A.G. Petrova, T.A. Bayanova, A.S. Vanyarkina, E.A. Novikova, E.V. Moskaleva, E.D. Kazantseva

ADHERENCE OF PARENTS AND PHYSICIANS OF IRKUTSK TO PERTUSSIS VACCINATION

DOI 10.25789/YMJ.2021.74.12

Background. Mass pertussis vaccination has significantly reduced morbidity and mortality among young children, however, despite the high coverage of primary vaccination against pertussis, there is an increase in pertussis morbidity and mortality in Russia.

Aim of the study. Assessment of knowledge and attitudes regarding pertussis preventive vaccination among parents and physicians in Irkutsk.

Materials and methods. To study the level of knowledge and attitudes regarding pertussis cocoon vaccination, we carried out a descriptive retrospective epidemiological study which included a voluntary anonymous survey of 1620 parents and 324 physicians of various specialties. Statistical data processing was performed using MS Excel 2010 (Microsoft Corporation, USA).

Results. Our study showed that 39.5 % of physicians are not sufficiently informed of cocoon vaccination strategy; 26.6 % of physicians consider it necessary to recommend cocoon vaccination; 29.1 % of physicians do not consider it necessary to recommend this strategy; 4.8 % of physicians consider vaccination to be contraindicated for pregnant women. Secondary vaccination against pertussis in carried out in 8.4 % of children of preschool, school age and in adolescence. 33.5 % of women were informed of the possibility to get vaccinated against pertussis during pregnancy, and 8.5 % of the respondents answered that they didn't understand the importance of pertussis vaccination before and during pregnancy.

Conclusion. We revealed a low level of awareness of the necessity for secondary vaccination at school age, and especially of cocoon vaccination strategy among parents and physicians in Irkutsk.

Keywords: vaccination, immunization, prevention, children, parents, physicians, whooping cough, pertussis, *Bordetella pertussis*

Introduction. Nowadays pertussis remains a common infectious disease, often with the development of complications, despite the achieved WHO-recommended vaccination coverage [5]. It has been earlier found out that pertussis makes the course of the disease more severe for those children, affected with premorbid metabolic or neurological diseases [13, 7]. Globally, since 2010, DTP (Diphtheria, Tetanus, Pertussis) vaccine coverage has remained insufficient - 86% [2]. Pertussis is a heavy burden for the healthcare system in many countries, including Russia. In recent years, there has been a significant increase in the incidence of pertussis, registered on the territory of the Russian Federation; and this increase occurs regardless of what vaccines have been used [10, 1, 11, 14]. Order No 125n of 21 March 2014 "On the approval of the national calendar of preventive vaccinations and the calendar of preventive vaccinations for epidemic indications (NCPV)" provides only one revaccination against pertussis at the age of 18 months.

In the Irkutsk region, there has been an increase in incidence rates since 2016, which exceeds the national level by 1.5-2 times [9, 8].

Aim of the study. To provide clinical and epidemiological characteristics of pertussis to justify measures for optimization of the pertussis vaccination strategy in the Irkutsk region and to analyze the commitment of parents and physicians to pertussis vaccination, the degree of awareness of revaccination necessity in preschoolers, schoolers, and adolescents, and of the cocoon strategy of vaccination.

Materials and methods. A descriptive retrospective epidemiologic study was carried out. The long-term trends in the incidence of pertussis among the total population and children of different age groups were analyzed for the period from 2000 to 2019, according to the State Federal Statistical Monitoring Forms (Form 2 "Information on Infectious and Parasitic Diseases"). We compared the incidence rates among children of different age groups in the year with the minimum level (2012) during the analyzed period and then in 2019.

To study the level of awareness and attitude to the cocoon strategy of vaccination against pertussis, a voluntary anonymous survey of physicians of various specialties (n = 324) was carried out. From this sample of physicians, 3 groups were selected: group 1 (n = 18) – physicians, prescribing vaccinations for children (pediatricians, neonatologists); group 2 (n = 54) – physicians, prescribing vaccinations for adults (therapists, obstetricians-gynecologists); group 3 (n = 52) – physicians, who can advise on vaccination issues (neurologists, surgeons, and other specialists).

