UDC 614.47:616-053.2(477.41/.42)

Ye.O. Grechukha[1], G.V. Gnyloskurenko[2], A.P. Volokha[1]

Delayed and incomplete immunization of children: cross-sectional community-based survey study among population of Kyiv, Rivne, and Volyn regions of Ukraine

[1]Shupyk National Healthcare University of Ukraine, Kyiv
[2]Educational and Scientific Center «Institute of Biology and Medicine» of Taras Shevchenko National University of Kyiv, Ukraine

Modern Pediatrics. Ukraine. (2025). 4(148): 19-27; doi 10.15574/SP.2025.4(148).1927

For citation: Grechukha YeO, Gnyloskurenko GV, Volokha AP. (2025). Delayed and incomplete immunization of children: cross-sectional community-based survey study among population of Kyiv, Rivne, and Volyn regions of Ukraine. Modern Pediatrics. Ukraine. 4(148): 19-27. doi: 10.15574/SP.2025.4(148).1927.

Immunization is essential for preventing infectious diseases, yet timely vaccination remains a challenge globally, particularly in regions affected by war and disrupted healthcare infrastructure. Ukraine faces unique challenges, including systemic issues and vaccine hesitancy, impacting immunization timeliness.
Aim – to determine the rate and characteristics of delayed immunization and its completeness among children in three regions of Ukraine.
Material and methods. A cross-sectional, community-based survey was conducted at state and private primary healthcare facilities in Kyiv, Bucha, Rivne, and Lutsk. Data were collected via structured questionnaires, face-to-face parental interviews, and medical documentation review. Statistical analyses included descriptive statistics, chi-square tests, logistic regression, and Kaplan-Meier analysis.
Results. Out of 152 children, 64.3% were fully vaccinated, but only 50% received timely vaccinations. The significant reasons for delays included untimely healthcare visits (29.2%), vaccine hesitancy (25.8%), and acute illness (18%). The presence of comorbidities in children was a statistically significant risk factor for delayed immunization. Kaplan-Meier analysis illustrated notable delays, especially for older children.
Conclusion. This study identifies critical barriers to timely immunization, emphasizing the need for improved healthcare accessibility, targeted educational initiatives, and enhanced professional training. Further research is required to develop comprehensive interventions, particularly considering Ukraine's complex demographic challenges due to internal displacement of the population.
The study was conducted in accordance with the principles of the Declaration of Helsinki. The study protocol was approved by the Local Ethics Committee for all participants. The informed consent was obtained from patients.
The authors declare no conflict of interest.
Keywords: child health, health services, immunization schedule, patient acceptance of health care, public health surveillance, vaccination refusal, vaccination coverage.

Відкладені та незавершені щеплення дітей: перехресне дослідження шляхом опитування населення Київської, Рівненської та Волинської областей України

Є.О. Гречуха[1], Г.В. Гнилоскуренко[2], А.П. Волоха[1],
[1]Національний університет охорони здоров'я України імені П.Л. Шупика, м. Київ
[2]ННЦ «Інститут біології та медицини» Київського національного університету імені Тараса Шевченка, Україна

Імунізація є важливою умовою профілактики інфекційних захворювань, проте забезпечення своєчасності вакцинації залишається глобальним викликом, особливо в регіонах, що потерпають від війн та порушень роботи медичної інфраструктури. Україна стикається з унікальними проблемами, серед яких – системні недоліки та вагання щодо вакцинації, що впливає на своєчасність щеплень.
Мета: визначити рівень та особливості відкладених щеплень, а також повноту завершених схем серед дітей у трьох регіонах України.
Матеріал та методи. Проведено перехресне дослідження шляхом опитування населення на базі державних та приватних закладів первинної медико-санітарної допомоги у таких містах, як Київ, Буча, Рівне та Луцьк. Дані зібрано за допомогою структурованих анкет, особистих інтерв'ю з батьками та аналізу медичної документації. Для статистичного аналізу використано описову статистику, критерій χ^2, логістичну регресію та аналіз за методом Каплана-Маєра.
Результати. Зі 152 дітей повністю вакцинованими були 64,3%, проте лише 50% отримали щеплення вчасно. Основними причинами відтермінування були несвоєчасні візити до лікаря (29,2%), вагання щодо вакцинації (25,8%) та гострі захворювання (18%). Наявність супутніх захворювань у дітей була статистично значущим фактором ризику відтермінованої вакцинації. Аналіз Каплана-Маєра продемонстрував помітні затримки, особливо серед дітей старшого віку.
Висновки. Дослідження виявило бар'єри, що перешкоджають своєчасній вакцинації, вказуючи на необхідність поліпшення доступності медичної допомоги, впровадження цільових освітніх програм та підвищення кваліфікації медичних працівників. Подальші дослідження мають бути спрямовані на розробку комплексних заходів з урахуванням складних демографічних викликів в Україні, пов'язаних із внутрішнім переміщенням населення.
Дослідження виконано відповідно до принципів Гельсінської декларації. Протокол дослідження погоджено локальним етичним комітетом установи. На проведення досліджень отримано інформовану згоду батьків, дітей.
Автори заявляють про відсутність конфлікту інтересів.
Ключові слова: здоров'я дітей, медичні послуги, календар щеплень, прихильність пацієнтів до медичної допомоги, нагляд громадського здоров'я, відмова від вакцинації, охоплення щепленнями.

