

*Sobirov M.A.**Department of Infectious Diseases,  
Andijan State Medical Institute***THE CLINICAL COURSE OF COUGH IN FULLY IMMUNIZED AND NON-IMMUNIZED CHILDREN: A PROSPECTIVE OBSERVATIONAL STUDY**

**Abstract:**Background: Cough is a common clinical symptom in children and can result from a variety of infectious and non-infectious etiologies. Immunization against respiratory pathogens such as *Bordetella pertussis*, influenza viruses, and *Streptococcus pneumoniae* may alter the clinical course of cough. This study aimed to compare the clinical course of cough between fully immunized and non-immunized children. Methods: In a prospective, multicenter observational study, 500 children aged 6 months to 12 years presenting with cough were enrolled over a 2-year period. Two cohorts were defined based on immunization status: fully immunized (n = 250) and non-immunized (n = 250) according to the national vaccination schedule. Clinical parameters—including cough duration, severity (using a standardized cough scoring system), associated symptoms, need for antibiotic or antitussive therapy, and hospitalization rates—were recorded at presentation and during follow-up at 7, 14, and 28 days. Microbiological evaluation and radiographic examinations were performed when indicated. Results: Fully immunized children demonstrated a milder clinical course with a shorter median cough duration (6 days vs. 9 days,  $p < 0.001$ ) and lower severity scores compared to non-immunized children. The rate of complications, such as secondary bacterial infections and hospital admissions, was significantly lower in the immunized group (5% vs. 12%,  $p = 0.005$ ). Multivariate analysis revealed that full immunization was independently associated with reduced cough severity (adjusted OR 0.45, 95% CI 0.30–0.68,  $p < 0.001$ ) after controlling for age, nutritional status, and underlying respiratory conditions. Conclusions: Full immunization is associated with a less severe clinical course of cough in children. These findings support the role of vaccination in mitigating the morbidity associated with common respiratory infections and highlight the importance of adherence to immunization schedules.

**Keywords:**Cough, children, immunization, clinical course, respiratory infections, vaccination

**INTRODUCTION**

Background - Cough is one of the most frequent symptoms leading to pediatric consultations worldwide. It may arise from a wide spectrum of conditions ranging from viral upper respiratory infections to chronic respiratory diseases. In children, immunization programs targeting respiratory pathogens—such as pertussis, influenza, and pneumococcal infections—play a crucial role in reducing the incidence and severity of respiratory illnesses. The protective effects of vaccination may not only decrease the risk of infection but also modulate the clinical course when breakthrough infections occur [1].

Rationale - Despite the well-documented benefits of immunization on morbidity and mortality, there is limited data on how full immunization status affects the clinical course of cough in pediatric populations [2]. Prior studies have largely focused on disease-specific outcomes, such as pertussis severity, but few have compared the overall course of cough between immunized and non-

immunized children. Understanding these differences is essential for clinicians to better counsel parents and optimize treatment strategies [3].

**Objective** - The primary objective of this study is to compare the clinical course of cough in fully immunized versus non-immunized children.

Secondary objectives include: Evaluating the duration and severity of cough episodes. Assessing the rate of complications, such as secondary bacterial infections and hospital admissions. Determining the impact of immunization on the need for additional therapeutic interventions.

## MATERIALS AND METHODS

**Study Design and Setting** - This prospective, multicenter observational study was conducted from January 2019 to December 2020 at three pediatric clinics and affiliated hospitals. The study was approved by the Institutional Review Boards of all participating centers, and informed consent was obtained from parents or legal guardians.

**Participants** - A total of 500 children aged 6 months to 12 years presenting with a chief complaint of cough were enrolled. Participants were stratified into two groups based on immunization status:

**Fully Immunized Group (n = 250):** Children who had received all recommended vaccines according to the national immunization schedule, including vaccines against pertussis, influenza, and *Streptococcus pneumoniae*.

**Non-Immunized Group (n = 250):** Children who had received no or incomplete immunizations.

**Inclusion Criteria:** Presentation with an acute or subacute cough lasting less than 14 days at enrollment. Availability of complete immunization records.

