Vietnam Journal of Community Medicine, Vol. 66, English version No. 2, 318-323

SEVERE PROGNOSTIC FACTORS OF POST-VACCINATION REACTIONS IN CHILDREN UNDER 5 YEARS AT VIET NAM NATIONAL CHILDREN'S HOSPITAL

Pham Ngoc Toan[1*], Ton Thi Thuy[2], Nguyen Van Duong[1]

[1]*Vietnam National Children's Hospital - 18/879 La Thanh, Lang Ward, Hanoi City, Vietnam*
[2]*Thai Nguyen University of Medicine and Pharmacy -*
- 284 Luong Ngoc Quyen, Phan Dinh Phung Ward, Thai Nguyen Province, Vietnam

Received: 11/12/2025
Revised: 18/12/2025; Accepted: 18/12/2025

ABSTRACT

Background: Post-vaccination reactions, caused by the body's immune response to vaccines, range from mild to severe and may pose risks to children. This study sought to identify key predictive factors for severe post-vaccination reactions among children under five years old treated at the Vietnam National Pediatric Hospital.

Methodology: A cross-sectional descriptive study was conducted on 103 pediatric patients who experienced adverse reactions following vaccination between January 2019 and December 2021.

Results: Among the pediatric patients, 43.7% were female, and 42 children (40.8%) experienced severe reactions. A significant correlation was found between prior abnormal vaccine reactions and severe outcomes (OR = 2.525, 95% CI: 1.019–6.261; p = 0.042). Additionally, delayed access to the first healthcare facility (over one hour) significantly increased the risk of severe reactions (OR = 2.821, 95% CI: 1.074–7.405; p = 0.031).

Conclusion: Identifying these prognostic factors contributes to enhancing expanded immunization programs for children and preventing severe post-vaccination reactions, ultimately improving pediatric care and safety.

Keywords: Adverse reactions, severe prognosis, vaccination, children under five, Vietnam,

1. INTRODUCTION

Post-vaccination reactions are the body's immune responses triggered by vaccines, ranging from mild to severe manifestations[1]. Mild reactions, such as fever, fatigue, or localized pain at the injection site, are common and indicate the immune system's activation[2]. However, severe cases, though rare, can include anaphylaxis or myocarditis, often requiring immediate medical attention[3]. These reactions may arise due to hypersensitivity, underlying health conditions, or genetic predispositions, and their outcomes can vary from full recovery to long-term complications[4]. During the COVID-19 pandemic, heightened vaccine development and deployment magnified public awareness and scrutiny of post-vaccination reactions, underscoring the balance between vaccine efficacy and safety monitoring.

Librada Fortuna et al. (2015) examined adverse events following DTaP and DTwP vaccinations in children in Thailand. Their study found that 1.4% of children who received the DTwP vaccine, but none who received the DTaP vaccine, developed a high fever (T ≥ 39°C) within 4 hours of vaccination[5]. Similarly, Rashmi et al. (2015) conducted a systematic review on post-vaccination adverse reactions and antibody responses in children, reporting febrile reactions (≥38.0°C or 100.4°F) within the first 24–48 hours in 0.60% (95% CI, 0.39–0.93) of cases and pain of all grades in 0.97% (95% CI, 0.55–1.7)[4]. Jing et al. (2015) investigated adverse reaction monitoring in Western Chinese provinces, finding that common reactions included fever (5.52 per 100,000 doses), local redness and swelling (3.33 per 100,000 doses), fatigue (3.15 per 100,000 doses), headache (2.76 per 100,000 doses), and local induration and nausea/vomiting (1.97 per 100,000 doses). Most adverse reactions occurred within one day of vaccination, with some extending to 1–3 days post-vaccination[3]. Despite these studies, evidence regarding the severity of post-vaccination reactions remained limited, highlighting the need to strengthen surveillance strategies to mitigate potential risks and enhance vaccine safety[6].

