Identifying the main determinants that have an impact on the level of vaccination among children.

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ABSTRACT

Background. Thanks to vaccinations, many infections can be prevented, including: whooping cough, diphtheria, tetanus, poliomyelitis, measles, mumps, rubella, hepatitis B, hemophilic infection, pneumococcal infection, meningococcal infection, rotavirus infection, chicken pox, hepatitis A, papillomavirus infection. and other. According to WHO research, it was established that if the level of vaccination coverage of the country's population drops by several percent, it creates favorable conditions for the spread of infectious diseases, that the lower the collective immunity, the higher the probability of outbreaks and epidemics.

The Aim. To study and analyze the impact of risk factors on reducing the level of vaccine prophylaxis in the children's population.

Materials and Methods. This study was conducted using the questionnaire method, for which a questionnaire was developed. The first group consisted of 280 children who received a vaccination and the second group consisted of 180 children who were not vaccinated. Non-parametric statistical analysis for two independent sample populations was used to compare median values Mann-Whitney (MW) test. Fisher's test was used to compare proportions.

Results. During the study, it was found that the most frequent reasons for parents' refusal to vaccinate their children were: religious views of family members increase the risk of non-vaccination in children by 2.4 times;in single-parent families where the parents are divorced, children did not receive any vaccination 2.6 times more than in full-parent families; unfinished average of 35.7 times and lack of education 24.1 times increase the impact on the lack of vaccination in children.

Conclusions. We identified the following risk factors that influence the vaccination rate, namely: demographic, socio-economic, biological and socio-psychological.

Keywords: vaccine prevention, statistics, infectious diseases, risk factors.

Introduction

Vaccination, as an integral part of the public health system, has proven itself as the most effective tool in the fight against infectious diseases. So far, scientists have not invented something more effective than immunoprophylaxis for this [1].

Today's global issue in Ukraine is to ensure the protection of the population from outbreaks of controlled infectious diseases through timely planned immunization of the country's residents. That is, the development of modern programs for immunization of children and adults is one of the urgent and priority directions of the public health system. In today's society, there are widespread misconceptions and ignorance about vaccination among parents. In Ukraine, parents unreasonably refuse vaccinations, which leads to outbreaks of deadly diseases. In 2020, WHO for the first time included vaccine refusal in its annual list of threats to humanity. Therefore, the study studied the dynamics of this phenomenon in order to develop ways to combat it. [1; 2]

According to a survey by the United Nations Children's Fund (UNICEF), mistrust of vaccinations in general and vaccine manufacturers, mistrust of medical professionals who promote vaccinating children and the conditions for storing vaccines, as well as fear of diseases and side effects from vaccinations - these are the main reasons for refusal of vaccination by the latter for years. [3;4]

One of the main risk factors for the decrease in childhood vaccination in recent years is the full-scale military invasion of the russian federation into Ukraine. The level of coverage of preventive vaccinations in Ukraine before the

war against most vaccine-controlled infections lagged behind the WHO recommended 90–95%. Currently, according to the Ministry of Health of Ukraine, the analysis of preventive vaccination coverage in the regions that provided information in 2022 indicates an even lower level of preventive vaccination coverage [2;5] In connection with the active hostilities on the territory of Ukraine, in some regions it is impossible to provide vaccination due to destroyed hospitals, warehouses, the inability to provide logistics, etc., therefore the rates of coverage are low [6].

Vaccine prophylaxis is recognized as one of the most successful and cost-effective measures of all existing public health measures. However, it is difficult to find a medical topic that would generate so much controversy among the population. Therefore, in recent years, anti-vaccination sentiments have sharply increased in Ukraine, and the number of vaccinated children is steadily decreasing. Doctors are a major source of both negative and positive attitudes toward vaccination, as well as a source of misinformation. Shortages and interruptions in the supply of free vaccines in hospitals also have a significant impact on vaccination coverage. [6; 7]

The aim of the work is to study and analyze the impact of risk factors on reducing the level of vaccine prophylaxis in the children's population.

