

ANNA BEDNAREK¹, VIOLETTA MIANOWANA²

Vaccinations of children against chickenpox and pneumococcal infection on the example of several family practice physicians' settings

Abstract

Introduction. Vaccinations against varicella and pneumococcal infection are an important form of prevention of infectious diseases and their possible complications.

Aim. Assessment of the vaccination control of children against varicella, and pneumococcal infection based on selected institutions of family practice physician.

Material and methods. There were verified 807 immunization cards of children from three vaccination offices, selected at random from the area of the southeastern Poland, i.e. the provinces of Lubelskie, Podkarpackie and Świętokrzyskie. Based on the results of quantitative analysis of medical records of vaccination carried out in these institutions through 2007-2012, the number of children vaccinated against varicella, and pneumococcal infection was assessed.

Results. The largest number of vaccinated children (against pneumococcal infection – 148 children and 84 against varicella among 335 subjects reporting in the facility) was confirmed in health care unit in Lublin. In health care unit in Podkarpackie the number of vaccinated children against pneumococcal infection was 84 and against chicken pox – 52 among 256 children using the medical services. In health care unit in Świętokrzyskie, 65 children were vaccinated against pneumococcal infection and 34 against varicella among 216 subjects reporting at the institution. The vast majority of these vaccines (431 – including three centers) was paid by parents.

Conclusions. 1. In all of the centers, a higher proportion of children was vaccinated against pneumococcal infection than chickenpox. 2. There was not a marked increase in the number of children vaccinated against varicella and pneumococcal infection during the analyzed period.

Keywords: vaccinations, children, chickenpox, pneumococcal infection.

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INTRODUCTION

Modern medical technologies allow for producing new vaccines, highly efficient, with a high safety profile, which play an important role in the prevention of many infectious diseases in children, particularly those with serious consequences and high mortality, such as invasive pneumococcal infections or complications of varicella [1].

Vaccinations against varicella and pneumococcal infection have been recommended in the Polish Vaccination Program (PSO) for over 10 years, and for several years have been compulsory for children in selected risk groups.

Vaccination against smallpox was introduced in the Polish Vaccination Program in 2002, and since 2008, it has been mandatory for children below 12 years of age from certain risk groups, as well as for adults and healthy children from the environment of immunocompromised persons with a high risk of severe course of disease. In contrast, the recommended vaccination applies to people who had not suffered chickenpox and had not been vaccinated within the mandatory or recommended vaccination program,

and to women planning to become pregnant, who had not had chickenpox before. Vaccination scheme involves administration of two doses of vaccine with an interval of 6-12 weeks from 9 months of age [2-4].

In 2006, also vaccination against pneumococcal infection (the official name *Streptococcus pneumoniae*) was included in the Polish Vaccination Program as recommended for all children under 2 years of age and children aged 2-5 years of age at high-risk groups, including children attending nursery schools or kindergartens. In contrast, since 2008, a vaccine against *Streptococcus pneumoniae* has been mandatory in the Polish Vaccination Program for children up to 5 years of age, with an increased risk of developing invasive pneumococcal disease (IPD). Currently in Poland, two types of vaccines against pneumococcal infection are registered: polysaccharide and conjugate. For children under two years of age, there are designed conjugate vaccines, i.e. 13-valent vaccine (PCV13), which replaces the 7-valent vaccine (PCV7), registered for children from 6 weeks of age, containing capsular polysaccharides of the following serotypes 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F and 23F

¹ Chair and Department of Paediatric Nursing, Faculty of Nursing and Health Sciences Medical University of Lublin, Poland

² Chair of Nursing Development, Faculty of Nursing and Health Sciences Medical University of Lublin, Poland

and 10-valent vaccine (PCV10) for children from 6 weeks to 5 years of age. It is composed of 10 capsular polysaccharides of serotypes 1, 4, 5, 6B, 7F, 9V, 14, 18C, 19F and 23F. In contrast, PPV23 polysaccharide vaccine is a mixture of 23 highly purified pneumococcal capsular polysaccharide antigens most commonly causing infection in humans (1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, 33F). This vaccine is not immunogenic for children under 2 years of age due to the rapid decrease in the concentration of specific antibodies, but in children above 2 years of age can be an important extension of immunization PCV13 [5-9].

AIM

Due to the importance of prevention of varicella and invasive pneumococcal infection, research studies have been undertaken in order to assess the state of vaccination control of children against varicella, and pneumococcal infection based on selected institutions of family practice physician.

MATERIAL AND METHODS

There was used a method of analysis of the medical records of three health care centers selected at random from the area of the southeastern Poland, i.e. the provinces of Lubelskie, Podkarpackie and the Świętokrzyskie. The research was conducted in January 2013 in the Children's Clinic NZOZ PULS-MED in Lublin, Independent Public Municipal Complex of Primary Health Care Center No. 2 in Sanok and Medical Center "Eskulap" in Sandomierz.