Parents also participated in the study. These were the parents of children, aged 0 to 18 years inclusive, who came for the outpatient appointments in 12 city children's polyclinics in Irkutsk (n = 930); the parents of children, who underwent treatment in the pediatric hospital of the Clinic of the Scientific Centre for Family Health and Human Reproduction Problems (n = 104); expectant mothers, attending antenatal clinics (n = 339); female patients of the city perinatal center of the III level (n = 247). Our own questionnaire included 15 questions to let us know more about: the degree of awareness of the vaccination

PETROVA Alla G.– Dr. Sc. (Med.), Professor, Chief Research Officer at the Laboratory of Infectology and Immunoprophylaxis in Pediatrics, Head of the Laboratory of Infectology and Immunoprophylaxis in Pediatrics, Scientific Centre for Family Health and Human Reproduction Problems, e-mail: rudial75@gmail.com, https://orcid.org/0000-0002-7965-8061, BAYANOVA Tatyana A. Cand. Sc. (Med.), Associate Professor at the Department of Epidemiology, Irkutsk State Medical University, e-mail: t.bayanova@ismu.baikal.ru.
VANYARKINA Anastasia S. – Cand. Sc. (Med.), Research Officer at the Laboratory of Infectology and Immunoprophylaxis in Pediatrics, Scientific Centre for Family Health and Human Reproduction Problems, e-mail: nasty-191@yandex.ru, https://orcid.org/0000-0001-8434-1600; **NOVIKOVA Evgeniya A.** – Junior Research Officer at the Laboratory of Infectology and Immunoprophylaxis in Pediatrics, Scientific Centre for Family Health and Human Reproduction Problems, e-mail: europe411@mail.ru, https://orcid.org/0000-0002-9353-7928; **MOSKALEVA Ekaterina V.** – Cand. Sc. (Med.), Research Officer at the Laboratory of Infectology and Immunoprophylaxis in Pediatrics, Scientific Centre for Family Health and Human Reproduction Problems, e-mail: mkatena@mail.ru, https://orcid.org/0000-0003-4196-0713; **KAZANTSEVA Ekaterina D.** – Clinical Resident, Scientific Centre for Family Health and Human Reproduction Problems, e-mail: kat.smile7@yandex.ru, https://orcid.org/0000-0003-0692-2295

necessity against infections, according to the NCPV; the degree of awareness of the vaccination possibility against pertussis of a pregnant woman and her environment to protect her baby from pertussis; adherence to revaccination against pertussis in preschoolers, schoolers and adolescents.

To assess the statistical significance of differences in relative indicators, confidence intervals were calculated with a significance level of 95% (95% CI). The statistical significance of intergroup differences in terms of qualitative characteristics was assessed using the χ2 criterion: with Rabs. <10 - with Yates' correction, with Rabs. <5 - using two-sided Fisher's exact test. The 95% CI for frequencies and fractions was calculated using an online calculator, proposed by the Vassar Stats: Web Site for Statistical Computation (http://vassarstats.net). Graphical data processing was performed using MS Excel 2010 (Microsoft Corporation, USA).

Results and discussion. Long-term trends in the incidence of pertussis among the total population of the Irkutsk region were characterized by uneven distributions of indicators over the years with a slight upward trend, the average annual growth rate (Tgr.) was 2% for the analyzed period (2000–2019). Until 2015, there was a pronounced downward trend with a decline rate of –5.8%, with an average annual value of 4.8 per 100 thousand people of the population. In 2016, a significant increase in the incidence rate was registered: for example, the indicator was 4.4 per 100 thousand people of the population, followed by an increase (Tgr. = 17.5%).

During the analyzed period, the incidence among children of 0-14 years old was significantly higher than that among adults and among the population, the long-run annual average value is 28.03 per 100 thousand people of this age group, the average annual growth rate for the period 2015-2019 is 31.6%. Incidence among adults was registered at a sporadic level, exceeding 1.0 per 100 thousand people of the corresponding group since 2018 (Fig. 1).