Materials and Methods

460 children who were divided into two groups took part in the study. The first group consisted of 280 children who received a full course of vaccination or were partially vaccinated, and the second group consisted of 180 children who were completely unvaccinated. All children are studying at Horodyshchenskiy pre-school educational institution No.1 "Dzhereltse" of Cherkasy region; Horodyshchensky Economic Lyceum of the Horodyshchenska District Council of Cherkasy Oblast; Horodyschensky pre-school educational institution No.2 "Zirochka" of Cherkasy region. All children are under medical supervision at the KP "Horodishchenskyi District Center of Primary Health Care" of the Horodyshchenskyi District Council of the Cherkasy region.

The study of data on the state of vaccination prophylaxis of children was also carried out by the method of copying data from the form of primary accounting documentation No.112/o "History of child development".

The questionnaire "Regarding the state of vaccine prevention of infectious diseases in children and determinants that have an impact on the level of vaccination of the children's population" was used to survey the people who participated in the study. All individuals participated in the study of their own free will and signed an informed consent.

Non-parametric statistical analysis for two independent sample populations Mann-Withney (MW) test was used to compare median values. Fisher's test was used to compare proportions or proportions.

In order to determine the risk factors of the lack of vaccine prophylaxis in children, a logistic regression analysis was used with the calculation of the odds ratio (OR) of the occurrence of the event according to the z-criterion, and their 95% confidence interval (CI) was determined using the program package "MedCalc Software" version 22.023 (MedCalc Software Ltd, Belgium). The difference in the parameters of the four hollow tables was considered statistically significant at $p<0.05$ and if the CI did not contain "1".

Results and Discussion

A scientific study was conducted using a questionnaire to identify risk factors for the reduction or absence of vaccination in children of various ages. The study involved 460 children who were divided into 2 groups: the main group - non-vaccinated children, 180 people, and the control group - children, 280 people, who received all or part of the vaccinations. Biological risk factors of children who were not vaccinated were identified. Demographic and socio-economic risk factors for lack of vaccination among children of different ages have been determined. Socio-psychological factors were also determined, thanks to which the state of parents vaccine prophylaxis, contraindications to vaccination, reasons for parents' refusal to vaccinate, and awareness of vaccines in general were revealed. (Tables 1–3).

Table 1. Demographic and socio-economic risk factors for lack of vaccination in children of different ages.

Risk factor	Output data (patients)				OR	95% CI	p
	a	b	c	d			
Number of children in the family							
Three childrens in the family	20	160	6	274	5.7	2.2–14.5	0.0030
Religiosity	148	32	185	95	2.4	1.5–3.7	0.0002
Belonging to religious organizations	78	70	85	100	1.3	0.9–2.1	0.2207
Education							
Medium special	43	133	38	242	2.0	1.3–3.3	0.0035
Average	47	129	29	251	3.2	1.9–5.2	0.0001
Unfinished secondary	20	156	1	279	35.7	4.8–269.0	0.0005
No education	14	162	1	279	24.1	3.1–185.0	0.0022
Marital status							
Divorced	43	136	30	250	2.6	1.6–4.4	0.0002
Employment							
Does not work	29	151	17	263	2.9	1.6–5.6	0.0007
Physical activity	102	49	31	249	16.7	10.1–27.7	0.0001
Financial income per family member							
One minimum wage per family member	111	69	14	266	30.5	16.5–56.5	0.0001
Smoking in the family	89	91	64	216	3.3	2.2–4.9	0.0001
Consumption of alcohol	155	25	72	208	17.9	10.8–29.5	0.0001 0.0014
Once a week	14	141	1	71	27.7	3.6–212.8	0.0002
Weekend	74	81	15	57	3.5	1.8–6.6	

Note *: a – children with sign and not vaccinated; b – children without sign and not vaccinated; c – children with sign and vaccinated; d – children without sign and vaccinated.

