conditions in young children. The significant associations of atopic dermatitis and bronchiolitis suggest a link between these conditions and recurrent croup. Considering these strong associations, we can conclude that bronchiolitis and croup should be included in the trajectory of the atopic march.

Keywords: Croup, Children, Risk Factors

INTRODUCTION

Croup is a common respiratory illness affecting the trachea, larynx, and bronchi in children under the age of 5. It often presents with inspiratory stridor and a barking cough due to viral infections like Parainfluenza virus, influenza A and B, measles, adenoviruses, and respiratory syncytial virus (RSV). Bacterial causes are rare. Croup affects about 3% of children per year, typically between the ages of 6 months and three years. Annually in the United States, croup accounts for 7% of hospitalizations for fever and acute respiratory illness in younger children than five years of

age, resulting from upper airway obstruction due to swelling of the larynx, trachea, and bronchi [1].

The disease is characterized by varying degrees of inspiratory stridor, barking cough, and hoarseness. Fever is not necessary for diagnosis. The diagnosis is primarily clinical, with minimal need for diagnostic investigations [2]. Management has improved significantly in the past decade, with corticosteroids being routinely used for children with croup [3]. Clinically, croup can manifest as mild, moderate, or severe. Severe cases, even though rare, are life-threatening and

require immediate hospitalization. Croup typically occurs at night with a strong hacking cough, hoarse voice, and inspiratory stridor. It is most common in children aged 6 months to 5 years and accounts for approximately 15% of lower respiratory diseases in children. The recurrence rate is high, with 61% of patients experiencing at least three episodes [4].

In the study “Croup and recurrent croup: their association with asthma and allergy” by Van Bever HP, Wieringa MH, Weyler JJ, Nelen VJ, Fortuin M, Vermeire PA, 15.5 % of children had suffered from croup, while 5.0 % had recurrent croup, with boys showing a higher cumulative incidence than girls. Children with croup or recurrent croup have an increased risk of wheezing, asthma, use of asthma medications, rhinitis, and hay fever [5]. The croup often begins as a mild viral infection and progresses to a dry, barking cough, hoarse voice, and inspiratory stridor, usually at night or in the early morning, causing significant anxiety for parents and increasing the risk of hospitalization [6].

Younger children are more affected due to the small dimensions of their airways, and laryngeal edema exacerbates the condition. The diagnosis of croup is straightforward, based on symptoms like difficult inspiration with laryngeal stridor, hoarse voice, intercostal retractions, and a dry, barking cough [7].

Mild croup presents with stridor without intercostal retractions, while moderate-to-severe croup involves increased work when breathing. A single dose of orally administered corticosteroids is the main treatment. Severe cases, though less common, can lead to respiratory failure, requiring emergency care [8].

Voice disorders affect up to 23.4% of the pediatric population and negatively impact quality of life [9]. Many children under 5 experience recurrent croup attacks, with allergic sensitization and gastroesophageal reflux being significant factors. Prior history of croup or bronchiolitis and multiple lower respiratory illnesses are associated with increased airway responsiveness, suggesting a need for longitudinal studies to understand these risk factors better [10].

Some evidence indicates that children with a history of croup may be at higher risk for developing asthma, atopy, and reduced pulmonary function later in life. This study aimed to determine the long-term outcomes of croup diagnosed in early life. Ten percent of children had croup

with wheeze, 5% had croup without wheeze, 36% had another lower respiratory infection, and 48% had no lower respiratory infection. RSV was more frequently isolated in children with croup and wheeze [11].

Viral croup, while usually self-limited, can occasionally become life-threatening. Asthma and allergy are common in children, influenced by genetic and environmental factors [12]. Croup and acute bronchiolitis are common viral respiratory diseases in early childhood. Corticosteroids can reduce disease severity, and nebulized adrenaline offers temporary symptomatic relief [13].

The study by Miller EK, Gebretsadik T, Carroll KN, Dupont WD, Mohamed YA, Morin LL, Heil L, Minton PA, Woodward K, Liu Z, Hartert TV, Williams JV. found that among infants with bronchiolitis, 76% had RSV, 18% had human rhinovirus (HRV), 10% had influenza, 2% had coronavirus, 3% had human metapneumovirus, and 1% had parainfluenza virus. Among infants with croup, 39% had HRV, 28% had parainfluenza virus, 28% had RSV, 11% had influenza, 6% had coronavirus, and none had human metapneumovirus [14]. Reducing X-ray use in children with croup, asthma, and bronchiolitis can decrease radiation exposure and healthcare costs [15].