*Corresponding author
Email: ngoctoancard@yahoo.com **Phone**: (+84) 904533068 **DOI:** 10.52163/yhc.v66i8.4081

In Vietnam, the increasing acceptance of vaccination services, alongside the Expanded Program on Immunization, has greatly contributed to public health improvements. However, vaccines, like any medical intervention, carry the potential for unintended effects. The frequency and severity of post-vaccination reactions depend on multiple factors, including vaccine storage conditions, the reliability of the cold chain, the skill of healthcare workers, and the health status of children[7]. While studies such as those by Fortuna, Rashmi, and Jing have provided valuable insights into the prevalence and nature of these reactions globally, research in Vietnam has primarily focused on mild and common reactions due to the sensitive nature of severe cases. This highlights the importance of robust monitoring systems to address the gaps in evidence and ensure the continued safety of expanding immunization programs[8].

Consequently, evaluating and anticipating the severity of post-vaccination reactions became crucial for devising strategies to enhance the monitoring of vaccine-related adverse events and mitigate associated risks. In light of this, the study was conducted to identify significant predictive factors for severe post-vaccination reactions among children under five years old receiving care at the Vietnam National Pediatric Hospital.

2. MATERIALS AND METHODS

- Objective: This study aimed to analyze cases of inpatients at the Vietnam National Children's Hospital who experienced adverse reactions following vaccination between January 2019 and December 2021.

- Selection Criteria: The research targeted children under five years old who were admitted to the hospital due to post-vaccination reactions. These included both common responses (local or systemic reactions) and severe adverse events, such as respiratory distress, anaphylaxis or anaphylactic shock, toxic shock syndrome, high fever with seizures, persistent crying, pallor, and apnea.

- Exclusion Criteria: Cases with insufficient data, underlying medical conditions mimicking post-vaccination reactions, or a refusal to participate were excluded from the study.

- Methodology: A cross-sectional descriptive design was employed, using a convenient sampling method to recruit 103 eligible pediatric patients.

- Processing and Analysis: Data collected were entered, processed, and analyzed using SPSS version 20.0.

- Ethics Statement: The study received approval from the Research Ethics Committee of the National Children's Hospital. Informed consent was obtained from the parents or guardians of all participants after providing detailed information about the study's purpose and implications. All collected data were treated confidentially and used solely for research purposes. The study was designed to ensure no adverse effects on the health or financial status of participants.

3. RESULTS

Table 1. Characteristics of the study participants (n=103)

Characteristics	Number of patients (n)	Percentage (%)
Age		
From 0 - ≤ 6 months	59	57.3
6 months and above	44	42.7
Gender		
Male	58	56.3
Female	45	43.7
Gestational age at birth		
Full term (38 to 42 weeks)	88	85.4
Prematurely (<38 weeks)	15	14.6
Medical History		
Normal	94	91.3
Abnormal	9	8.7
Vaccination Obstetric History		
Normal	88	85.4
Abnormal	15	14.6
Previous abnormal reactions to vaccines		
No	26	25.2
Yes	77	74.8
Vaccination Time to First Facility		
Over 1 hour	74	71.8
Under 1 hour	29	28.2
Total		
	103	100

Between January 2019 and December 2021, 103 pediatric patients meeting the inclusion criteria were monitored at the Vietnam National Children's Hospital (Table 1). The majority of these patients were infants aged 0 to 6 months, comprising 57.3% of the study population. Gender analysis indicated that 56.3% of adverse post-vaccination reactions occurred in male patients, while 43.7% were observed in female patients. Among the cohort, 85.4% of infants were born at full term, with 14.6% classified as preterm. A total of 9 children had a documented medical history of illness prior to vaccination, and 26 children (25.2%) had experienced abnormal reactions to previous vaccinations, predominantly fever. The mean duration of hospitalization from symptom onset to discharge was 3.84 ± 2.48 days, ranging from 1 to 16 days.

