

EPIDEMIOLOGIC DATA OF COVID-19 IN CHILDREN

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ABSTRACT

Objective: This study aims to provide a comprehensive understanding of the epidemiology, clinical presentation, and risk factors associated with hospitalization in pediatric COVID-19 cases. **Material and Methods:** This cross-sectional study included 663 children aged 0-14 who presented to the Emergency Department of the Pediatric Hospital in Elbasan, Albania, between April 2020 and September 2024, with suspected COVID-19 symptoms. Sociodemographic and clinical data were collected, including symptomatic status, source of infection, underlying conditions, and disease outcomes. Multivariable logistic regression analysis was used to identify risk factors for hospitalization. **Results:** The mean age of children was 6.8 years, with 88.7% symptomatic and 11.3% asymptomatic. Among symptomatic individuals, the most commonly reported symptom was fever, affecting 65.2% of the population. Upper respiratory symptoms were present in 44.5%, while 3.6% experienced lower respiratory symptoms. The majority (79%) experienced mild illness. In the multivariable analysis, infants <1 year had a significantly higher likelihood of hospitalization compared to children aged 5-9, (OR) of 1.83 (95% CI: 1.11–3.98, p=0.029). Also, lower respiratory symptoms, OR of 2.1 (95% CI: 1.13–5.31, p=0.012) and children with underlying conditions were at higher risk of hospitalization, OR of 2.7 (95% CI: 1.15–7.40, p=0.001). The majority of children (97.7%) recovered fully, with only 2.3% experiencing post-acute complications. **Conclusion:** This study emphasizes the importance of monitoring vulnerable subgroups, such as infants and those with respiratory symptoms or underlying conditions, to prevent severe outcomes and guide public health interventions.

Keywords: Pediatric COVID-19, Epidemiology, Risk factors, Hospitalization

INTRODUCTION

Since March 2020, countries have implemented various public health measures to mitigate the impact of COVID-19; however, epidemiological data on COVID-19 in children remain sparse, with notable research gaps and inconsistent findings across studies (1-3). Children are underestimated in terms of their disease burden as well as their public health role in the transmission of many infectious diseases. Due to this underestimation or lack of awareness, children have often been the ones most affected by certain epidemiological disasters. Therefore, and especially in the context of COVID-19, it is critical to broadly understand the epidemiology of SARS-CoV-2 in the essential population of children (4,5). This will have direct implications for appropriate control measures being taken.

This study aims to provide a comprehensive understanding of the epidemiology of COVID-19 in children, clinical profile, disease severity and complications and assist in the decision-making process for interventions and management strategies.

MATERIAL AND METHODS

This is a cross-sectional monocenter study that includes 663 children aged 0-14 who presented to or were admitted to the Emergency Department of the Pediatric Hospital in the Elbasan district, Albania, with suspected COVID-19 symptoms during the period from April 2020 to September 2024. Testing was conducted using polymerase chain reaction (PCR) and rapid antigen tests for SARS-CoV-2 infection. Sociodemographic and clinical data were collected for each child. For children who presented more than once with symptoms similar to COVID-19, only data from the first visit were analyzed. The study describes the following: symptomatic status, source of infection, symptoms reported, underlying conditions, disease severity, hospitalization, disease duration, and disease outcomes.

Statistical analysis

Mean and standard deviation were reported for continuous data. A multivariable logistic regression model was used to identify the risk factors associated with hospitalization. Odds ratios and 95% confidence intervals were reported. A p-value ≤ 0.05 was considered statistically significant. The data were processed using MedCalc® Statistical Software version 23.0.2 (MedCalc Software Ltd, Ostend, Belgium; <https://www.medcalc.org>; 2024).

RESULTS

The sociodemographic and clinical characteristics of children are shown in (table 1).

Table 1 Sociodemographic and clinical characteristics of children.