AIM

This study aimed to explore variations in croup and factors contributing to its recurrence in some children.

MATERIAL AND METHODS

A cohort of 707 children aged 0-5 years in the Republic of North Macedonia was examined between 2016 and 2022. Demographic data, gender distribution, and the number of croup attacks were extracted from medical records. Clinical records from healthcare facilities were reviewed to identify cases of croup. A diagnosis of croup was confirmed based on established clinical criteria, which typically include the presence of symptoms such as inspiratory stridor, barking cough, and hoarseness. The study was specifically designed to include children from 0-5 years who had experienced one or more episodes of croup. Addition-

ally, the study did not include participants older than 5 years, and a child diagnosed with cerebral palsy was also excluded. This careful selection of participants helped to ensure a focused and relevant study. An odds ratio analysis examined the differences in the odds for recurrent croup between exposed and non-exposed groups for females and males. The odds ratio analysis was employed to explore the association between atopic dermatitis and croup, as well as bronchiolitis exposure and croup, separately for females and males.

In terms of data collection and analysis, Microsoft Excel (Version 8) was employed for data collection, facilitating efficient organization and initial analysis of the gathered information. Subsequent data analysis, involving statistical computations and modeling, was conducted using Statistics for Windows (Version 10). The analytical procedures encompassed a range of statistical tests, including the calculation of prevalence, Mean, Median and Mode and Odds ratio. These tests were employed to comprehensively explore and interpret the relationships and patterns within the collected data. The study ensured the confidentiality and welfare of the participating children. Data were anonymized and handled according to ethical standards to protect patient privacy. In this investigation, informed consent was obtained from participants, mainly parents or guardians. Strict data security measures were in place, and confidentiality was prioritized using encrypted storage and coded identifiers.

The study adhered to ethical guidelines. The combination of these methods provided a comprehensive understanding of the factors influencing croup occurrences and recurrences in the studied pediatric population of North Macedonia.

This approach allowed for identification of significant risk factors, understanding of gender differences in croup occurrence, exploration of the impact of atopic dermatitis and bronchiolitis on croup. The results of this study contribute to a deeper understanding of croup in young children, offering insights that could inform future clinical practices and preventive strategies.

RESULTS

To understand croup and its variations in children population, we retrospectively analyzed the population of 707 children from 0-5 years old for the exposition of croup from the period from 2016 to 2022. In the group of 707 children we found 254 males (329 females, and 378 males) from 0-5 years old who were exposed to croup from the period of 2016-2022 year.

The data are organized so that the children are categorized based on specific characteristics, distribution of attacks of croup including the presence of atopic dermatitis, and a history of previous bronchiolitis. Each category specifies the number of children who fall into the respective group, accompanied by the corresponding prevalence expressed as a percentage of the total cohort. This breakdown serves as a valuable snapshot, shedding light on the prevalence rates of these health conditions, essential for understanding their occurrence and potential correlations within the studied pediatric population.

The analysis underscores significant prevalence rates, notably 35.9% for croup for seven years and 5.1% per year, and 12.7% for

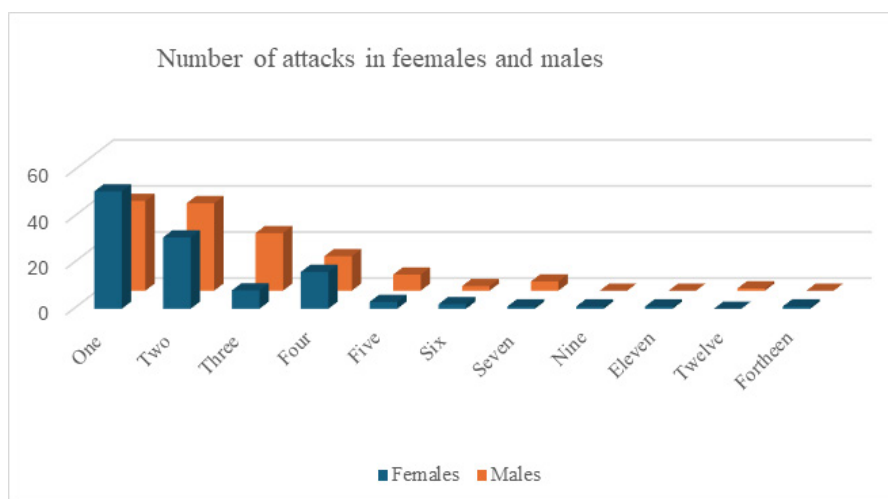
Table 1. *Prevalence of Croup and other Health Conditions in a Pediatric Cohort (Ages 0-5)*