The highest incidence rates were registered among children in the age group under 1 year of age with an the long-run annual average value of 53.6 per 100 thousand people of the corresponding group, significantly exceeding similar indicators in the age groups of children of 1–2 years (1.9 times), 3–6 years (in 2.5 times), 7-14 years (3.1 times) and 15-17 years (8.1 times). Moreover, children under 1 year of age were the most affected

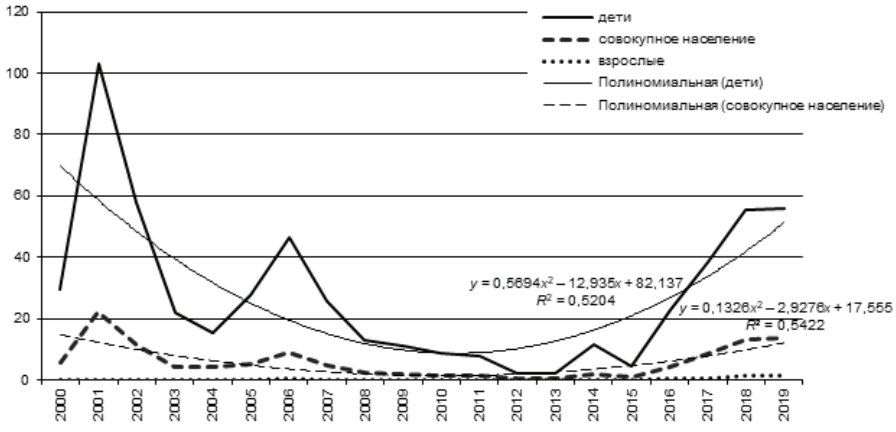

Fig. 1. Long-term trends in the pertussis incidence in adults and 0–14 y.-o. children in the Irkutsk region in 2000–2019 (per 100 000 people of the population)

Table 1

Pertussis incidence (per 100 000 people of the population. 95% CI) and the proportion (%) of children from various age groups during the periods of high and low incidence

Age groups	Years				χ^2	*p*
	2012		2019			
	%	Per 100 000 people	%	Per 100 000 people		
under 1 year	18.2	5.4 [0÷12.9]	11.3	121.1 [82.2÷160.0]	38.4	$p < 0.001$
1–2 year-olds	27.3	4.3 [0÷9.1]	14.6	69.3 [41.6÷97.0]	41.1	$p < 0.001$
3–6 year-olds	18.2	1.6 [0.9÷2.3]	16.8	37.5 [27.7÷47.3]	40.6	$p < 0.001$
7–14 year-olds	36.4	1.8 [0.1÷3.5]	41.8	52.8 [43.9÷61.7]	106.2	$p < 0.001$
15–17 year-olds	0	0	7.9	31.0 [18.9÷43.2]	26.7	$p < 0.001$

age group during periods of high and low incidence rates (Table 1).

Even though the region has achieved and is maintaining the normative indicators of preventive vaccination coverage against pertussis in the decreed groups of the child population (vaccination coverage of children at the age of 12 months was 97.03%, revaccination coverage of children at the age of 24 months was 97.08%) [8], in 2019 there was an increase in the incidence in all age groups (p <0.001).

Over the analyzed period, the proportion of children under 14 years of age among those, who became sick, was 89.5%, adolescents - 5.1%, adults - 5.4%.

The proportion of children of different age groups has changed (Fig. 2, 3) since 2016, which was affected by the excess incidence. There was a statistically significant decrease in the propor-

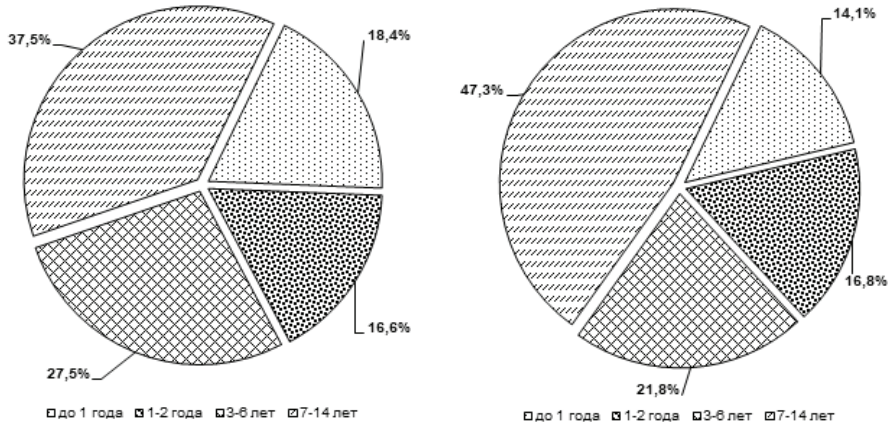

Fig. 2. The structure of pertussis incidence (%) in children of various age groups in 2000–2015 (па), 2016–2019 (б)