These centers provide free of charge services for primary care, under contract with the National Health Fund and implement and promote vaccination among parents as a standard, including modern combined vaccine formulations.

An analysis of medical records of vaccinations carried out in these facilities in 2007-2012 was made. A quantitative assessment of immunization cards of 807 children born between 1 January 2007 and 31 December 2012 was used, taking into account that the children underwent vaccination against varicella and *Streptococcus pneumoniae* and the total number of children reporting in the child health clinic in a particular institution. The study was conducted with the approval of the head of each unit of health care institutions and the Bioethics Committee of the Medical University of Lublin.

RESULTS

A quantitative analysis of 335 immunization cards of children born between 1 January 2007-31 December 2012 from the NZOZ PULS-MED in Lublin, and of 256 cards of children born at the same time coming from the Independent Public Municipal Unit Primary Health Care Center No. 2 in Sanok and of 216 children's immunization cards from Medical Center "Eskulap" in Sandomierz, was made.

There were 84 children vaccinated against varicella (Table 1) in NZOZ PULS-MED in Lublin, which accounted for 25.1% of all vaccinated subjects during the analyzed period. Because the manufacturer recommends vaccination after completing 9 months of age, none of the children born in 2012 has been covered by the vaccination yet. The result of analysis of medical records and indications for compulsory vaccination confirmed that 9 children received the refunded vaccines. Vaccinations against smallpox implemented with parents' funds were most common among children born in 2008 (6.6%), and least frequently used in children in 2011 (2.1%).

In Primary Health Care Clinic No. 2 in Sanok 52 children were vaccinated, i.e. 20.3%, including the highest proportion in 2010 (6.2%) and the lowest in 2008 (2.7%). A Refunded vaccine in this facility was offered to 5 children.

In the Medical Center "Eskulap" in Sandomierz, 34 children were vaccinated against chickenpox (15.7%), including 2 children qualified to get the vaccine free of charge. Most children were vaccinated in 2010 (5.1%) and the least in 2007 (1.4%).

The analysis of immunization cards resulted in determining the number of children vaccinated against pneumococcal infection. Overall in NZOZ PULS-MED in Lublin 148 children were vaccinated, which accounted for 44.1% of all respondents. According to Mandatory Vaccination Program, taking into account the indications for mandatory vaccinations, 11 children at risk were given refunded vaccines against pneumococcal infection. The Municipal Office of Lublin covered the cost of the vaccine for 29 children born in 2007.

In the Primary Health Care Clinic No. 2 in Sanok, 84 children (32.8%) were vaccinated against pneumococcal infection, including 7 children at risk. Most children received vaccination in 2009 (8.2%) and the least in 2007 (1.6%).

In the Medical Center "Eskulap" in Sandomierz, 65 children (30.1%) were given pneumococcal vaccine. Two

TABLE 1. The number of children vaccinated against varicella.

VARICELLA (CHICKENPOX)								
NZOZ PULS-MED in Lublin			Primary Health Care Center nr 2 in Sanok			Medical Center „Eskulap” in Sandomierz		
Total number of immunization cards – 335			Total number of immunization cards – 256			Total number of immunization cards – 216		
Number of immunized children with the refunded vaccine – 9			Number of immunized children with the refunded vaccine – 5			Number of immunized children with the refunded vaccine – 2		
Year	N	%	Year	N	%	Year	N	%
2007	20	5.9	2007	9	3.5	2007	3	1.4
2008	22	6.6	2008	7	2.7	2008	5	2.3
2009	14	4.2	2009	8	3.2	2009	8	3.7
2010	21	6.3	2010	16	6.2	2010	11	5.1
2011	7	2.1	2011	12	4.7	2011	7	3.2
TOTAL	84	25.1	TOTAL	52	20.3	TOTAL	34	15.7

children received refunded vaccination. Most children were vaccinated in 2012 (8.8%) and the least in 2007 (0.9%). The detailed number of vaccinated children in these Health Care units is presented in Table 2.

DISCUSSION OF RESULTS

Despite the systematic improvement of the overall epidemiological situation in Poland, infectious diseases are still a serious public health problem, and the prevalence of many of them is more common than the average incidence in the European Union. Among these diseases the chickenpox and its complications and risks resulting from invasive pneumococcal disease are still listed [10-12].

Chickenpox is generally considered a mild disease and typical of childhood. However, it can be associated with serious complications, hospitalization, and surgical interventions. In 1-2% of children, it damages the central nervous system. In many countries, it has been considered an important health problem and universal vaccinations have been introduced, which caused a decrease in the number of cases, eliminated the risk of severe complications, hospitalizations and deaths. Varicella vaccine is highly immunogenic. A single dose of the vaccine prevents 97% of the vaccinated from getting sick with severe form and 82% with mild form of smallpox. In the United States, after the introduction of universal varicella vaccination of healthy children, a reduced incidence by 76-87% was observed in 1995-2000 [13]. The most common complications of varicella in children are secondary bacterial infections of the skin and subcutaneous tissue, pneumonia and acute neurological syndromes.