Introduction

Immunization is considered the primary method of prevention of a number of infectious diseases. Since the implementation of the Expanded Programme on Immunization (EPI) in 1974, the percentage of children protected against six diseases (tuberculosis, diphtheria, tetanus, pertussis, poliomyelitis, and measles) has steadily increased, gradually expanding to include other infections. As a result, immunization today prevents approximately 2–3 million deaths annually [24]. For example, in Ukraine, between 1965 and 2015, a significant decline in mortality was observed both in the general population (1.6–2.6 times) and among children under 14 years (15.2–20.4 times) [17]. Despite this significant progress, globally, routine childhood immunization coverage levels have recently declined, influenced notably by the COVID-19 pandemic [11], and in Ukraine specifically, due to the full-scale war by russia.

Vaccinating children according to recommended time intervals is crucial for forming individual protection, supporting child development [28], and creating herd immunity necessary for controlling disease outbreaks and protecting children who are, for various reasons, still unimmunized [20]. Currently, vaccination coverage is a widely used indicator to identify strengths and weaknesses in immunization programs and access to healthcare services in general [30].

Several methods are employed to monitor vaccination coverage, each with its advantages and disadvantages [5]. Current approaches to evaluating immunization program coverage generally focus on the proportion of vaccinated children across different age groups. In Ukraine, for instance, the public health sector continues to utilize an aggregated database from 2008 known as UkrVak [15]. However, such systems inadequately address the crucial aspect of the timely administration of scheduled vaccines [10]. Timely vaccination serves as an essential complementary indicator to standard coverage metrics, offering critical insights within the context of disease control [1]. Conversely, administering vaccines prematurely or without appropriate intervals between doses may compromise the completeness of protection [29].

The primary objective of this analysis was to estimate the proportion of children with delayed vaccinations and completed schedules according to the National Immunization Schedule in three regions of Ukraine.

The aim of the study is to estimate the timing of vaccination against antigens included in the National Immunization Schedule and the completeness of immunization schemes among children in three regions of Ukraine.

Materials and methods of the study

Data source. The study was conducted at state and private primary healthcare facilities (HCFs) in Kyiv, Bucha, Rivne, and Lutsk. Data collection was performed through a community-based survey via face-to-face parental interviews, examinations, and reviews of their children's medical documentation (form No. 063/o «Vaccination card» [14]).

During the visit to parents who expressed interest in participating in the study, completed structured questionnaires, providing essential demographic, socio-economic, and health-related information (Table 1).

Table 1

Compositions of the questionnaire

Component	Means
Sociodemographic characteristics	Region of residence Type locality (urban/rural) Age and gender of the child
Medical history	Information about pregnancy complications (e.g., preeclampsia) Presence of chronic or concomitant diseases in children, previous infections, and other health conditions that could potentially influence immunization timing
Parental vaccination attitudes and practices	Vaccination status of parents, including whether the mother and father were vaccinated according to the National Immunization Schedule during childhood, their immunization against diphtheria, tetanus, influenza, and other recommended vaccines
Family vaccination practices	Information on siblings, including their vaccination completeness and timely adherence to the immunization schedule
Reasons for vaccination delays	Parents reported explicit reasons for delaying immunization, categorized into medical (e.g., acute illness), logistical (e.g., vaccine shortage), or personal (e.g., vaccine hesitancy, misinformation)

Table 2

Method of calculating age at birth and age at vaccination in days using the dot-separated date format

Antigens	**NIS-recommended time for vaccination**					
	1st dose		**2nd dose**		**3rd dose**	
	start date	end date	start date	end date	start date	end date
HepB	DoB	DoB+30 d	DoB+59 d	DoB+160 d	DoB+179 d	DoB+210 d
BCG	DoB+2 d		DoB+60 d		NA	
Polio	DoB+59 d	DoB+90 d	DoB+119 d	DoB+150 d	DoB+179 d	DoB+540
DTP	DoB+59 d	DoB+90 d	DoB+119 d	DoB+150 d	DoB+179 d	DoB+540
Hib	DoB+59 d	DoB+90 d	DoB+119 d	DoB+150 d	DoB+179 d	DoB+395
MMR	DoB+364 d	DoB+390	DoB+2190d	DoB+2220d	NA	

A total of 152 questionnaires and forms on immunization were included in the analysis. The gender distribution was equal: 76 female (50%) and 76 male children (50%).

Definition of primary outcome. The primary outcome of the study was delayed vaccination for primary immunization series for hepatitis B (HepB, 3 doses), Bacillus Calmette-Guérin (BCG; 1 dose), poliomyelitis (Polio, 3 doses), diphtheria, tetanus, and pertussis (DTP, 3 doses), Haemophilus influenzae type b (Hib, 3 doses) and measles, mumps, and rubella (MMR, 2 doses). Booster doses for DTP and Polio were also included in the additional analysis.

Delayed vaccination for each vaccine was defined as administration of the vaccine dose after the recommended age. Date of birth and age at vaccination (for individual vaccine dose) were calculated in dot-separated date format. Vaccination was categorized as delayed if given later than the proposed timeframe according to the National Immunization Schedule in Ukraine (NIS) and recommendations of the Order #595 by the Ministry of Health of Ukraine [16] (Table 2).