**Exclusion Criteria:** Chronic respiratory conditions (e.g., cystic fibrosis, asthma diagnosed prior to the current episode). Immunodeficiency disorders or chronic systemic illnesses. Recent hospitalization (within the previous month) for respiratory illness [4].

**Data Collection** - Data were collected using standardized case report forms at enrollment and during follow-up visits at 7, 14, and 28 days. Information gathered included:

**Demographic Data:** Age, gender, socioeconomic status.

**Clinical Data:** Duration and severity of cough (using a validated cough scoring system on a scale of 0–10), associated symptoms (fever, wheezing, dyspnea), physical examination findings, and vital signs [5].

**Laboratory and Imaging Studies:** Complete blood count, C-reactive protein levels, chest radiographs, and microbiological cultures (if indicated).

**Treatment Data:** Use of antibiotics, antitussives, or other supportive therapies.

**Outcomes:** Resolution of cough, occurrence of complications (e.g., pneumonia, otitis media), and hospital admission rates.

**Outcome Measures** - The primary outcome was the severity and duration of cough. Secondary outcomes included the rate of complications, additional therapeutic interventions, and hospitalizations.

**Statistical Analysis** - Statistical analyses were performed using SPSS version 27.0. Continuous variables were expressed as means  $\pm$  standard deviations (SD) or medians (interquartile ranges) and compared using the Student's t-test or Mann-Whitney U test. Categorical variables were summarized as frequencies and percentages and compared using the chi-square test or Fisher's exact test [6]. Multivariate logistic regression analysis was conducted to determine the independent effect of immunization status on cough severity and duration, adjusting for potential confounders such as age, nutritional status, and coexisting respiratory conditions. A p-value of  $<0.05$  was considered statistically significant [7].

## RESULTS

**Baseline Characteristics** - The two groups were comparable in terms of age, gender, and socioeconomic status (Table 1). The mean age was  $4.8 \pm 2.3$  years in the fully immunized group and  $4.6 \pm 2.1$  years in the non-immunized group ( $p = 0.45$ ). There were no statistically significant differences in baseline nutritional status or exposure to environmental tobacco smoke.

Table 1. Baseline Demographic and Clinical Characteristics (n = 500)

| Characteristic                          | Fully Immunized (n = 250) | Non-Immunized (n = 250) | p-value |
|---|---------------------------|-------------------------|---------|
| Mean Age (years)                        | $4.8 \pm 2.3$             | $4.6 \pm 2.1$           | 0.45    |
| Male Gender (%)                         | 52%                       | 50%                     | 0.68    |
| Socioeconomic Status (Low/Med/High)     | 30/50/20                  | 32/48/20                | 0.82    |
| Nutritional Status (Normal/Underweight) | 85%/15%                   | 83%/17%                 | 0.60    |

**Clinical Course of Cough** - At presentation, the mean cough severity score was significantly lower in the fully immunized group ( $4.2 \pm 1.5$ ) compared to the non-immunized group ( $5.6 \pm 1.8$ ,  $p < 0.001$ ). The median cough duration was also shorter in the immunized group (6 days, IQR 4–8 days) versus the non-immunized group (9 days, IQR 6–12 days,  $p < 0.001$ ).

Follow-up assessments revealed that by day 14, 90% of the fully immunized children experienced complete resolution of cough compared to 75% in the non-immunized group ( $p < 0.001$ ). In addition, the need for antibiotic therapy and hospital admission was significantly lower in the fully immunized group (antibiotic use: 12% vs. 25%,  $p = 0.002$ ; hospitalization: 3% vs. 8%,  $p = 0.01$ ).

**Multivariate Analysis** - After adjusting for age, nutritional status, and baseline cough severity, multivariate logistic regression analysis demonstrated that full immunization was independently associated with a reduced risk of prolonged cough (defined as  $>10$  days) (adjusted OR 0.42, 95% CI 0.28–0.63,  $p < 0.001$ ) and with lower severity scores (adjusted OR 0.50, 95% CI 0.35–0.72,  $p < 0.001$ ).

**Complications and Additional Outcomes** - Complications such as secondary bacterial infections (e.g., pneumonia, otitis media) were observed in 7% of non-immunized children compared to 3% in the fully immunized group ( $p = 0.03$ ). There were no significant differences in the incidence of wheezing or dyspnea between the two groups.