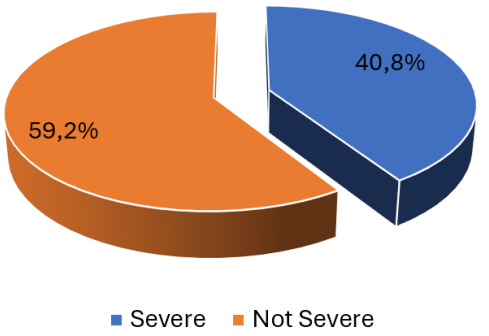

Figure 1. Prevalence of severe reactions in the population who experienced adverse reactions following vaccination

The number of severe reactions in the group of participants who experienced adverse reactions following vaccination was 42 children, accounting for 40.8% (Figure 1).

Table 2. Multivariate regression between severe adverse reactions after vaccination and related characteristics

Characteristics		Severe		Not Severe		p	OR (95%CI)
		No. of patients (n)	Percentage (%)	No. of patients (n)	Percentage (%)		
Age	From 0 - ≤ 6 months	27	48.5	32	54.2	0.233	1.631 (0.728 – 3.655)
	6 months and above	15	34.1	29	65.9		
Gender	Male	25	43.1	33	56.9	0.585	1.248 (0.563 – 2.765)
	Female	17	37.8	28	62.2		
Medical History	Normal	37	39.4	57	60.6	0.345	0.519 (0.131 – 2.061)
	Abnormal	5	55.6	4	44.4		
Gestational age at birth	Normal	33	37.5	55	62.5	0.101	0.400 (0.131 – 1.225)
	Abnormal	9	60	6	40		
Previous abnormal reactions to vaccines	No	15	57.7	11	42.3	0.042	2.525 (1.019 – 6.261)
	Yes	27	35.1	50	64.9		
Vaccination Time to First Facility	Over 1 hour	35	47.3	39	52.7	0.031	2.821 (1.074 – 7.405)
	Under 1 hour	7	21.4	22	75.9		

Table 2 highlights the significant factors associated with severe adverse reactions following vaccination. Prior abnormal vaccine reactions were significantly linked to severe outcomes, OR= 2.525 (95% CI: 1.019–6.261; p = 0.042). Additionally, delayed time to the first healthcare facility (over 1 hour) was associated with a higher likelihood of severe reactions (OR = 2.821, 95% CI: 1.074–7.405; p = 0.031). These findings emphasize the importance of prompt medical attention and careful monitoring of children with a history of abnormal vaccine responses.

4. DISCUSSION

In this study, 2.9% of children who experienced post-vaccination reactions had a family history of abnormal medical conditions, including maternal Graves' disease, paternal allergies to bees and wasps, maternal shellfish allergy, and paternal urticaria. Among the cases analyzed, 84 (81.6%) were attributed to post-vaccination reactions, while 18 were coincidental with other illnesses. No cases were linked to vaccination errors or psychological fears. Severe reactions were more

frequently observed in children under 6 months of age compared to those aged 6 months or older, though the difference was not statistically significant.

Findings from related research supported these observations. Tran Van Thien reported that infants under 2 months of age had a significantly higher risk of mortality due to severe post-vaccination reactions, with an odds ratio (OR) of 6.455 (95% CI: 2.541–16.938).[9] Similarly, Ngo Thi Tam found that while the risk of death in the 2-month-old group was only 20% of that in infants under 2 months, the rate of adverse events following immunization (AEFI) was higher in infants aged 2 months or older[10]. Additionally, a study conducted in China from 2010 to 2015 estimated an overall AEFI-related death rate of 0.26 per one million vaccine doses, with a neonatal death rate of 0.77 per one million doses for the first dose of the hepatitis B vaccine[11]. The findings highlight the heightened vulnerability of younger infants, particularly those under 2 months of age, to severe post-vaccination reactions and associated mortality, aligning with previous studies that demonstrate similar risks[12,13]. These results underscore the importance of targeted monitoring and timely interventions for this high-risk age group[14].