Statistical analysis. The mean age (in days) for each vaccine dose was calculated by subtracting the child's date of birth from the date of vaccination. Standard deviations were computed to measure variability. The calculation formula is as follows:

$$\text{Mean age} = \frac{\sum_{i=1}^{n}(V_i - B_i)}{n}$$

where: V_i – date of vaccination of child i; B_i – date of birth of child i; n – total number of vaccinated children.

Chi-square tests or Fisher's exact tests were applied to identify associations between categorical variables, such as region, locality (urban/rural), presence of maternal pregnancy complications, presence of comorbidities in children, parental vaccination status, and delayed vaccination status.

The Shapiro–Wilk test was used to assess normality of age distribution; since the assumption of normality was not met, non-parametric Mann–Whitney U tests were used.

Logistic regression analyses (univariate and multivariate) were conducted to identify predictors of delayed immunization. Variables that showed statistical significance ($p<0.05$) at univariate logistic regression were included in a multivariate logistic regression model. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to quantify the strength of associations.

The Kaplan–Meier analysis was performed to evaluate the timing of MMR vaccination among children. The curve illustrates the probability of remaining unvaccinated over time following the recommended vaccination age. This analysis helps to visually and statistically assess delays and compliance with the vaccination schedule.

The statistical significance was set at $p<0.05$, and all statistical analyses were performed using statistical software packages (e.g., SPSS v.26).

Results of the study

Sociodemographic and health-related characteristics. Overall, information on socio-demographic information, medical history, and attitudes towards immunization provided by caregivers is provided in Table 3.

Mean age and standard deviation for receiving each dose per antigen. Table 4 summarizes the analysis of the identification of the mean age for receiving each vaccine dose.

Overall vaccination status of children. Table 5 below summarizes the vaccination coverage for specific vaccines. Coverage for each specific vaccine was calculated from all children included in this particular study.

Of the 152 children included for analysis, 98 (64.3%), with 95% CI: 56.6–71.6% were fully vaccinated while 76 (50.0%), with 95% CI: 42.1–57.9% were fully vaccinated on time (Fig. 1). Among them, 20 children (13.2%, with 95% CI: 8.7–19.5%)

Table 3

Sociodemographic and health information provided by caregivers

Component	Total (%)
Sociodemographic characteristics	
Region of residence:	
Kyiv	53 (34%)
Kyiv (city)	50 (32%)
Rivne	32 (21%)
Volyn	21 (13%)
Settlement type:	
Urban	132 (86%)
Rural	22 (14%)
Age of the child	
1 ≤	21 (13%)
>1-6≤	52 (34%)
>6	79 (53%)
Gender	
Girls	76 (50%)
Boys	76 (50%)
Medical history	
Information about pregnancy complications (Yes)	16 (10%)
Presence of chronic or concomitant diseases in children (Yes)	40 (26%)
Natural history of vaccine-preventable diseases	23 (12%)
Parental vaccination attitudes and practices	
Fully vaccinated mother in childhood	141 (92%)
Fully vaccinated father in childhood	127 (83%)
Booster dose against diphtheria and tetanus received by mother	83 (54%)
Booster dose against diphtheria and tetanus received by father	74 (48%)
Annual vaccination against influenza by mother	48 (31%)
Annual vaccination against influenza by father	26 (%)
Other vaccines by mother	
COVID-19	97 (63%)
Other (varicella, HPV)	5 (3%)
Other vaccines by father (COVID-19)	82 (53%)
Family vaccination attitudes and practices (information on siblings, including their vaccination completeness and timely adherence to the immunization schedule)	
No other children	55 (36%)
Fully vaccinated siblings	20 (13%)
Delay with the vaccination of siblings	77 (50%)

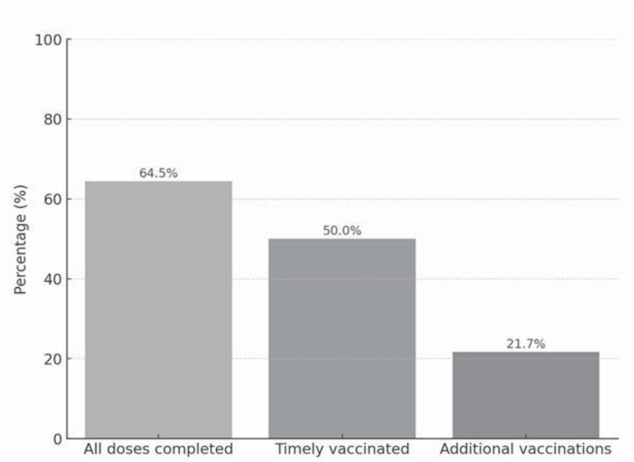


Fig. 1. Overall vaccination status of children in Kyiv, Rivne, and Volyn regions

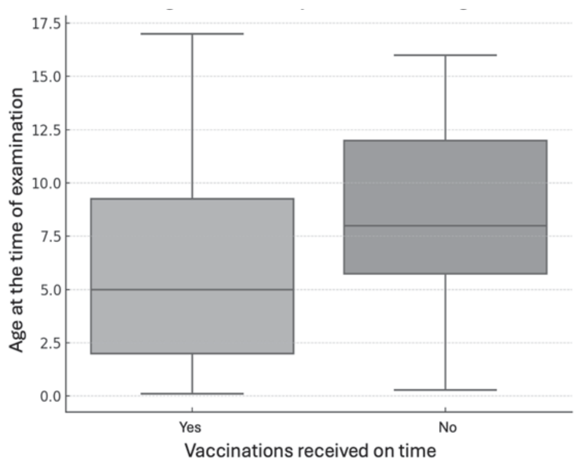


Fig. 2. Age distribution by vaccination timing among children in Kyiv, Rivne, and Volyn regions

received vaccines against pneumococcal infection, 13 children (8.6%, 95% CI: 5.1–14.1%) were vaccinated against varicella and influenza.