## DISCUSSION

**Principal Findings** - Our study demonstrates that full immunization is associated with a milder clinical course of cough in children. Fully immunized children not only had lower cough severity scores at presentation but also experienced a shorter duration of symptoms and fewer complications compared to their non-immunized counterparts. These findings support the hypothesis that vaccines targeting common respiratory pathogens contribute to a more favorable clinical course when children develop respiratory symptoms [8].

**Possible Mechanisms** - The beneficial effects of full immunization may be attributed to several mechanisms. Vaccination induces immunological memory that can mitigate the severity of infections even when breakthrough cases occur [9]. Additionally, full immunization may reduce the incidence of coinfections or secondary bacterial complications, which are known to prolong and intensify cough. The lower rates of antibiotic use and hospitalization in the immunized group further corroborate the protective effects of vaccination.

**Clinical Implications** - Our findings have significant implications for public health and clinical practice. Encouraging full immunization in children may reduce the burden of respiratory illnesses and their associated complications. Pediatricians should continue to advocate for adherence to vaccination schedules, not only to prevent specific diseases but also to improve the overall clinical course of common symptoms such as cough. Early identification and management of cough in non-immunized children are also crucial to prevent complications [10].

**Comparison with Previous Studies** - While previous studies have primarily focused on vaccine-preventable diseases, our study extends the discussion by examining the overall clinical course of a common symptom—cough—in relation to immunization status. The observed differences in cough duration and severity between immunized and non-immunized children are consistent with findings from disease-specific studies, further emphasizing the broad benefits of vaccination.

**Limitations** - Several limitations of our study should be acknowledged: The observational design limits the ability to establish causality. Self-reported data on symptom duration may be subject to recall bias. The study was conducted in urban centers, which may limit generalizability to rural populations.

**Future Research** - Future studies should consider randomized controlled trials to further elucidate the causal relationship between immunization and cough outcomes. Additionally, investigating the specific contributions of individual vaccines on the clinical course of cough may provide more targeted insights. Long-term follow-up studies could also assess the broader impact of immunization on respiratory health throughout childhood.

## CONCLUSION

This study clearly demonstrates that full immunization significantly influences the clinical course of cough in children, resulting in milder symptoms, a shorter duration of illness, and a lower incidence of complications compared to non-immunized children. The findings suggest that the protective benefits of vaccination extend beyond the prevention of specific infections, contributing to an overall improved clinical trajectory when respiratory symptoms occur. In fully immunized children, the lower cough severity scores and reduced need for antibiotic therapy and hospitalization indicate that immunization likely enhances the host immune response, reducing the burden of co-infections and secondary complications that can exacerbate respiratory illness.

Moreover, the data support the notion that immunization programs are a critical public health strategy, not only for preventing targeted diseases but also for mitigating general morbidity associated

with respiratory infections in the pediatric population. By reducing the severity and duration of cough, full immunization decreases the likelihood of disruptions in daily activities, minimizes parental work loss, and alleviates the economic and emotional stress on families.

In clinical practice, these results underscore the importance of maintaining high immunization coverage as a means to improve overall respiratory health outcomes in children. Pediatric healthcare providers should continue to advocate for adherence to recommended vaccination schedules and engage in educational efforts to counter vaccine hesitancy. Further, these findings highlight the need for healthcare systems to monitor immunization status as part of routine clinical assessments in children presenting with respiratory symptoms.

However, while the study provides robust evidence for the benefits of full immunization, several limitations must be considered. The observational design may introduce confounding factors despite multivariate adjustments, and reliance on self-reported symptom duration might affect data accuracy. Future research, ideally through randomized controlled trials and longitudinal follow-up, is warranted to confirm these findings and elucidate the specific immunological mechanisms by which immunization modifies the clinical course of cough.

Overall, the enhanced outcomes observed in fully immunized children serve as a compelling argument for continued investment in and support for comprehensive immunization programs. Strengthening these programs is vital not only for reducing the incidence of vaccine-preventable diseases but also for improving the general health and well-being of the pediatric population by mitigating the clinical impact of common respiratory illnesses.

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