The findings of this study indicated that male infants exhibited a slightly higher risk of severe post-vaccination reactions compared to female infants (43.1% versus 37.8%), though the difference was not statistically significant. Similarly, Ngo Thi Tam's research on severe post-vaccination reactions reported a higher mortality rate in females compared to males (48.3% versus 33.3%), but this variation also lacked statistical significance[10]. In addition, a study conducted in India on children aged 0–12 years, following vaccinations such as polio, DTP, Hepatitis B, MMR, BCG, HiB, influenza, measles, and oral rotavirus, found no significant relationship between the occurrence of severe reactions and the gender of the children[15].

The group of prematurely born infants showed a higher incidence of severe post-vaccination reactions compared to those born at full term, with rates of 60% and 37.5%, respectively. Similarly, children with a history of abnormal medical conditions experienced severe reactions more frequently than those without such histories, at 55.6% and 39.4%, respectively. Despite receiving only Hepatitis B and BCG vaccines, infants under 2 months of age exhibited a relatively high mortality rate, accounting for 16 out of 45 cases (35.5%), although these vaccines represented just 14.1% of all administered doses. Among the deaths attributed to these vaccines, 37.5% were classified as coincidental, while the cause remained unidentified in 62.5% of cases [15] A 2019 report on infant mortality in England and Wales documented a neonatal mortality rate (under 28 days) of 2.8 per 1,000 live births, with contributing factors including prematurity, sudden infant death syndrome (SIDS), neural tube defects, and congenital heart defects. Similarly, a U.S. report recorded a decline in neonatal mortality rates from 6.2 per 1,000 live births in 2010 to 5.7 per 1,000 in 2017, although the rate remained higher than in Canada (4.8 per 1,000), the United Kingdom (3.9 per 1,000), Australia (3.4 per 1,000), and Japan (2.1 per 1,000). The leading causes of 67.5% of neonatal deaths included congenital malformations, preterm birth, low birth weight, sudden unexpected infant death (SUID), pregnancy complications, placental and cord abnormalities, infections, cardiovascular and respiratory disorders, and neonatal hemorrhage[16].

The group that did not receive immediate medical treatment when experiencing the first symptoms of a reaction after vaccination had a higher risk of severe reactions compared to the group that received treatment (57.7% versus 35.1%). The rate of severe reactions in the group that received medical treatment at home was higher than the group brought to a medical facility (51.8% versus 26%). This difference is statistically significant. Ngo Thi Tam'sstudy also showed that the group that did not receive immediate medical treatment had a significantly higher risk of death compared to the treated group (83.3% versus 29.6%). The risk of death in the untreated group was 9.1 times higher than in the treated group (OR=11.9; 95%CI: 3.3 – 43.3). The death rate in the group treated at home after experiencing post-vaccination reactions (53.6%) was higher than the group taken to a medical facility immediately (20.0%). The risk of death in the group taken to a medical facility was only 20% of that in the group treated at home (OR=0.2, 95%CI: 0.1-0.6)[10].

The group that delayed seeking medical attention after the onset of post-vaccination symptoms demonstrated a significantly higher likelihood of severe reactions compared to those who received prompt care (57.7% versus 35.1%). Similarly, severe reactions occurred more frequently in children managed at home than in those taken to a medical facility (51.8% versus 26.0%), with this difference achieving statistical significance. These findings are consistent with those reported by Ngo Thi Tam, who observed a markedly higher risk of mortality in children who did not receive immediate medical intervention compared to those who did (83.3% versus 29.6%), with an odds ratio (OR) of 11.9 (95% CI: 3.3–43.3). Additionally, the mortality rate among children treated at home following post-vaccination reactions (53.6%) was significantly greater than that of children brought to a healthcare facility (20.0%), with the risk of death being only 20% in the latter group (OR = 0.2; 95% CI: 0.1–0.6). These results emphasize the vital role of timely medical intervention in reducing the severity of adverse reactions and minimizing mortality risks in affected children[10].