A difference was observed when comparing children's ages between the timely and delayed vaccination groups, indicating that children's age may be associated with timely or delayed immunization across different age groups (U=2088.0, p=0.0032) (Fig. 2).

Timeliness for each specific vaccine was calculated based on the proportion of children vaccinated timely for that vaccine within the cohort (Fig. 3). Notably, the lowest timely vaccination coverage was observed for the sixth dose of the Polio vaccine (57.2%).

Reasons for vaccination delays were reported by 76 caregivers (50%), with a summary provided in Table 6.

Multilevel logistic regression analysis. The table below presents the results of the multilevel logistic regression analysis performed to identify factors associated with delayed immunization among children. Odds Ratios (OR) along with their 95% Confidence Intervals (95% CI) and p-values are provided for each factor (Table 7).

Kaplan–Meier curve for MMR vaccine. The analysis focused on determining the duration between the recommended vaccination age (12 months after birth) and the actual vaccination date. Steeper decreases in the curve indicate periods when vaccination uptake was higher, while flatter sections suggest intervals with significant vaccination delays (Fig. 4).

Table 4

Mean age and standard deviation for receiving each dose per antigen received by children in Kyiv, Rivne, and Volyn regions

Vaccine		Mean Age (days)	Standard Deviation (days)
antigen	dose		
HepB	1	445.0	896.4
	2	530.5	952.4
	3	713.7	1043.7
Polio	1	265.5	791.2
	2	377.3	824.0
	3	480.6	894.5
DTP	1	271.9	790.1
	2	407.7	845.0
	3	463.0	787.0
Hib	1	119.8	567.8
	2	219.7	605.0
	3	290.3	663.2
MMR	1	701.4	879.2
	2	2348.2	896.1

Note: the table summarizes the mean age (in days) and standard deviation for receiving each vaccine dose among children. The BCG vaccine was intentionally excluded from this table due to data inaccuracies identified during analysis

Table 5

Antigen-specific immunization coverage of children in Kyiv, Rivne, and Volyn regions

Antigen	Number of administrated doses (N)	Coverage (%)
HepB-3	103	67%
BCG		
Polio-3		
DTP-3		
Hib-3		
MMR-1		
MMR-2		

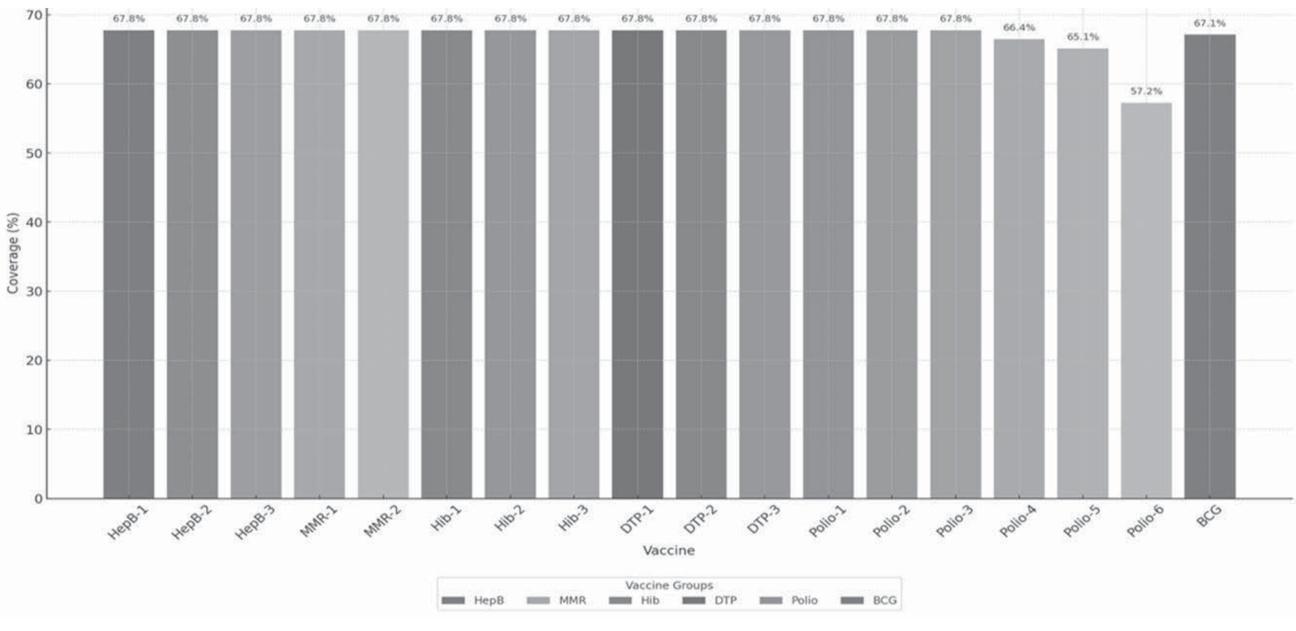
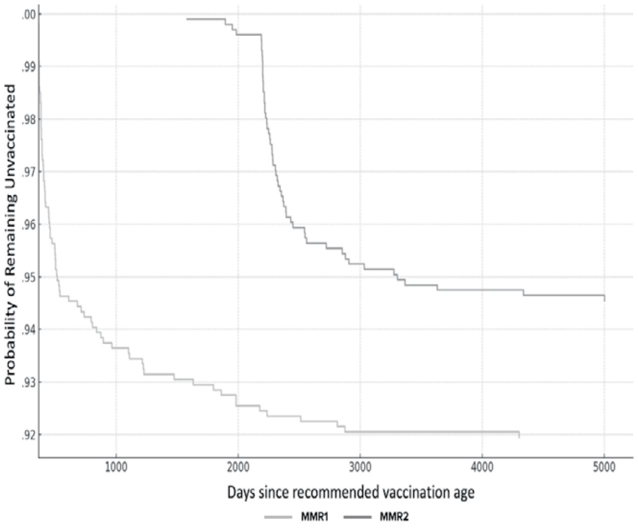