Table 2

Attitudes of physicians of different specialties to the cocoon strategy of vaccination (n = 324)

Respondents' answers	Group 1 (n = 218)			Group 2 (n = 54)			Group 3 (n = 52)			The total number (n = 324)		
	abs.	%	[95% CI]	abs.	%	[95% CI]	abs.	%	[95% CI]	abs.	%	[95% CI]
Yes, I consider iYes, I consider it necessary to recommend the cocoon strategy of vaccination for pregnant women	57	23.8	[18.6÷29]	20	35.1	[22.8÷47.4]	17	29.3	[17.6÷41]	94	26.6	[22.1÷31.1]
No, I do not consider it necessary to recommend the cocoon strategy of vaccination for pregnant women.	75	31.3	[25.7÷36.9]	14	24.5	[13.5÷35.5]	14	24.1	[13.1÷35.1]	103	29.1	[24.4÷33.8]
Insufficiently informed about the cocoon strategy of vaccination	94	39.3	[33.3÷45.3]	21	36.8	[24.3÷49.3]	25	43.1	[30.4÷55.8]	140	39.5	[34.6÷44.4]
Vaccination is contraindicated for pregnant women	13	5.6	[3.1÷8.3]	2	3.6	[0÷8.3]	2	3.5	[0÷8.2]	17	4.8	[2.7÷6.9]

Note. Some physicians gave several answers, % was calculated on the number of answers (group 1 - 239 answers; group 2 - 57 answers, group 3 - 58 answers).

tion of children under 1 year of age ($\chi 2 = 6.3$; $p < 0.05$); the proportion of children of 1–2 years old did not change; the proportion of children of 3–6 years old and 7–14 years old increased significantly ($\chi 2 = 7.9$; $p < 0.01$ and $\chi 2 = 18.2$; $p < 0.001$, respectively).

Several European countries use the cocoon strategy of vaccination, which is vaccination of family members surrounded by a newborn, quite successfully. Our research has shown that among the total number of respondents, 39.5% of physicians are not sufficiently informed about the cocoon strategy of vaccination; 26.6% consider it necessary to recommend the cocoon strategy of vaccination; 29.1% do not consider it necessary to recommend the cocoon strategy of vaccination; 4.8% consider vaccination to be the contraindication for pregnant women (intergroup differences according to the $\chi 2$ criterion are not statistically significant ($p > 0.05$)) (Table 2).

The analysis of the parents' questionnaires showed that 98% [97.3 ÷ 98.7%] of parents (1590 out of 1620) vaccinate their children according to the NCPV, including additional vaccinations. Revaccination against pertussis in preschoolers, schoolers and adolescents is carried out by 8.4% [7.1 ÷ 9.8%] of respondents (136 out of 1620). Refusal to vaccinate was registered in 2% of the parents surveyed. At the same time, as our earlier works demonstrated, the level of education (incomplete secondary), the financial situation in the family (average) and the acquisition of information about vaccinations through the mass media affect the refusal to vaccinate [3].

33.5% [31.2 ÷ 35.8%] (543 out of 1620) women were informed about the possibility of getting vaccinated against this infection during pregnancy, and 8.5% [7.2 ÷ 10.0%] of the respondents (138 of 1620) told they did not understand the importance of pertussis vaccination before and during pregnancy.

29.4% [27.4 ÷ 31.7%] of the parents (477 out of 1620) know and agree that before entering school it is necessary to revaccinate against pertussis, diphtheria, and tetanus. Revaccination against diphtheria, tetanus, and pertussis before entering school was carried out by 33.5% [31.1 ÷ 35.8%] of respondents (542 out of 1620), and 24% [22.0 ÷ 26.4%] (390 of 1620) replied that they did not do the revaccination.