The rate of severe post-vaccination reactions was significantly lower in children who reached a healthcare facility within one hour compared to those who arrived after one hour (24.1% versus 47.3%). This finding underscores the critical role of timely medical intervention in managing severe reactions[17], such as the prompt administration of adrenaline, oxygen therapy,

and anti-allergy medications in accordance with Ministry of Health protocols. In Ngo Thi Tam's study, only 5% of cases sought medical care within the first hour of symptom onset, resulting in a mortality rate of 40.7% among severe cases[10]. Despite recommendations emphasizing the importance of early healthcare access, factors such as geographical barriers and caregivers' awareness continue to influence delays in seeking treatment for severe post-vaccination reactions[18, 19].

Other factors associated with post-vaccination reactions included birth weight, gestational age, duration of mechanical ventilation, and the timing of vaccination[20]. At the Vietnam National Children's Hospital, vaccines were administered not only to healthy children but also to high-risk groups, including those born prematurely, those with allergies, chronic illnesses, congenital abnormalities, or primary immunodeficiencies. This practice aimed to reduce the risk of infection within the hospital and the broader community, particularly for children who had not yet completed the immunization schedule outlined by the Ministry of Health. Furthermore, in the event of adverse reactions, these children had immediate access to medical care and emergency treatment at the hospital's emergency department.

The results underscored that prompt medical intervention significantly reduced the risk of mortality in cases of severe post-vaccination reactions, particularly when care was administered at healthcare facilities. This finding emphasized the vital role of medical facilities in delivering timely and effective healthcare services to the population. Furthermore, it was evident that immediate medical attention at the nearest healthcare facility was critical in managing adverse reactions[21, 22]. As previously noted, seeking treatment at lower-level healthcare facilities in urgent situations often facilitated a quicker response and improved survival outcomes compared to traveling longer distances to higher-level facilities, which could result in delays.

5. CONCLUSION

The analysis of 103 pediatric patients who experienced adverse reactions following vaccination between January 2019 and December 2021 revealed that 43.7% of cases occurred in female patients. Among the participants, 42 children (40.8%) experienced severe reactions. A significant association was identified between prior abnormal vaccine reactions and severe outcomes (OR = 2.525, 95% CI: 1.019–6.261; p = 0.042). Furthermore, delayed access to the first healthcare facility (over one hour) significantly increased the likelihood of severe reactions (OR = 2.821, 95% CI: 1.074–7.405; p = 0.031). Understanding these prognostic factors not only supports the improvement of expanded immunization programs for children but also aids in preventing severe post-vaccination outcomes.

CONFLICT OF INTEREST

None

ACKNOWLEDGEMENTS

We also thank our Vietnam National Children's Hospital colleagues for their collaboration and assistance.

REFERENCES

[1] Peikert A, Claggett BL, Kim K, et al. Association of post-vaccination adverse reactions after influenza vaccine with mortality and cardiopulmonary outcomes in patients with high-risk cardiovascular disease: the INVESTED trial. Eur J Heart Fail 2023; 25: 299–310.

[2] Soriano A, Nesher G, Shoenfeld Y. Predicting post-vaccination autoimmunity: who might be at risk? Pharmacol Res 2015; 92: 18–22.

[3] An J, Liu Y, Ma Y, et al. Real-world data of China: Analysis of HPV vaccine coverage and post-vaccination adverse reaction monitoring in Western Chinese provinces from 2018 to 2021. Hum Vaccin Immunother 2024; 20: 2315653.

[4] Das RR, Panigrahi I, Naik SS. The effect of prophylactic antipyretic administration on post-vaccination adverse reactions and antibody response in children: a systematic review. PLoS One 2014; 9: e106629.

[5] Fortuna L, Sirivichayakul C, Watanaveeradej V, et al. ADVERSE EVENTS POST-DTAP AND DTwP VACCINATION IN THAI CHILDREN. Southeast Asian J Trop Med Public Health 2015; 46: 764–774.

[6] Mills RO, Abdullah MR, Akwetey SA, et al. Post-Vaccination Streptococcus pneumoniae Carriage and Virulence Gene Distribution among Children Less Than Five Years of Age, Cape Coast, Ghana. Microorganisms 2020; 8: 1987.