Fig. 3. Timeliness of vaccination for specific vaccines among children in Kyiv, Rivne, and Volyn regions



Notes: MMR – Measles, mumps, and rubella vaccine. On the horizontal axis (X) – the number of days after the recommended vaccination age (i.e., 12 months from birth). On the vertical axis (Y) – the probability that a child has not yet received the vaccination. If the curve drops sharply, this indicates that many children are vaccinated promptly or with minimal delay. If the curve is more gradual or remains flat, it suggests significant delays in vaccination. A rapid decline in the curve shortly after the recommended vaccination age indicates that most children are vaccinated on time or with only minor delays. If the curve remains relatively flat or decreases slowly, it points to systemic problems or barriers contributing to delayed vaccination. Extended periods without changes in the curve (horizontal segments) may indicate intervals during which vaccination was effectively unavailable or insufficiently promoted among the population

Fig. 4. Kaplan–Meier curve for time to MMR-1 vaccination among children in Kyiv, Rivne, and Volyn

Discussion

This study provides essential insights into the timing and completeness of childhood vaccinations in three regions of Ukraine, highlighting important findings for the national immunization program, healthcare professionals, and caregivers. The comprehensive assessment of vaccination timing is critical for public health planning, especially given the ongoing conflict and disruptions in healthcare services [3], alongside recent outbreaks of polio [19] and measles [22] and the current emerging situation with outbreaks of vaccine-preventable diseases in Ukraine [27]. Our findings underscore the necessity of targeted interventions to improve vaccination timeliness, ultimately increasing immunization coverage and enhancing protection against vaccine-preventable diseases.

Approximately two-thirds (64.3%) of children in our study were fully vaccinated, yet only half (50%) completed vaccinations timely, indicating significant gaps in adherence to recommended schedules. These findings align with global trends of declining timely vaccination due to systemic challenges and external disruptions, such as the recent COVID-19 pandemic [24] and the ongoing conflict in Ukraine [8].

Table 6

Reasons for vaccination delays reported by caregivers in Kyiv, Rivne, and Volyn regions

N°	Reason	Count	Percentage (%)	95% CI
1	Untimely healthcare visits / travel abroad	26	29.2	20.8-39.4
2	Refusal due to vaccine safety concerns and not to overload the immune system	23	25.8	17.9-35.8
3	Child was ill (most often acute respiratory infection; 4 cases of pertussis)	16	18.0	11.4-27.2
4	Refusal by healthcare workers	11	12.4	7.0-20.8
5	Organizational issues (e.g., absence of vaccines)	6	6.7	3.1-13.9
6	Religious beliefs	5	5.6	2.4-12.5
7	Awaiting vaccines at private facilities	2	2.2	0.6-7.8

Table 7

Multilevel regression analysis of factors associated with on-time vaccination in Kyiv, Rivne, and Volyn regions

Mixed factors of sociodemographic data and parental attitudes	Odds Ratio (OR)	95% CI	p-value
Urban (ref: Rural)	0.65	0.30–1.38	0.260
Gender (Female vs Male)	0.89	0.43–1.84	0.748
Pregnancy Complications (Yes vs No)	1.58	0.61–4.10	0.347
Child Comorbidities (Yes vs No)	2.12	1.01–4.46	0.047
Mother Vaccinated (Yes vs No)	0.37	0.12–1.14	0.084
Father Vaccinated (Yes vs No)	0.44	0.17–1.12	0.084

The identification of additional vaccinations (e.g., pneumococcal and varicella) received by 21.7% of children suggests parental awareness and acceptance of supplementary preventive measures. Increasing availability and awareness of these vaccines could potentially improve general vaccination adherence.

A significant age difference between the timely and delayed vaccination groups (U=2088.0, p=0.0032) suggests that older children tend to have more frequent delays. Younger children's higher vaccination adherence may reflect recent improvements in the health system, improvement of vaccine supply chain, usage of multivalent products, or improvement of parental attitudes towards vaccinations [9].