Discovered trends are traced in presence of epidemiological problems with pertussis. At the present stage, the epidemic process of pertussis is characterized by a high incidence rate of children under one year of age, fading away of post-vaccination immunity, and a high susceptibility of adolescents and adults [12].

Several works [6, 4] demonstrated that among children, affected by pertussis, previously vaccinated children of the first 2 years of life predominated, which is due to insufficient coverage with preventive vaccinations due to parents' refusal to vaccinate children, unreasonable medical exemption, non-adherence of vaccination and revaccination schemes, as well as no domestic vaccine for age-related revaccinations for children over 5 years old.

Conclusion. There has been an increase in the incidence of pertussis in children of all age groups. Low coverage with revaccination against pertussis in schoolers and adolescents has been registered. There is an objective necessity to introduce age-related revaccinations into the vaccination calendar for children, aged 6 and 14 years. In addition, it is necessary to do vaccinations of people in contact with an unvaccinated child under 1 year of age.

Among different groups of the population (parents and physicians) in Irkutsk city, there is low awareness of the revaccination necessity at school age, especially in relation to the cocoon strategy of vaccination. What is need is to conduct training seminars, lectures for physicians and to hold events to raise awareness of the population.

Conflict of interests. The authors declare neither direct nor potential conflicts of interest related to the publication of this article.

Литература

1. Басов А.А. Эпидемический процесс коклюша на современном этапе: автореф. дис. … канд. мед. наук. М.; 2016. [Basov AA. Pertussis epidemic process at the present stage: Abstract of the Dissertation of Cand. Sc. (Med.). Moscow; 2016. (In Russ.).]

2. В 2018 г. 20 миллионов детей не были охвачены жизненно важными прививками от кори, дифтерии и столбняка. 2019; URL: https://www.who.int/ru/news-room/detail/15-07-2019-20-million-children-miss-out-on-lifesaving-measles-diphtheria-and-tetanus-vaccines-in-2018. (дата обращения: 17.02.2021) [20 million children miss out on lifesaving measles, diphtheria and tetanus vaccines in 2018. 2019; URL: https://www.who.int/ru/news-room/detail/15-07-2019-20-million-children-miss-out-on-lifesaving-measles-diphtheria-and-tetanus-vaccines-in-2018. (In Russ.).]

3. Вакцинопрофилактика у детей: знания родителей или компетенция врача. Ваняркина А.С., Петрова А.Г., Баянова Т.А. [и др.] // Тихоокеанский медицинский журнал. 2019. №4(78). С. 23-28. DOI: 10.34215/1609-1175-2019-4-23-

28 [Preventive vaccination in children: Parents' knowledge or physician's competence. Vanyarkina AS. Petrova AG. Bayanova TA [et al.] *Pacific Medical Journal*. 2019. №4(78). P. 23-28. (In Russ.).] DOI: 10.34215/1609-1175-2019-4-23-28.

4. Клинико-эпидемиологические аспекты коклюша у детей в условиях массовой вакцинопрофилактики. Бабаченко И.В., Нестерова Ю.В., Чернышова Ю.Ю., [и др.] // Журнал инфектологии. 2019. №11(2). С. 88-96. DOI: 10.22625/2072-6732-2019-11-2-88-96 [Clinical-epidemiological aspects of whooping cough in children in conditions of mass vaccinoprophylactics. Babachenko IV, Nesterova YuV, Chernyshova YuYu [et al.]. *Journal Infectology*. 2019; 11(2): 88-96. (In Russ.). DOI: 10.22625/2072-6732-2019-11-2-88-96.

5. Миндлина А.Я., Полибин Р.В. О необходимости совершенствования тактики иммунопрофилактики коклюша // Пульмонология. 2016. №26(5). С. 560-569. DOI: 10.18093/0869-0189-2016-26-5-560-569 [Mindlina AYa, Polibin RV. About the need to improve immunization against the whooping cough. *Russian Pulmonology*. 2016; 26(5): 560-569. (In Russ.) DOI: 10.18093/0869-0189-2016-26-5-560-569.