Category	Number (n)	Females	Males	Prevalence (%)
Total children in the study (0-5 years old)	707	329	378	-
Children diagnosed with croup	254	118	136	35.9
Croup-One attack	90	51	39	12.7
Croup-Two attacks	69	31	38	9.9
Recurrent croup (>three attacks)	95	37	58	13.3
Children with bronchiolitis (from croup cases)	118	55	63	16.7
Children with atopic dermatitis (from croup cases)	133	67	66	18.8

one attack of croup, and 9.75% with two attacks of croup. Additionally, 16.7% of children had experienced previous bronchiolitis, and 18.8% exhibited early signs of atopic dermatitis. These prevalence rates provide valuable insights into the health conditions common in this cohort of children. However, it is important to remember that these rates are specific to this cohort and

may not reflect the prevalence in the general population. Further studies would be needed to confirm these findings.

The data shows the distribution of attacks of croup among a group of 254 children and there was 1 child who had 9 attacks, 1 with 11 attacks, 1 child who had 12 and one child with 14 attacks of croup.



Graph 1. Distribution of attacks of croup among females and male's children (0-5)

This Graph allows us to see how common each number of attacks is among children. In the sample of 707 children from 0-5 years old, 329 females were included, of which 118 (35.9%) females were with croup, and 378 males of which 136 (35.97%) were with croup.

Data regarding the presence of bronchiolitis and atopic dermatitis in childhood among this group of children with croup were included. Males account for most of the attacks of croup, then females. It is interesting to note that male children with recurrent attacks predominated, then females with three and four recurrent attacks. Additionally, there were also cases where children experienced 9, 11, 12, and 14 episodes of croup, each observed in only one child.

Furthermore, we examined the frequency of croup episodes among the children. Among the 254 children diagnosed with croup, 90 experienced one attack, 70 had two attacks, 94 had recurrent croup with three or more episodes of croup. This detailed categorization illuminates the frequency and recurrence patterns of croup episodes within the studied group.

The assessment of mean, median, and mode provides insights into the central tendency

of severity scores for children with croup (see Table 2).

An analysis of mean, median, and mode was made to get a sense of the central tendency of the number of attacks. A mean severity score of 2.49 indicates the average severity observed. A median score of 2 shows that half of the children have a severity score of 2 or lower, while a mode score of 1 appears most frequently, occurring 90 times, suggesting it is a common severity level. A total of 254 children were assessed, with quartiles Q1 and Q3 at 1 and 3 respectively, indicating that 25% have a severity score of 1 or less, and 75% have a score of 3 or less. The interquartile range (IQR), representing the middle 50% of scores, is 2. Severity scores range from 0 to 14, with outliers such as scores of 14, 7, 11, 9, 7, 12, 7, 9, 7, 7, significantly higher than most, indicating a few children have much higher severity levels. The standard deviation (SD) of 1.92 quantifies variability around the mean, while the standard error (SE) of 0.12 reflects the precision of the mean estimate. This summary provides a comprehensive view of croup severity among the children, encompassing central tendencies, variability, and extreme values in the dataset.

To provide additional insights into gender differences and croup, we conducted an odds ratio analysis, complemented by Chi-square (χ^2) test calculations, separately for male and female children, comparing those exposed versus those not exposed to croup.

In order to contribute additional information for the variations between gender and the number of attacks we used an analysis of Odds ratio in the female and male groups who were exposed or not exposed to recurrent croup separately and numbers of recurrence attacks.

Table 2. *Severity scores summaries in children: Mean Median Mode*

Mean	2.49	The average severity score observed among the children
Median	2	The middle value indicating half of the children have severity score of two or lower
Mode	1(90 times)	The most frequently occurring severity score which is 1 occurring 90 times
Total number of children with croup	254	The total number of children with croup
Q1 1-st Quartile	1	25% of children have a severity score of 1 or lower
Q3 3-th Quartile	3	75% of the children have a severity score of 3 or lower
Interquartile range (IQR)	2	The range within which the middle 50% of the severity scores lie (Q3-Q1)
Range	0-14	The span of severity scores observed from the lowest to the highest
Outliers	14, 7, 11, 9, 7, 12, 7, 9, 7, 7	Severity scores that are significantly higher than most of the other scores
Standard deviation (SD) and standard error (SE)	(SD)=1.92 (SE)= 0.12	SD quantifies variability around the mean Standard error (SE) reflects the precision of the mean estimate.

