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Incidence and Clinical Severity of Pertussis in Children after the COVID-19 Pandemic: A Comparative Study of Unvaccinated and Partially Vaccinated Patients

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ABSTRACT

Background: Pertussis remains a serious bacterial infection in children, especially infants, despite routine vaccination. During the COVID-19 pandemic, reported cases declined due to public health restrictions, but routine immunization coverage was disrupted as well. In the post-pandemic period, a resurgence of pertussis has been observed globally, including in Georgia. Evaluating disease frequency and clinical severity in children is essential for understanding current trends and improving prevention strategies.

Objectives: This study aimed to evaluate the incidence and clinical severity of pertussis in children after the COVID-19 pandemic and to compare disease occurrence and severity between unvaccinated and partially vaccinated groups.

Methods: This retrospective study (Jan 2024–Jan 2025) included 66 hospitalized and 34 outpatient children with PCR- or serology-confirmed pertussis from two pediatric clinics in Georgia.

Results: Unvaccinated patients had higher rates of prolonged cough (>10 days: outpatients 83%, hospitalized 74%), paroxysmal cough (outpatients 92%, hospitalized 55%), pneumonia (outpatients 58%, hospitalized 84%), and leukocytosis (>10×10^9/L: outpatients 58%, hospitalized 63%; >20×10^9/L: hospitalized 29% vs 15% in partially vaccinated) compared with partially vaccinated patients. Vomiting after coughing was more frequent in partially vaccinated outpatients (86%) but higher in unvaccinated hospitalized patients (82%), while normal leukocyte counts, nighttime cough, and brief loss of consciousness were more common or similar in partially vaccinated children.

Conclusions: Unvaccinated children had more severe pertussis, underscoring the role of vaccination in the post-pandemic period.

Keywords: Children; pertussis; post COVID-19; vaccination.

BACKGROUND

Pertussis is an acute bacterial infection that is particularly severe in infants. Although widespread vaccination programs have reduced its incidence, pertussis remains a life-threatening disease, posing a significant public health risk and representing an important economic burden for the country. The disease is especially severe in infants and is often accompanied by complications, frequently requiring hospitalization.[1] Pertussis is characterized by a prolonged clinical course, necessitating repeated outpatient visits and extended absence of children from educational activities.[2]

In recent years, the incidence of pertussis has increased worldwide, including in Georgia.[3,4] In 2024, 1,639 cases of pertussis were reported in Georgia, of which 1,174 were laboratory-confirmed, and 465 were suspected cases.[5] The COVID-19 pandemic (2019–2023) had a significant impact on the epidemiology of pertussis. During the pandemic, pertussis incidence decreased sharply due to reduced social contacts, stricter isolation measures, and suspension of educational activities. SARS-CoV-2 nearly replaced all other circulating microorganisms.[6]

Since 2024, the World Health Organization (WHO) and the European Centre for Disease Prevention and Control (ECDC) have predicted an increase in pertussis cases.[7] In the post-pandemic period, leading global health organizations consider pertussis an urgent disease with growing risk.[8] While the COVID-19 pandemic temporarily reduced pertussis incidence, there remains a high risk of increased cases, particularly in countries where pertussis vaccination was not fully implemented during or after the pandemic.[9]

Researchers have identified several factors that hindered routine pertussis vaccination during the COVID-19 pandemic: (i) healthcare systems were overburdened, with priority given to COVID-19 prevention, treatment, and control; (ii) illness in infants due to SARS-CoV-2 delayed timely vaccination; (iii) reduced healthcare-seeking behavior due to the high risk of SARS-CoV-2 infection; and (iv) increased public distrust regarding vaccine efficacy and safety.[10]

In the post-pandemic period, amid a significant global increase in pertussis incidence, it is timely and important to assess pertussis incidence and its main clinical features in children in Georgia. This will allow identification of disease trends and support the development of recommendations to optimize prevention and management strategies.

Our study aimed to evaluate the clinical and paraclinical features of pertussis in unvaccinated and partially vaccinated children in Georgia, identify key disease patterns, and develop recommendations to optimize prevention strategies.

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METHODS

This retrospective study was conducted between January 1, 2024, and January 1, 2025, at the Tbilisi State Medical University G. Zhvania University Pediatric Clinic and the Acad. V. Bochorishvili Clinic. Clinical and anamnestic data were analyzed for 100 pediatric patients, including 66 hospitalized children treated at the Acad. V. Bochorishvili Clinic and 34 outpatients were consulted at the TSMU G. Zhvania University Pediatric Clinic. Pertussis was laboratory-confirmed in all patients by PCR and/or serological testing.

RESULTS

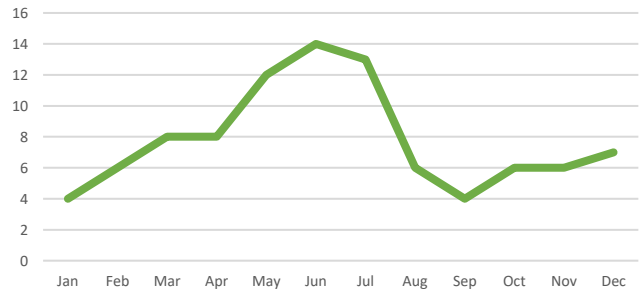
The distribution of hospitalized and outpatient patients by age groups is presented in Table 1.