[7] Huu TN, Phuong NTM, Toan NT, et al. IMMUNOGENICITY AND SAFETY OF QUINVAXEM® (DIPHTHERIA, TETANUS, WHOLE-CELL PERTUSSIS, HEPATITIS B AND HAEMOPHILUS INFLUENZAE TYPE B VACCINE) GIVEN TO VIETNAMESE INFANTS AT 2 TO 4 MONTHS OF AGE. Southeast Asian J Trop Med Public Health 2015; 46: 753–763.

[8] WHO. Global Advisory Committee on Vaccine Safety, 10 August 2021; Global Advisory Committee on Vaccine Safety, 15 December 2021, https://www.who.int/publications/i/item/who-wer9710-81-96 (2021, accessed 19 December 2024).

[9] Tran Van Thien, Tran Manh Tung, Tran Nhu Duong, et al. Characteristics of Severe Post-Vaccination Reactions in Expanded Immunization in Northern Vietnam from 2016 to 2020 and Related Prognostic Factors. TC YHDP 2021; 31: 30–38.

[10] Ngo Thi Tam, Tran Manh Tung, Tran Nhu Duong, et al. Severe Reactions in Expanded Immunization in Northern Vietnam from 2013 to 2017 and Related

Factors. TC YHDP 2018; 28: 30–38.
[11] Wu W, Liu D, Nuorti JP, et al. Deaths reported to national surveillance for adverse events following immunization in China, 2010-2015. Vaccine 2019; 37: 1182–1187.
[12] Mouliou DS, Dardiotis E. Current Evidence in SARS-CoV-2 mRNA Vaccines and Post-Vaccination Adverse Reports: Knowns and Unknowns. Diagnostics (Basel) 2022; 12: 1555.
[13] Agmon-Levin N, Paz Z, Israeli E, et al. Vaccines and autoimmunity. Nat Rev Rheumatol 2009; 5: 648–652.
[14] Orchard A, Vally M, Khan R, et al. A guide for the management of post vaccination allergy and anaphylaxis in a pharmacy clinic. Health SA 2022; 27: 1987.
[15] Paramkusham V, Palakurthy P, Gurram NS, et al. Adverse events following pediatric immunization in an Indian city. Clin Exp Vaccine Res 2021; 10: 211–216.
[16] Sen S, Cloete Y, Hassan K, et al. Adverse events following vaccination in premature infants. Acta Paediatrica 2001; 90: 916–920.
[17] Ruhrman-Shahar N, Torres-Ruiz J, Rotman-Pikielny P, et al. Autoimmune reaction after anti-tetanus vaccination-description of four cases and review of the literature. Immunol Res 2017; 65: 157–163.
[18] Martín Arias LH, Sanz Fadrique R, Sáinz Gil M, et al. Risk of bursitis and other injuries and dysfunctions of the shoulder following vaccinations. Vaccine 2017; 35: 4870–4876.
[19] Essink B, Chu L, Seger W, et al. The safety and immunogenicity of two Zika virus mRNA vaccine candidates in healthy flavivirus baseline seropositive and seronegative adults: the results of two randomised, placebo-controlled, dose-ranging, phase 1 clinical trials. Lancet Infect Dis 2023; 23: 621–633.
[20] Livengood JR, Mullen JR, White JW, et al. Family history of convulsions and use of pertussis vaccine. J Pediatr 1989; 115: 527–531.
[21] Clark S, Wei W, Rudders SA, et al. Risk factors for severe anaphylaxis in patients receiving anaphylaxis treatment in US emergency departments and hospitals. J Allergy Clin Immunol 2014; 134: 1125–1130.
[22] Lopes SRC, Perin JLR, Prass TS, et al. Adverse Events Following Immunization in Brazil: Age of Child and Vaccine-Associated Risk Analysis Using Logistic Regression. International Journal of Environmental Research and Public Health 2018; 15: 1149.