Table 3. *Number of Females and Males with and without Recurrent Croup*

Groups of children	Number of children (n)
Females +/+ recurrent croup	37
Females +/- recurrent croup	81
Males +/- recurrent croup	37
Males -/- recurrent croup	81
Males+/+ recurrent croup	58
Males+/- recurrent croup	78
Females +/- recurrent croup	58
Females -/- recurrent croup	78

Condition Pair	Odds Ratio	95% Confidence Interval	Z Statistic	P value
Females	0.6143	0.3665 to 1.0296	1.849	P = 0.0644
Males	1.6279	0.9712 to 2.7285	1.849	P = 0.0644

Females: Odds Ratio: 0.6143. This indicates that females are less likely to have recurrent croup compared to the reference group. 95% CI is: 0.3665 to 1.0296 and the true odds ratio is likely between 0.37 and 1.03. Since the interval includes 1, we can't conclusively say there is an association. Z Statistic: 1.849; p value: 0.0644; The p value is greater than 0.05, indicating that the result is not statistically significant.

Males: Odds Ratio: 1.6279. This indicates that males are more likely to have recurrent croup compared to the reference group. 95% CI: 0.9712 to 2.7285; The true odds ratio is likely between 0.97 and 2.73; Since the interval does not include 1, we can say there is an association; Z Statistic: 1.849; p value: 0.0644; The p value is higher than 0.05, indicating that the result is not statistically significant.

For females, the odds of having recurrent croup are lower, but the result is not statistically significant ($p=0.0644$). For males, the odds of having recurrent croup are higher (2.7285) but this result is also not statistically significant ($p=0.0644$). Those results suggest that males might be more prone to recurrent croup than females, but there are not a statistically significant association found in males.

To determine the existence of risk factors for the increased occurrence of croup, an analysis of the Odds ratio for the impact of Atopic dermatitis and bronchiolitis in children with croup was additionally made.

Table 4. Number of Females and Males with and without atopic dermatitis

Groups of children	Number of children (n)
Female/AD ⁺ /croup ⁺	67
Female/AD ⁺ /croup ⁻	51
Female/AD ⁻ /croup ⁺	66
Female/AD ⁻ /croup ⁻	281
Male /AD ⁺ /croup ⁺	66
Male /AD ⁺ /croup ⁻	67
Male /AD ⁻ /croup ⁺	70
Male /AD ⁻ /croup ⁻	293

Condition Pair	Odds Ratio	95% Confidence Interval	Z Statistic	P value
Female	5.5933	3.5584 to 8.7919	7.461	$P<0.0001$
Male	4.1232	2.6865 to 6.3284	6.481	$P<0.0001$

Females: Odds Ratio (OR): 5.5933; This means that females with atopic dermatitis who were exposed to croup have about 5.6 times higher odds of experiencing the outcome compared to those not exposed. 95% Confidence Interval (CI): 3.5584 to 8.7919; The true odds ratio is likely between 3.56 and 8.79, with 95% confidence. Z Statistic: 7.461 This indicates the strength of the association between exposure and outcome. p value: $p < 0.0001$; This is highly significant, suggesting that the result is very unlikely due to chance.

Males: Odds Ratio (OR): 4.1232; This means that males with atopic dermatitis who were exposed to croup have about 4.1 times higher odds of experiencing the outcome compared to those not exposed. 95% Confidence

Interval (CI): 2.6865 to 6.3284; The true odds ratio is likely between 2.69 and 6.33, with 95% confidence. Z Statistic: 6.481; This also indicates a strong association between exposure and outcome. p value: $p < 0.0001$; This is highly significant, suggesting that the result is very unlikely due to chance.

Both females and males with atopic dermatitis who were exposed to croup have significantly higher odds of experiencing the outcome compared to those not exposed. The association is slightly stronger in females (OR = 5.5933) than in males (OR = 4.1232), but both are statistically significant with very low p -values.