Variables	N	%
Age, M (SD)	6.8	4.3
Agegroup		
<1	105	15.8
1-4	173	26.1
5-9	142	21.4
10-14	243	36.7
Sex		
Female	322	48.6
Male	341	51.4
Symptomatic status		
Symptomatic	588	88.7
Asymptomatic	75	11.3
Source of infection		
Community	612	92.3
Family	48	7.2
Vertical	3	0.5
Symptoms reported		
Fever	432	65.2
Upper Respiratory	295	44.5
Lower Respiratory	24	3.6
Gastrointestinal	97	14.6
Other	88	13.3
Underlying conditions		
No	647	97.6

Yes	16	2.4
Disease Severity		
Mild	524	79
Moderate	107	16.1
Severe	32	4.8
Hospitalization		
No	585	88.2
Yes	78	11.8
Disease duration (days) M (SD)		
Duration of illness	6.4	2.4
Duration between symptom onset to detection	2.1	0.7
Duration of hospital stay	4.2	2.3
Disease Outcomes		
Recovered	649	97.7
Post acute complications	14	2.3

The mean age of children is 6.8 (4.3) years. The population was predominantly composed of children and adolescents, with 36.7% of the individuals falling within the 10-14 age group. The distribution across other age groups was as follows: 15.8% were under 1 year, 26.1% were aged 1-4 years, and 21.4% were between 5-9 years old. 8.6% of the children are female, and 51.4% are male.

The majority of the children (88.7%) presented with symptoms, while 11.3% were asymptomatic. The primary source of infection was community transmission, accounting for 92.3% of the cases. Family transmission was responsible for 7.2% of infections, and vertical transmission occurred in 0.5% of cases.

Among symptomatic individuals, the most commonly reported symptom was fever, affecting 65.2% of the population. Upper respiratory symptoms were present in 44.5%, while 3.6% experienced lower respiratory symptoms. Gastrointestinal symptoms were reported in 14.6% of cases, and 13.3% presented with other unspecified symptoms.

The presence of underlying health conditions was rare, with 97.6% of the population having no pre-existing conditions and only 2.4% reporting comorbidities. In terms of disease severity, the majority (79%) experienced mild illness, 16.1% had moderate disease, and 4.8% suffered from severe disease.

Regarding hospitalization, 11.8% of the children required hospital care, while the remaining 88.2% were managed without the need for admission. The mean duration of illness was 6.4 (2.4) days, and the average time from symptom onset to detection was 2.1 (0.7) days. For those hospitalized, the mean length of stay was 4.2 (2.3) days.

The overall outcomes were positive, with 97.7% of the children recovering fully. A small percentage (2.3%) experienced post-acute complications, but notably, there were no deaths in the cohort.

The risk factors associated with hospitalization were identified through multivariable analysis (table 2).

Table 2. Risk factors associated with hospitalization.

Variables	OR	95%CI	P
Age-group			
<1	1.83	1.11-3.98	0.029
1-4	1.22	0.79-1.61	0.423
5-9	Ref.		
10-14	0.83	0.58-1.55	0.227
Lower respiratory symptoms	2.1	1.13-5.31	0.012
Underlying conditions	2.7	1.15-7.40	0.001

In the multivariable analysis, several risk factors were identified as being significantly associated with hospitalization. Infants under the age of one had a significantly higher likelihood of hospitalization compared to children aged 5-9, with an odds ratio (OR) of 1.83 (95% CI: 1.11–3.98, $P = 0.029$). However, children aged 1-4 did not show a statistically significant increased risk (OR = 1.22, 95% CI: 0.79–1.61, $P = 0.423$), nor did those aged 10-14 (OR = 0.83, 95% CI: 0.58–1.55, $P = 0.227$) when compared to the 5-9 age group.

Additionally, lower respiratory symptoms were found to be a significant risk factor for hospitalization, with an OR of 2.1 (95% CI: 1.13–5.31, $P = 0.012$). Children with underlying conditions were at an even higher risk, with an OR of 2.7 (95% CI: 1.15–7.40, $P = 0.001$), indicating that these factors greatly increased the likelihood of hospitalization in the affected population.