Delays of timely vaccination, primarily caused by untimely healthcare visits or travel abroad (29.2%), highlight gaps in healthcare system accessibility and continuity of care. Given 1) the number of people who left Ukraine, 2) the number of people who are potentially planning to return, and 3) their unknown immunization status – this issue has gained another level of importance and complexity [4]. Vaccine hesitancy due to safety concerns (25.8%) points to the ongoing need for targeted educational interventions aimed at caregivers. Acute illnesses (18.0%) as reasons for delays underline the importance of healthcare worker training to effectively manage temporary contraindications and subsequent catch-up vaccinations. Healthcare provider refusal (12.4%) indicates possible gaps in knowledge or compliance with guidelines among medical personnel, emphasizing the need for ongoing professional education [21].

Children with comorbidities were significantly more likely to experience vaccination delays (OR=2.12, p=0.047), reflecting potential uncertainties among caregivers or healthcare providers regarding vaccination safety in medically complex cases. The trend towards reduced vaccination delays among children of fully vaccinated parents suggests the influential role of parental attitudes and experiences in vaccination adherence [25].

The Kaplan–Meier analysis provided critical insights into the temporal dynamics of vaccination uptake, with many children vaccinated soon after the recommended age, although substantial delays were evident for others. Flat sections on the curve suggest periods of systematic disruptions or barriers, emphasizing the importance of ensuring continuous vaccine availability and accessibility. Rapid initial decreases in the curve highlight periods of effective vaccination campaigns or increased public awareness, reinforcing the value of sustained public health messaging and needs in new strategies to increase demand and acceptance, alongside with modern trends of using electronic technologies [18].

Calculations of mean ages for vaccine doses revealed substantial variations, indicating inconsistent adherence to the immunization schedule across different antigens. Notably, data inaccuracies related to BCG vaccinations highlight a crucial need for improved data collection processes and accuracy checks within the medical card and electronic healthcare system as an alternative.

Our findings demonstrate significant variability in vaccination timeliness, influenced by both healthcare system constraints and caregiver attitudes, warranting targeted educational and logistical interventions. It is important to emphasize that the existing system for assessing vaccination coverage levels in Ukraine requires substantial improvement, as current tools do not allow for accurate and timely evaluation [13]. One such solution could be the development of a specialized module within the electronic healthcare system, which is actively evolving in Ukraine [6] and, once refined, could serve as an alternative and more modern tool for both clinicians and public health professionals. Systematic monitoring of vaccine administration age could serve as an additional and effective tool for early identification and mitigation of delays in vaccine delivery [26].

Additionally, in these challenging times, there is a unique opportunity to unite all relevant sectors, including healthcare professionals, public health experts, and service recipients, in the collective search for optimal solutions. Regular training of healthcare professionals on vaccination schedules, contraindications, and effective communication could significantly enhance vaccination adherence [7]. Using standardized screening checklists for contraindications and modern digital calculators that have already been implemented nationwide in certain settings [2] could also be convenient and time-saving solutions for healthcare providers. Enhanced community engagement and targeted public health campaigns addressing common misconceptions and fears related to vaccines are critical steps toward improving vaccination timeliness [12].

Further research with larger, nationally representative samples is essential for a deeper understanding and developing robust interventions, especially given the substantial number of people who left Ukraine and may be planning to return, adding another layer of complexity and urgency to the issue [23].

Conclusions

This study highlights significant issues concerning vaccination timeliness and completeness among children in Kyiv, Rivne, and Volyn regions of Ukraine. Only half of the children received vaccinations within recommended timeframes, underscoring systemic and individual-level barriers. Major factors contributing to delayed vaccination included logistical issues, healthcare provider refusals, and caregiver vaccine hesitancy. Significant associations between vaccination delays and child comorbidities suggest targeted educational initiatives for both healthcare providers and caregivers. The mean age analysis of vaccine administration revealed substantial adherence variability, indicating a need for closer monitoring and standardized practices. Kaplan–Meier analysis illustrated clear patterns of vaccination delays, highlighting critical periods when healthcare accessibility and vaccine promotion require strengthening. Effective public health interventions should focus on improving healthcare system accessibility, addressing vaccine hesitancy, and enhancing professional education. Parental attitudes towards vaccination notably influence vaccination timeliness, emphasizing the importance of parental education and community engagement programs. Future studies with expanded scope and sample sizes are essential for developing more comprehensive and sustainable solutions to vaccination delays and immunization coverage overall in Ukraine.

Authors declare the absence of any conflicts of interests and own financial interest that might be construed to influence the results or interpretation of the manuscript.

Acknowledgments. The authors are grateful for the cooperation of medical specialists from state and private primary healthcare facilities in Kyiv, Bucha, Rivne, and Lutsk – Iryna Voloshyna, Zhanna Linchuk, Anna Ostafiychuk, Iryna Ivanyuk, and Orysya Vasylyshyn.