Table 5. Number of Females and Males with and without Bronchiolitis

Groups of children	Number of children (n)
Female/Bronchiolitis ⁺ /croup ⁺	55
Female/Bronchiolitis ⁺ /croup ⁻	63
Female/Bronchiolitis ⁻ /croup ⁺	63
Female/Bronchiolitis ⁻ /croup ⁻	284
Male/Bronchiolitis ⁺ /croup ⁺	63
Male/Bronchiolitis ⁺ /croup ⁻	55
Male/Bronchiolitis ⁻ /croup ⁺	73
Male/Bronchiolitis ⁻ /croup ⁻	305

Condition Pair	Odds Ratio	95% Confidence Interval	Z Statistic	P value
Females	3.9355	2.5015 to 6.1915	5.926	$p<0.0001$
Males	4.7858	3.0737 to 7.4516	6.931	$p<0.0001$

Here, the data represent the odds of children with croup being exposed to bronchiolitis compared to those without croup.

Females: OR = 3.9355: This means that females with croup are approximately 3.9 times more likely to have been exposed to bronchiolitis compared to females without croup. Females: 95% CI = 2.5015 to 6.1915; This interval does not include 1, which means the association is statistically significant. Females: Z = 5.926.

Males: OR = 4.7858 This means that males with croup are approximately 4.9 times more likely to have been exposed to bronchiolitis compared to males without croup. The confidence interval provides a range within which the true odds ratio is likely to fall. A narrower interval indicates more precise estimates. Males:

95% CI = 3.0737 to 7.4516; The higher values of Z statistic indicate stronger evidence against the null hypothesis. Males: $Z = 6.931$.

Both Z values are quite high, suggesting strong evidence against the null hypothesis of no association between bronchiolitis and croup in both males and females. A lower p-value indicates stronger evidence against the null hypothesis. Females: $P < 0.0001$; Males: $p < 0.0001$. Both p-values are extremely low, indicating that the observed associations are highly statistically significant. Females with croup are significantly more likely to have been exposed to bronchiolitis, with an odds ratio of 3.9355 (95% CI: 2.5015 to 6.1915). Males with croup are also significantly more likely to have been exposed to bronchiolitis, with an odds ratio of 4.7858 (95% CI: 3.0737 to 7.4516). The results are statistically significant for both sexes ($P < 0.0001$), indicating a strong association between bronchiolitis and croup in children.

These results suggest a significant association between bronchiolitis and croup in both female and male children, with males showing a slightly higher odds ratio than females. This indicates that children with croup are much more likely to have been exposed to bronchiolitis compared to those without croup.

DISCUSSION

The study delves into the health implications of early-onset croup in a cohort of 254 children aged 0-5 years, spanning the years 2016 to 2022. In this period, 707 children were considered, revealing a nuanced understanding of croup attacks among the selected age group. The research sheds light on the distribution of attacks, gender differences, and the prevalence of related conditions such as atopy and bronchiolitis [16, 17].

The data analysis illustrates the frequency of croup attacks among the children, with a notable concentration of 90 children experiencing 1 attack, 69 children having 2 attacks, 33 having 3 attacks (predominantly in males) and 31 children having four attacks 4 attacks [18]. Remarkably, there is a discernible gender-based difference, indicating that male children are more prone to croup, especially to two, three, and four recurrent attacks of croup, compared to their female

counterparts [19]. Further exploration of associated conditions, such as atopic dermatitis and bronchiolitis adds a layer of complexity to the discussion, hinting at potential correlations between these ailments [20]. Prevalence of croup in our study was found as 35.9% [13].

The study on croup attacks employs mean, median, and mode analyses. The mean is 2.49, suggesting a moderate frequency. The median is 2, indicating a central value. The range spans 0 to 14, showcasing diversity. Outliers are present, prompting investigation into extreme cases for a nuanced understanding of variability. The interquartile range (IQR) of 1-3 (IQR=2) focuses on the middle 50%, indicating most children experience 1 to 3 attacks [7]. These insights into croup attacks among children aged 0-5, considering gender and health conditions, form a basis for future research and interventions. The central tendency and variability metrics provide a holistic view, therefore aiding informed decision-making in pediatric healthcare.

The study goes beyond examining croup attacks alone and explores associated conditions such as atopic dermatitis and bronchiolitis [15, 18]. This adds a layer of complexity to the discussion, suggesting potential correlations between these ailments and croup. The prevalence of croup is reported at 35.9% (5.1% per year), emphasizing the significance of these health conditions within the studied population [3].