During the conducted research, the main demographic and socio-economic risk factors that lead to the lack of vaccination among children of different ages were identified. We can observe that in families with three children, children lack vaccination 5.7 times more often than in families with fewer children. The religiosity of family members increases the risk of lack of vaccination in children by 2.4 times. The level of education is a risk factor for refusing vaccination, namely, incomplete secondary education in 35.7 times and no education in 24,1 times increase the impact on the lack of vaccination in children.

The labor activity of people also depends indirectly on the availability of education. Therefore, if family members do not work, then 2.9 times more often the child will not be vaccinated, and if family members are engaged in physical labor only, then in 16.7 times more often. The social risk factor for not vaccinating a child is the income per family member, when it is one minimum wage, this is 30.5 times more than in the vaccinated group children Social risk factors, namely, bad habits, also increase the chances that a child will not be vaccinated: smoking by 3.3 times, alcohol use by 17 .9 times.

Table 2. Biological risk factors for lack of vaccination of children.

Risk factor	Output data (patients)				OR	95% CI	p
	a	b	c	d			
Child's health condition							
Is the child healthy?	112	68	233	47	0.3	0.2–0.5	0.0001
Perinatal risk factors							
Complicated pregnancy	27	153	1	279	49.2	6.6–365.8	0.0001
Presence of diseases in the child:							
Respiratory organs	23	157	21	259	1.8	0.9–3.3	0.0007
Cardiovascular system	27	153	12	268	3.9	1.9–8.0	0.0001

Musculoskeletal system	11	169	1	279	18.0	2.3–141.9	0.0057
Immune system	10	170	11	269	16.4	2.1–129.3	0.0079
Genitourinary system	24	156	19	261	42.9	5.7–120.0	0.0002
Endocrine system	36	144	1	279	1.8	1.1–3.0	0.0232
Suffered operations, injuries	47	133	52	228	1.9	1.2–3.0	0.0031
Does the child take any medications?	46	134	35	245	2.4	1.5–3.9	0.0004
Father's temperament							
Phlegmatic	33	147	31	249	1.8	1.1–3.0	0.0225
Melancholic	37	143	18	262	3.7	2.0–6.8	0.0001
Mother's temperament							
Phlegmatic	44	136	26	254	3.1	1.8–5.3	0.0001
Melancholic	23	157	14	266	2.7	1.3 – 5.5	0.0038

Note *: a – children with sign and not vaccinated; b – children without sign and not vaccinated; c – children with sign and vaccinated; d – children without sign and vaccinated.

Biological risk factors for parental refusal of vaccinations are pregnancy complications 49.2 times more often than in families without complications. Diseases of respiratory organs in children increase the refusal of vaccinations by 1.8 times, cardiovascular diseases by 3.9 times, diseases of the musculoskeletal system of the child – 18 times, diseases of the genitourinary system by 42.9 times, and taking medication due to various diseases increases the risk of parents refusing to vaccinate their children by 2.4 times.

Table 3. Socio-psychological factors of the lifestyle of parents, unvaccinated children.

Risk factor	Output data (patients)				OR	95% CI	p
	a	b	c	d			
Is the mother vaccinated?	133	47	279	1	<0.0	–	0.0001
Reasons for lack of vaccination or incomplete vaccination of the child's mother							

Allergic reactions	18	29	1	279	71.1	22.1–134.0	0.0001
Religious views	23	24	1	279	67.0	34.5–206	0.0001
Distrust	26	21	1	279	84.1	44.0–267	0.0001
Insufficient awareness	1	46	1	279	6.0	0.3–98.0	0.2053
Is the father vaccinated?	152	28	279	1	<0.0	–	0.0001
Reasons for lack of vaccination or incomplete vaccination of the child's father							
Allergic reactions	6	22	1	279	76.0	8.7–160.1	0.0001
Religious views	13	15	1	279	44.1	0.6–193.4	0.0001
Distrust	23	5	1	279	128.0	123–953	0.0001
Insufficient awareness	8	20	1	279	111.1	13.0–973	0.0001
Awareness of additional vaccines not included in the national calendar	96	84	279	1	<0.0	–	0.0001
Uncertainty about the safety of vaccines	63	117	1	279	150	20.1–196	0.0001
Not interested in vaccine safety	84	96	1	279	244	33.3–777	0.0001

Note *: a – children with sign and not vaccinated; b – children without sign and not vaccinated; c – children with sign and vaccinated; d – children without sign and vaccinated.