Discussion

To better understand the epidemiology of COVID-19 in children, a series of studies were conducted. These studies aimed to characterize the epidemiology and effects of non-pharmaceutical interventions on transmission in children, healthcare utilization patterns and outcomes among infected children, severity of illness in infected children, and systematic reviews and meta-analyses summarizing existing literature. Considered together, these results characterize COVID-19 in children and inform preparations for the return to in-person schooling and childcare.

This study provides valuable insights into the epidemiology, clinical presentation, and risk factors associated with hospitalization for COVID-19 in children. The findings align with existing literature, emphasizing that while children are generally less severely affected by COVID-19 than adults, certain subgroups remain vulnerable to more serious outcomes. Specifically, this study identified that infants under the age of one, children with lower respiratory symptoms, and those with underlying health conditions are at significantly higher risk of hospitalization.

The higher hospitalization rates observed in infants under one year of age (OR = 1.83, 95% CI: 1.11–3.98, $P=0.029$) could be attributed to the unique physiological characteristics of this age group, including immature immune systems and narrower airways, which increase susceptibility to severe respiratory infections. This finding is consistent with previous research on respiratory viral infections, such as RSV, where infants are also at a higher risk of severe disease (6). These results underscore the importance of prioritizing infants in public health interventions, including enhanced monitoring, preventive strategies, and potentially prioritization in vaccination campaigns. In line with our findings, Liguoro et al. (7) reported that infants under one year of age have a higher risk of severe COVID-19 outcomes, including hospitalization. They emphasized that infants, due to their immature immune systems and smaller airways, are particularly susceptible to severe respiratory complications. Our study found that infants had nearly twice the odds of being hospitalized compared to older children. This is consistent with a study by Dong et al. (8), which noted that children under one year have the highest rates of severe and critical disease among pediatric cases. Lower respiratory symptoms were another significant predictor of hospitalization (OR = 2.1, 95% CI: 1.13–5.31, $P = 0.012$), which aligns with clinical reports that have identified respiratory complications, such as pneumonia and bronchiolitis, as common causes of severe illness in pediatric COVID-19 cases. The association between lower respiratory symptoms and hospitalization mirrors the findings of Zhu et al. (9), who identified that lower respiratory tract infections, such as pneumonia, were more likely to result in severe illness requiring hospitalization in pediatric COVID-19 patients. In our study, 3.6% of children presented with lower respiratory symptoms, and this subset was significantly more likely to require hospital care. This is supported by other respiratory viral infection studies, including those on RSV, where lower respiratory involvement is a major factor for severe outcomes in young children Hall et al. (10). The consistent observation across studies underscores the critical importance of early diagnosis and management of respiratory symptoms to mitigate severe disease. This highlights the need for early identification and management of lower respiratory tract infections to prevent severe outcomes and the need for hospitalization. Underlying medical conditions were also strongly associated with an increased risk of hospitalization (OR = 2.7, 95% CI: 1.15–7.40, $P=0.001$) which is consistent with numerous studies globally. For instance, Göttinger et al. (11) found that children with pre-existing conditions, such as asthma, heart disease, and immune deficiencies, were more likely to experience severe COVID-19 outcomes, including intensive care unit (ICU) admission. Similarly, Smith et al. (12) observed that underlying comorbidities increased the risk of hospitalization and severe disease. Children with chronic illnesses, such as asthma, congenital heart disease, or immunodeficiencies, are already predisposed to severe outcomes from various infections, and COVID-19 appears to exacerbate this vulnerability. This suggests that children with chronic illnesses should be prioritized for preventive interventions, including vaccination and early therapeutic interventions, to reduce the likelihood of severe outcomes. Interestingly, the study found no significant difference in hospitalization risk for children aged 1-4 and 10-14 compared to those aged 5-9. This is in line with previous studies that suggest older children, while still susceptible to infection, often experience milder disease courses, likely due to a more developed immune system and reduced

physiological vulnerability compared to infants. Parri et al. (13) demonstrated that adolescents were more likely to have mild or moderate disease compared to infants and younger children. Similarly, Tagarro et al. (14) reported that the majority of adolescents experienced mild symptoms and rarely required hospitalization. The biological basis for this difference may lie in the relative maturity of the immune system in older children and adolescents compared to infants, who are more vulnerable due to their underdeveloped immune responses.