The interpretation of the results of Odds ratio suggests a robust and highly significant association between atopic dermatitis and croup in both genders. Female children exposed to atopic dermatitis have higher odds ratio than males. The association is stronger in females based on the higher odds ratio. In some studies, atopic dermatitis is more common in boys [22, 23].

Both genders show a significant positive association between bronchiolitis exposure and croup. The odds ratios for males (4.70) and females (3.94) are comparable. The Z-statistics and low p-values for both genders indicate highly significant associations [21]. The results suggest a significant association between bronchiolitis and croup in both female and male children, with males showing a slightly higher odds ratio than females. This indicates that children with croup are much more likely to have been exposed to bronchiolitis compared to those without croup [20].

CONCLUSION

The research provides insights into the prevalence, distribution, and associated conditions of croup attacks within the age group of 0-5 years. Noteworthy findings include a gender-based difference, with male children being more prone to recurrent croup but without statistical significance. The prevalence of croup in children in North Macedonia is calculated as 35.9% in this study (5.1% per year). This comprehensive study on early-onset croup among children provides valuable insights into the health implications of this respiratory condition. This research not only explores the frequency and distribution of croup attacks but also delves into associated conditions such as atopy and bronchiolitis, adding complexity to the discussion. The statistically significant correlation between gender and the number of croup attacks, supported by Pearson's Correlation analysis and an Odds ratio analysis, suggests a consistent tendency for croup occurrences to vary with changes in gender.

The study contributes valuable insights into the dynamics of croup occurrences among different genders in early childhood. The findings provide a foundation for future research and potential intervention strategies in pediatric healthcare, acknowledging the importance of considering gender differences and associated conditions as atopic dermatitis and bronchiolitis in understanding and addressing early-onset croup. The interpretation of the results of the Odds ratio suggests significant association between atopic dermatitis and croup in both genders. Female children exposed to atopic dermatitis have a higher odds ratio than males. Association is stronger in females based on a higher odds ratio. Both genders show a significant positive association between bronchiolitis exposure and croup. The statistical analyses conducted in the study provide compelling evidence of the relationships between gender, croup attacks, and associated conditions. The study's meticulous statistical analyses reveal gender-specific dynamics in the occurrence of croup, with exposure to atopy and bronchiolitis playing significant roles. The findings not only contribute to our understanding of croup but also underscore the importance of considering gender-specific factors in pediatric healthcare. The acknowledgment of potential variations in associations across different populations highlights

the need for continued research to inform targeted interventions and preventive strategies. The obtained results of this research could imply the involvement of atopic dermatitis and bronchiolitis in the trajectory of the atopic march.

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Резиме**КРУПОТ КАЈ ДЕЦАТА И РИЗИК-ФАКТОРИ****Валентина Ристеска Нејашмиќ**

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Крупот е честа реапираторна болест кај децата под 5 години, предизвикана од вируси. Симптомите вклучуваат инспираторен стидор, кашлица како лаење на куче и засипнат глас поради воспаление на гласилките. Дијагнозата е базирана врз основа на симптоми, какви што се кашлицата, тешкото дишење, стридорот и засипнатиот глас. Тежината на болеста варира од лесни до многу тешки форми. Целта на овој труд е да се истражат варијациите на крупот и факторите што допринесуваат за развој на рекурентен круп. Направена е ретроспективна лонгитудинална студија во педијатриската установа „Виталино“ во Велес, РС Македонија, каде што се анализирани податоците од здравствените картони на деца на возраст од 0 до 5 години, експонирани на круп најмалку еднаш за период од 2016 до 2022 година. Примерокот беше значаен и репрезентативен, овозможувајќи темелно истражување на потенцијалните корелации и трендови во појавата на круп. Од 707 анализирани деца, 254 имале круп, со преваленција од 35,9 % за период од 7 години или 5,1 % годишно. Експозицијата на атописки дерматитис и бронхиолитис била значително асоцирана со круп кај двата пола. Истражувањето обезбедува длабока анализа на преваленцијата, дистрибуцијата и асоцирачките состојби со круп. Машките деца биле повеќе предиспонирани на рекурентен круп во однос на женските деца, но без значителна статистичка разлика. Утврдена е статистички значителна асоцијација на атопискиот дерматитис и бронхиолитисот со рекурентниот круп. Осврнувајќи се на овие значајни асоцијации, можеме да заклучиме дека бронхиолитисот и крупот треба да бидат вклучени во траекторијата на атопискиот марш.

Клучни зборови: круп, деца, ризик-фактори