6. Михеева И.В., Салтыкова Т.С., Михеева М.А. Целесообразность и перспективы вакцинопрофилактики коклюша без возрастных ограничений // Журнал инфектологии. 2018. №10(4). С. 14-23. DOI: 10.22625/2072-6732-2018-10-4-14-23 [Mikheeva IV, Saltykova TS, Mikheeva MA. Expediency and prospects of a vaccinal prevention of whooping cough without age restrictions. *Journal Infectology*. 2018; 10(4): 14-23. (In Russ.).] DOI: 10.22625/2072-6732-2018-10-4-14-23.

7. Ожирение и связанное со здоровьем качество жизни в этнических группах подростков, проживающих в сельских районах Республики Бурятия. Рычкова Л.В., Погодина А.В., Аюрова Ж.Г. [и др.] // Бюллетень сибирской медицины. 2018. №17(3). С. 105-114. DOI: 10.20538/1682-0363-2018-3-105-114 [Obesity and health-related quality of life in adolescents from ethnic groups of rural areas of Buryatia, Russia. Rychkova LV, Pogodina AV, Ayurova ZhG [et al.]. Bulletin of Siberian Medicine. 2018. №17(3). P. 105-114. (In Russ.).] DOI: 10.20538/1682-0363-2018-3-105-114.

8. О состоянии санитарно-эпидемиологического благополучия населения в Иркутской области в 2018 году. 2019; URL: http://38.rospotrebnadzor.ru/396 (дата обращения: 17.02.2021). [On the state of sanitary and epidemiological well-being of the population in the Irkutsk region in 2018. 2019; URL: http://38.rospotrebnadzor.ru/396. (In Russ.).]

9. О состоянии санитарно-эпидемиологического благополучия населения в Российской Федерации в 2018 году. Государственный доклад. М.: Федеральная служба по надзору в сфере защиты прав потребителей и благополучия человека; 2019 [On the state of sanitary and epidemiological well-being of the population in the Russian Federation in 2018. State report. Moscow: Federal Service for Surveillance on Consumer Rights Protection and Human Well-being; 2019].

10. Резолюция междисциплинарного совещания специалистов «Нерешённые вопросы эпидемиологии коклюша в РФ и новые возможности его вакцинопрофилактики». Эпидемиология и Вакцинопрофилактика. 2018. №17(4). С. 63-67. DOI: 10.31631/2073-3046-2018-17-4-63-67 [Resolution of the interdisciplinary meeting 'Unresolved issues in the pertussis epidemiology in the Russian Federation and new opportunities for its vaccine prevention'. *Epidemiology and Vaccinal Prevention*. 2018. №17(4). P. 63-67. (In Russ.).] DOI: 10.31631/2073-3046-2018-17-4-63-67.

11. Таточенко В.К. Перспективы развития иммунопрофилактики в России // Журнал микробиологии, эпидемиологии и иммунологии. 2010. №5. С. 90-98. [Tatochenko VK. Prospects for the preventive immunization in Russia. *Journal of Microbiology*, *Epidemiology and Immunobiology*. 2010. №5. P. 90-98. (In Russ.).]

12. Эпидемиологическое обоснование к изменению стратегии и тактики специфической профилактики коклюша в современных условиях. Субботина К.А., Фельдблюм И.В., Кочергина Е.А. [и др.] // Эпидемиология и Вакцинопрофилактика. 2019. №18(2). С. 27-33. DOI: 10.31631/2073-3046-2019-18-2-27-33 [Epidemiological rationale for changing the strategy and tactics of vaccination of pertussis in current conditions. Subbotina KA, Feldblum IV, Kochergina EA [et al.]. Epidemiology and Vaccinal Prevention. 2019; 18(2): 27-33. (In Russ.). DOI: 10.31631/2073-3046-2019-18-2-27-33.

13. Completeness and timeliness of diphtheria-tetanus-pertussis, measles-mumps, rubella, and polio vaccines in young children with chronic health conditions: A systematic review. Walker EJ, MacDonald NE, Islam N [et al.]. *Vaccine*. 2019; 37(13): 1725-1735. DOI: 10.1016/j.vaccine.2019.02.031

14. Duration of immunity against pertussis after natural infection or vaccination. Wendelboe AM, Van Rie A, Salmaso S [et al.]. *Pediatr Infect Dis J*. 2005; 24(5): 58-61. DOI: 10.1097/01.inf.0000160914.59160.41