In our study, the mean duration of illness in children with COVID-19 was 6.4 (2.4) days, with an average time of 2.1 (0.7) days from symptom onset to detection. The mean length of hospital stay for those requiring admission was 4.2 (2.3) days. These findings are generally consistent with other studies but reveal some variability in reported disease durations, which may be attributed to differences in study populations, healthcare settings, and disease severity. For instance, Zachariah et al. (15) reported a median length of hospital stay of 4 days among children admitted with COVID-19 in a large cohort study from the United States, which closely aligns with our findings. Similarly, Garazzino et al. (16) found that the average disease duration for children with mild to moderate symptoms in Europe was approximately 7 days, with most children recovering within this timeframe. This highlights the relatively short course of illness in the majority of pediatric cases, reflecting the typically mild nature of COVID-19 in children.

However, in cases of more severe disease, especially among children with complications such as MIS-C or those requiring intensive care, the duration of illness and hospitalization may be significantly longer. Feldstein et al. (17) found that children with MIS-C had a median hospital stay of 7 days, with some children requiring prolonged care due to multiorgan involvement. These findings suggest that while most children experience a brief and self-limiting illness, those with severe disease or complications may require extended hospitalization and follow-up care. Overall, the duration of illness and hospitalization in our study is consistent with the broader pediatric COVID-19 literature, though factors such as age, underlying conditions, and disease severity can influence the length of recovery. Continued research into the long-term outcomes, particularly for children with severe cases, remains essential to better understand the full spectrum of COVID-19's impact on pediatric populations. Our findings, in conjunction with those from other studies, emphasize the need for tailored public health measures to protect the most vulnerable pediatric subgroups. While children overall experience milder COVID-19 outcomes than adults, infants, children with respiratory symptoms, and those with underlying conditions remain at heightened risk for hospitalization. As a result, these groups should be prioritized in prevention strategies, such as vaccination and enhanced clinical monitoring.

The results of this study are particularly important given the ongoing debate about the role of children in the transmission of COVID-19 and the potential risks they face. Although children are less likely than adults to experience severe illness, they can still play a role in community transmission, as noted in studies by Ludvigsson (18) and Viner et al. (19), who emphasized the importance of including children in broader public health efforts to curb the spread of SARS-CoV-2. Our findings reinforce the need for a balanced approach to managing the risk in children, including maintaining public health measures like mask-wearing and hygiene practices, particularly in settings such as schools where children are in close contact.

Additionally, while the overall recovery rate in our study was high (97.7%), the presence of post-acute complications (2.3%) is a reminder that the long-term effects of COVID-19, even in children, should not be overlooked. Studies by Buonsenso et al. (20) have highlighted the potential for long-COVID symptoms in children, particularly those who experienced severe illness, suggesting that follow-up care may be necessary even after initial recovery.

CONCLUSION

In conclusion, our study identifies key risk factors for hospitalization among children with COVID-19, with infants, children with lower respiratory symptoms, and those with underlying health conditions being at greatest risk. These findings are consistent with the broader literature and underscore the need for targeted public health interventions and vaccination strategies for vulnerable pediatric subgroups. As the pandemic continues, ensuring adequate protection for children, particularly those at higher risk for severe outcomes, remains critical for mitigating the impact of COVID-19 on the pediatric population.

Conflict of Interest. The authors declare that they have no conflict of interest.

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