TABLE 1. Distribution of hospitalized and outpatient patients across different age groups

	<1 year		1-5 years		>5 years	
	n	%	n	%	n	%
Inpatients	40	60.6	16	24.2	10	15.2
Outpatients	15	44.1	10	29.4	9	26.5

Figure 1 illustrates the monthly distribution of outpatient and hospitalized patients.

FIGURE 1. Monthly distribution of outpatient and hospitalized patients



Among hospitalized patients, 38 (57.6%) were not vaccinated against pertussis according to the routine immunization schedule, while 28 (42.4%) were partially vaccinated or unable to provide documentation confirming their vaccination status. Among outpatients, 12 (35.2%) were unvaccinated, and 22 (64.7%) were partially vaccinated or had no vaccination records.

The frequency of clinical manifestations by vaccination status among hospitalized and outpatient patients is presented in Tables 2 and 3, respectively.

TABLE 2. Clinical features in hospitalized unvaccinated and partially vaccinated patients

Symptom	Unvaccinated (N=38)	Partially vaccinated (N=28)	p-value
Nighttime cough	30/38 (78.9%)	16/28 (57.1%)	0.065
Vomiting after coughing episodes	31/38 (81.6%)	10/28 (35.7%)	0.004
Cough duration >10 days	28/38 (73.7%)	11/28 (39.3%)	0.042
Paroxysmal cough	21/38 (55.3%)	6/28 (21.4%)	0.008
Complication with pneumonia	32/38 (84.2%)	7/28 (25.0%)	0.0001
Brief loss of consciousness	7/38 (18.4%)	2/28 (7.1%)	1.000

TABLE 3. Clinical features in outpatient unvaccinated and partially vaccinated patients

Symptom	Unvaccinated (N=12)	Partially vaccinated (N=22)	p-value
Nighttime cough	8/12 (66.7%)	19/22 (86.4%)	0.21
Vomiting after coughing episodes	6/12 (50.0%)	19/22 (86.4%)	0.04
Cough duration >10 days	10/12 (83.3%)	5/22 (22.7%)	0.001
Paroxysmal cough	11/12 (91.7%)	11/22 (50.0%)	0.006
Complication with pneumonia	7/12 (58.3%)	0/22 (0.0%)	0.00015
Brief loss of consciousness	0/12 (0.0%)	0/22 (0.0%)	—

Based on complete blood count results, leukocytosis was observed in 24 hospitalized unvaccinated patients (63.1%), among whom 7 (29.1%) had marked leukocytosis (>20 $\times 10^9$/L).

Among hospitalized partially vaccinated patients, 13 (46.4%) had leukocytosis (>10$\times 10^9$/L), and 2 of them (15.3%) demonstrated a marked elevation (>20$\times 10^9$/L). Meanwhile, 15 partially vaccinated hospitalized patients (43.5%) had leukocyte counts within the normal range. A similar trend was observed among outpatient patients. Leukocytosis (>10$\times 10^9$/L) was detected in 7 unvaccinated patients (58.3%), compared with 5 partially vaccinated patients (22.7%).

DISCUSSION

Based on our study findings, we compared the clinical and paraclinical features of pertussis in unvaccinated and partially vaccinated children at both inpatient and outpatient levels.

The study identified several key trends. Infants under 1 year of age represented the largest proportion of both hospitalized and outpatient cases. Pertussis in unvaccinated children presented with more diverse and severe clinical manifestations compared with partially vaccinated patients. Unvaccinated children more frequently experienced paroxysmal cough, prolonged cough, and pneumonia as complications. Among paraclinical findings, leukocytosis — particularly marked leukocytosis — was observed more often in unvaccinated patients. Our results are consistent with those reported in recent studies.[11,12] Evidence from large-scale

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retrospective studies employing a design similar to ours further supports this conclusion.[13]

These findings highlight the importance of adhering to the full routine pertussis vaccination schedule. Vaccination status was associated with differences in disease severity, laboratory abnormalities, and clinical presentation. Timely completion of the vaccination schedule is more critical than the specific vaccine type.[14]

Increasing public awareness about the necessity of pertussis vaccination and the risk of complications is essential. Updated clinical guidelines for healthcare professionals on the diagnosis and management of pertussis, ranging from mild to severe, are also recommended.

The COVID-19 pandemic has significantly impacted global public health, with both short- and long-term effects that are still under investigation. Consequently, it is essential to resume adherence to the routine vaccination schedule to prevent long-term COVID-19 sequelae and additional infectious complications.[15]

CONCLUSIONS

Our findings align with recent literature showing that infants under one year of age are most affected by pertussis and that unvaccinated children experience more severe disease, including prolonged and paroxysmal cough, pneumonia, and marked leukocytosis. These results further support evidence that incomplete vaccination is associated with greater disease severity. Timely adherence to the routine pertussis vaccination schedule remains essential for reducing complications and improving clinical outcomes in children.

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