Among children who were not vaccinated, the following risk factors were determined, due to which the child's mother was not vaccinated with any vaccine or was partially vaccinated, the main ones are: allergic reactions OR=71.1, religious views OR=67.0, the largest share is mistrust of vaccines OR=84.1 and lack of awareness about vaccines in general OR=6.0. The factors of lack of vaccination or partial vaccination of the child’s father are also determined: allergic reactions OR=76.0, religious views OR=44.1, the most significant factor is mistrust of vaccines OR=128.0, factors are insufficient information about vaccines OR=111, 1.

During the study, we found that these risk factors have a significant impact on the decrease in the level of vaccination among children in the Cherkasy region, where this study was conducted. If we compare the vaccination coverage of the child population in the Cherkasy region with all – Ukrainian indicators, for example, for the last year, then it can be noted that some levels are lower in the region. Such as vaccination against measles, rubella and mumps in children in the first year of life, which is 86.2%, while the all-Ukrainian indicators are 92.4% and vaccination against these infections in children 6 years in the region is 86.3%, while in Ukraine 87.3% .[2]

But still, most indicators are higher than in Ukraine. Although the indicators of vaccination coverage are higher than all Ukrainian, they are insufficient for the formation of stable collective immunity to fight infectious diseases, which should be 95%.

Among the 280 children who were vaccinated according to the national vaccination calendar, they were additionally vaccinated against the following infections: against meningococcus 78 (27.8%), pneumococcus 56 (20.0%), influenza 128 (45.7%), chicken pox 10 (3.5%), hepatitis A 12 (4.2%), rotavirus infection 22 (7.8%). That is, there is a low proportion of children who are vaccinated with additional vaccines, even against infections that can threaten life.

Parents who vaccinate their children showed a different proportion of trust in the quality of vaccines depending on the country of manufacture. Thus, 100% trust was expressed in France and Belgium, 67.8% in the USA, 36.4% in the Republic of Korea, 33.9% in Bulgaria and 29.6% in India.

Conclusion

All the given reasons for refusing vaccinations with one or another vaccine are scientifically unfounded and groundless. A detailed analysis of the reasons for refusal of vaccination and proof of the necessity and expediency of vaccination makes it possible to cover a larger number of the population with mass vaccination and protect a significant number of people from serious

infectious diseases. All of the listed risk factors require the improvement of the social, financial, and educational status of families, prevention of harmful habits and measures to raise public awareness.

Demographic and socio-economic risk factors for not vaccinating children are the presence of three or more children in the family, the religiosity of the family and belonging to religious organizations, divorce, i.e. incomplete family, average and low level of education, physical work of parents, bad habits, bad financial situation.

The processes of vaccine prophylaxis in children are influenced by such biological risk factors as complicated pregnancy of the mother, diseases of various organs and systems, and the temperament of parents also affects the decision on the issue of vaccination of children. Socio-psychological risk factors for the lack of vaccine prevention are insufficient awareness of communities about vaccine safety, vaccination points and availability of vaccines in hospitals, storage and transportation conditions, and vaccine safety.

If the tendency to refuse vaccination continues in the future, the scale of the problem will grow. The growth of whooping cough has already increased, and real epidemics are possible in the future. And if we let the problem go, we'll be back in the Middle Ages, when infections were the main cause of high mortality and short life expectancy.

DECLARATIONS:

Disclosure Statement.

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References

1.World Health Organization URL: 2023 [Internet]. Available at: https://www.who.int/europe/health-topics/vaccines-and-immunization#tab=tab_1 [accessed 05 Jan 2024].