REFERENCES/ЛІТЕРАТУРА

1. Akmatov MK, Mikolajczyk RT. (2012). Timeliness of childhood vaccinations in 31 low and middle-income countries. J Epidemiol Community Health. 66: e14. doi: 10.1136/jech.2010.124651.
2. Australian Government, Department of Health and Aged Care. Australian Immunization Handbook: National Immunisation Catch-up Calculator. https://immunisationhandbook.health.gov.au/catch-up-calculator/calculator.
3. Beyrer C. (2024, May 3). Assessing the Impact of Russia's Invasion of Ukraine on Health Services: Crimes of War. JAMA Health Forum. 5(5): e240924. doi: 10.1001/jamahealthforum.2024.0924. PMID: 38758568.
4. Brinkmann F, Friedrichs A, Behrens GM, Behrens P, Berner R, Caliebe A et al. (2024, Apr). Prevalence of infectious diseases, immunity to vaccine-preventable diseases and chronic medical conditions among Ukrainian refugees in Germany – A cross sectional study from the German Network University Medicine (NUM). J Infect Public Health. 17(4): 642-649. Epub 2024 Feb 16. doi: 10.1016/j.jiph.2024.02.003. PMID: 38458134.
5. Cutts FT, Claquin P, Danovaro-Holliday MC, Rhoda DA. (2016, Jul 29). Monitoring vaccination coverage: Defining the role of surveys. Vaccine. 34(35): 4103-4109. Epub 2016 Jun 24. doi: 10.1016/j.vaccine.2016.06.053. PMID: 27349841; PMCID: PMC4967442.
6. Dolan SB, Carnahan E, Shearer JC, Beylerian EN, Thompson J, Gilbert SS et al. (2019, Mar 22). Redefining vaccination coverage and timeliness measures using electronic immunization registry data in low- and middle-income countries. Vaccine. 37(13): 1859-1867. Epub 2019 Feb 23. doi: 10.1016/j.vaccine.2019.02.017. PMID: 30808566; PMCID: PMC6420680.
7. Edinboro M. (2019, Apr). Assessing Vaccine Contraindications Through the Use of the Immunization Action Coalition Screening Checklist. Workplace Health Saf. 67(4): 204. doi: 10.1177/2165079919837253. PMID: 30900965.
8. Grundy J, Biggs BA. (2019, Apr 1). The Impact of Conflict on Immunisation Coverage in 16 Countries. Int J Health Policy Manag. 8(4): 211-221. doi: 10.15171/ijhpm.2018.127. PMID: 31050966; PMCID: PMC6499911.
9. Hadjipanayis A, van Esso D, Del Torso S, Dornbusch HJ, Michailidou K, Minicuci N et al. (2020, Feb 5). Vaccine confidence among parents: Large scale study in eighteen European countries. Vaccine. 38(6): 1505-1512. Epub 2019 Dec 14. doi: 10.1016/j.vaccine.2019.11.068. PMID: 31848051.
10. Hughes MM, Katz J, Englund JA, Khatry SK, Shrestha L, LeClerq SC et al. (2016, Feb 10). Infant vaccination timing: Beyond traditional coverage metrics for maximizing impact of vaccine programs, an example from southern Nepal. Vaccine. 34(7): 933-941. Epub 2016 Jan 11. doi: 10.1016/j.vaccine.2015.12.061. PMID: 26788880; PMCID: PMC4744084.
11. Jones CE, Danovaro-Holliday MC, Mwinnyaa G et al. (2024). Routine Vaccination Coverage — Worldwide, 2023. MMWR Morb Mortal Wkly Rep. 73: 978-984. doi: 10.15585/mmwr.mm7343a4.
12. Lukusa LA, Ndze VN, Mbeye NM, Wiysonge CS. (2018). A systematic review and meta-analysis of the effects of educating parents on the benefits and schedules of childhood vaccinations in low and middle-income countries. Hum Vaccin Immunother. 14(8): 2058-2068. Epub 2018 May 14. doi: 10.1080/21645515.2018.1457931. PMID: 29580159; PMCID: PMC6149946.
13. Malakhov KS. (2023, Dec 12). Insight into the Digital Health System of Ukraine (eHealth): Trends, Definitions, Standards, and Legislative Revisions. Int J Telerehabil. 15(2): e6599. doi: 10.5195/ijt.2023.6599. PMID: 38162941; PMCID: PMC10754247.
14. Ministry of Health of Ukraine. (2006). Instruction on Completing the Primary Medical Documentation Form No. 063/o «Vaccination Card». Order of the Ministry of Health of Ukraine No. 1 dated 10.01.2006. URL: https://zakon.rada.gov.ua/laws/show/z0688-06#Text.
15. Ministry of Health of Ukraine. (2008). On Approval of Reporting Forms for Planning and Implementing Preventive Vaccinations 'UkrVak 08'». Order of the Ministry of Health of Ukraine No. 413 dated 25.07.2008. URL: https://zakononline.com.ua/documents/show/51655___538042.