2. Prevention of infections and infection control. [Internet]. Public Health Center of the Ministry of Health of Ukraine: [Last reviewed 17 Dec 2022; accessed 05 Jan 2024]. Available at: https://www.phc.org.ua/pro-centr/contacts.

3. Tolovova T.I, Halchuk O.V. Current issues of vaccination in Ukraine. Nursing. 2020;(4):15-8. Available at: https://doi.org/10.11603/2411-1597.2019.4.10830 . [In Ukrainian].

4. Trushchenkova L.V., Terenda N.O., Soltys I.S. Comparative analysis of organizational forms and models of population immunization management in the world and in Ukraine. Herald of social hygiene and health care organization of Ukraine. 2023;(1):70-5. Available at: https://doi.org/10.11603/1681-2786.2023.1.13864 [In Ukrainian].

5. Order No. 595 "On the procedure for preventive vaccinations in Ukraine and quality control and circulation of medical immunobiological preparations" from 16.09.2011. With changes and additions in accordance with the orders of the Ministry of Health from August 11, 2014 to February 1, 2022. Verkhovna

Rada of Ukraine. Legislation of Ukraine.Available at: https://zakon.rada.gov.ua/laws/show/z1159-11#Text

6. Annual report on the state of health of the population of Ukraine and the epidemic situation for 2022. [Internet]. Infectious diseases controlled by means of specific immunoprophylaxis . [cited 2024 Jan 02]. Available at: https://moz.gov.ua/uploads/ckeditor/

7. Kramariev S.O., Hrechukha Ye.O. Whooping cough, diphtheria and tetanus: all new - well forgotten old (review of current international recommendations). Actual infectology. 2020;(1):18-3. Available at http://dx.doi.org/10.22141/2312-413x.8.1.2020.196173 [In Ukrainian].

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Тема:Виявлення основних детермінант, які мають вплив на рівень вакцинації серед дитячого населення.

Резюме

Завдяки щепленням можна запобігти багатьом інфекціям, зокрема: кашлюк, дифтерія, правець, поліомієліт, кір, епідемічний паротит, краснуха, гепатит В, гемофільна інфекція, пневмококова інфекція, менінгококова інфекція, ротавірусна інфекція, вітряна віспа, гепатит А, папіломавірусна інфекція. . та інші. Згідно з дослідженнями ВООЗ встановлено, що якщо рівень охоплення щепленнями населення країни падає на кілька відсотків, то це створює сприятливі умови для поширення інфекційних захворювань, що чим нижчий колективний імунітет, тим вище ймовірність спалахів та епідемій.

Мета. Вивчити та проаналізувати вплив факторів ризику на зниження рівня вакцинопрофілактики дитячого населення.

Матеріали та методи. Дане дослідження проводилось анкетним методом, для чого було розроблено анкету. Першу групу склали 280 дітей, які отримали щеплення, а другу групу склали 180 дітей, які не були щеплені. Для порівняння медіанних значень використовувався непараметричний статистичний аналіз для двох незалежних вибіркових сукупностей Mann-Whitney (MW) test. Для порівняння часток або пропорцій використовували тест Фішера.

Результати. У ході дослідження з'ясувалося, що найчастішими причинами відмови батьків від вакцинації дітей були: релігійні погляди членів сім'ї збільшують ризик відмови від вакцинації дітей у 2,4 рази; у неповних сім'ях, де батьки розлучені. дітей, які не отримали щеплення, у 2,6 рази більше, ніж у повних сім'ях; незакінчена в середньому в 35,7 рази і відсутність освіти в 24,1 рази посилюють вплив на відсутність щеплень у дітей.

Висновки. Виділили такі фактори ризику, які впливають на рівень вакцинації, а саме: демографічні, соціально-економічні, біологічні та соціально-психологічні.

Ключові слова: вакцинопрофілактика, статистика, інфекційні захворювання, фактори ризику.