16. Ministry of Health of Ukraine. (2011). On the Procedure for Conducting Preventive Vaccinations in Ukraine and Control of Quality and Circulation of Medical Immunobiological Products. Order of the Ministry of Health of Ukraine No.595 dated 16.09.2011. URL: https://zakon.rada.gov.ua/laws/show/z1159-11#Text.
17. Mokhort H, Kovalchuk A, Sokolovska O, Higgs S. (2018, Dec). Contribution of Vaccination to the Reduction of Infectious Mortality in Ukraine in the Second Half of the 20th and Early 21st Century: A Comparative Population-Based Study of the Dynamics and Structure of Infectious Mortality and Incidence. Viral Immunol. 31(10):695-707. doi: 10.1089/vim.2018.0054. Epub 2018 Oct 9. PMID: 30300573; PMCID: PMC6362321.
18. Odone A, Gianfredi V, Sorbello S, Capraro M, Frascella B et al. (2021, Oct 3). The Use of Digital Technologies to Support Vaccination Programmes in Europe: State of the Art and Best Practices from Experts' Interviews. Vaccines (Basel). 9(10): 1126. doi: 10.3390/vaccines9101126. PMID: 34696234; PMCID: PMC8538238.
19. O'Leary A. (2023, Mar 1). Polio has recently been detected in places like London, New York, Ukraine and Israel-but what does it really mean to the global eradication effort? Int Health. 15(2): 111-112. doi: 10.1093/inthealth/ihac066.
20. Rasmussen AL. (2020, Dec 18). Vaccination Is the Only Acceptable Path to Herd Immunity. Med. 1(1): 21-23. doi: 10.1016/j.medj.2020.12.004. PMID: 33521750; PMCID: PMC7831753.
21. Rivero I, Raguindin PF, Buttler R, Martinon-Torres F. (2019, Sep). False Vaccine Contraindications Among Healthcare Providers in Europe: A Short Survey Among Members of The European Society of Pediatric Infectious Diseases. Pediatr Infect Dis J. 38(9): 974-976. doi: 10.1097/INF.0000000000002401. PMID: 31261366.
22. Rodyna R. (2019, Nov). Measles situation in Ukraine during the period 2017-2019. European Journal of Public Health. 29; Suppl 4: ckz186.496. https://doi.org/10.1093/eurpub/ckz186.496.
23. Scobie HM, Edelstein M, Nicol E, Morice A, Rahimi N, MacDonald NE et al. (2020, Oct 27). Improving the quality and use of immunization and surveillance data: Summary report of the Working Group of the Strategic Advisory Group of Experts on Immunization. Vaccine. 38(46): 7183-7197. Epub 2020 Sep 17. doi: 10.1016/j.vaccine.2020.09.017. PMID: 32950304; PMCID: PMC7573705.
24. Shattock AJ, Johnson HC, Sim SY, Carter A, Lambach P, Hutubessy RCW et al. (2024, May 25). Contribution of vaccination to improved survival and health: modelling 50 years of the Expanded Programme on Immunization. Lancet. 403(10441): 2307-2316. doi: 10.1016/S0140-6736(24)00850-X.
25. Tal O, Ne'eman Y, Sadia R, Shmuel R, Schejter E, Bitan M. (2021, Nov 2). Parents' attitudes toward children's vaccination as a marker of trust in health systems. Hum Vaccin Immunother. 17(11): 4518-4528. Epub 2021 Oct 6. doi: 10.1080/21645515.2021.1971472. PMID: 34613882; PMCID: PMC8828148.
26. Tchoualeu DD, Fleming M, Traicoff DA. (2023, May 11). A systematic review of pre-service training on vaccination and immunization. Vaccine. 41(20): 3156-3170. Epub 2023 Apr 15. doi: 10.1016/j.vaccine.2023.03.062. PMID: 37069032; PMCID: PMC10410287.
27. Ukrainian Public Health Center. (2025). Infectious morbidity of the population of Ukraine. Report on selected infectious and parasitic diseases as for March 2025. URL: https://phc.org.ua/kontrol-zakhvoryuvan/inshi-infekciyni-zakhvoryuvannya/infekciyna-zakhvoryuvanist-naselennya-ukraini.
28. Verster JC, Kraneveld AD, Garssen J. (2022, Dec 20). The Assessment of Immune Fitness. J Clin Med. 12(1): 22. doi: 10.3390/jcm12010022. PMID: 36614822; PMCID: PMC9821524.
29. Walton S, Cortina-Borja M, Dezateux C, Griffiths LJ, Tingay K, Akbari A et al. (2017). Measuring the timeliness of childhood vaccinations: using cohort data and routine health records to evaluate quality of immunisation services. Vaccine. 35: 7166-7173. doi: 10.1016/j.vaccine.2017.10.085.
30. WHO. (2021). European Immunization Agenda 2030. Copenhagen: WHO Regional Office for Europe; Licence: CC BY-NC-SA 3.0 IGO. URL: https://www.who.int/europe/publications/i/item/9789289056052.

Відомості про авторів:
Гречуха Євгеній Олегович – PhD-здобувач педіатрії, неонатології, дитячих інфекційних хвороб, імунології та алергології НУОЗ України імені П.Л. Шупика.
Адреса: м. Київ, вул. Дорогожицька, 9; тел.: +38 (044) 201-32-04. http://orcid.org/0000-0001-7371-3798.
Гнилоскуренко Ганна Валеріївна – к.мед.н., доц., доц. каф. педіатрії, акушерства і гінекології ННЦ «Інститут біології та медицини». Адреса: м. Київ, просп. Акад. Глушкова, 2; тел.: +38 (044) 521-35-98. https://orcid.org/0000-0003-4141-4579.
Волоха Алла Петрівна – д.мед.н., проф., зав. каф. дитячих інфекційних хвороб та дитячої імунології НУОЗ України імені П.Л. Шупика. Адреса: м. Київ, вул. Дорогожицька, 9; тел.: +38 (044) 201-32-04. https://orcid.org/0000-0003-3092-2228.
Стаття надійшла до редакції 14.02.2025 р., прийнята до друку 10.06.2025 р.