Research conducted in Germany by Liese et al. [14] in 918 children hospitalized due to complications of varicella, showed that in 77% of healthy children having no medical risk factors, various complications in the course of varicella occurred. On the other hand, Bozzola E. et al. [15] evaluated the incidence of neurological complications in the course of varicella in 404 children without immunodeficiency hospitalized in one of Rome's hospitals in the years 2004-2011. Neurological complications occurred in 76 patients (18.8%), and the most common was inflammation of the cerebellum, which was diagnosed in 34 children (44.7%). The authors of the study suggest that in immunocompetent children, chickenpox complications may occur in the form of neurological

disorders that prolong hospitalization, but usually do not leave permanent consequences. In Poland, varicella complications requiring hospitalization occur in 7-8 cases per 1,000 cases [10].

While analyzing the NIH epidemiological data on infectious diseases in Poland, a steady increase in the incidence of chickenpox has been observed since 2004. At the same time the implementation of vaccinations against this disease, in which the vaccine is not refundable in our country in children and healthy people, varies in different provinces. The highest number of the vaccinated in 2012 was recorded in the Mazowieckie (14,310 people) and relatively high in the regions of Lower Silesia (5,299 people), Silesia (5,359 people), Pomerania (4,208 people) and Wielkopolska (4,486 people). The number of persons (in the age range 0-19 years) vaccinated with chickenpox in the Lubelskie Province was 2,607, in Podkarpackie 1,245, and Świętokrzyskie 788 people [16].

The analysis of documentation of immunization cards in health care institutions confirmed a small percentage of performed vaccination against chickenpox. Only in a medical facility from Lublin, chickenpox vaccination was implemented in 25.1% of the children out of 335 children included in health care services in this unit, which is the highest percentage of children among all analyzed Health Care Centres. In the remaining institutions, 20.3% out of 256 children under the healthcare services of the Health Care Centre from Podkarpackie were vaccinated and 15.7% out of 216 children in a medical facility from the Świętokrzyskie region. The vast majority of these vaccines, i.e. in 154 children (including all three Health Care Centres) was covered by the parents' funds.

Pneumococcal infections cause Invasive Pneumococcal Diseases (IPD). They can be especially severe in children under 5 years of age. Attending nursery school or kindergarten increases this risk. Before the introduction of vaccination of infants and young children, severe pneumococcal infections in the United States every year caused death of about 40 thousand of people. Since the introduction in 2000 of the universal vaccination program of infants and young children with 7-valent conjugate pneumococcal vaccine (PCV-7) the incidence and mortality due to IPD have significantly decreased by 45% compared to the period 1998-1999 as a result of indirect effect, the so-called community resistance

TABLE 2. The number of children vaccinated against pneumococcal infection.

<i>STREPTOCOCCUS PNEUMONIAE</i>								
NZOZ PULS-MED in Lublin			Primary Health Care Center nr 2 in Sanok			Medical Center „Eskulap” in Sandomierz		
Total number of immunization cards – 335			Total number of immunization cards – 256			Total number of immunization cards – 216		
Number of immunized children with the refunded vaccine – 11			Number of immunized children with the refunded vaccine – 7			Number of immunized children with the refunded vaccine – 2		
Year	N	%	Year	N	%	Year	N	%
2007	45	13.4	2007	4	1.6	2007	2	0.9
2008	21	6.3	2008	8	3.2	2008	4	1.8
2009	16	4.7	2009	21	8.2	2009	12	5.5
2010	22	6.5	2010	15	5.8	2010	11	5.2
2011	26	7.8	2011	17	6.6	2011	17	7.9
2012	18	5.4	2012	19	7.4	2012	19	8.8
TOTAL	148	44.1	TOTAL	84	32.8	TOTAL	65	30.1

[17-19]. The recently published multicenter results of the monitoring of IPD in Poland in the years 2006-2009 indicated the incidence of 2.7/100 000 in children below 2 years of age [7,12].

There is a very favorable situation in terms of vaccination against pneumococcal infection in Kielce, where the proportion of vaccinated children reaches 99% primarily due to funding of this vaccine by local authorities for all children up to 2 years. In March 2006, Kielce was the only city in Poland where for the first time – by the Decision of Municipal Council – a free of charge PCV7 vaccination in a scheme 2+1 was introduced. Currently in Poland more than 30 local government units under a special prevention program implement vaccinations against pneumococcal infection for healthy children. This increases the possibility to vaccinate children with funds entirely financed by the various cities participating in the program [7].

According to the NIH data for the year 2012, in the Lubelskie Province 8.419 people were vaccinated against *Streptococcus pneumoniae*, including many children in the age range 0-14 years (7.317 people). In the province of Podkarpackie totally 7.150 persons were vaccinated and in Świętokrzyskie – 5.946 people. Just like in the Lubelskie Province, the largest number of children was vaccinated in the age range 0-14 years, i.e. 6.594 in Podkarpackie and 5.538 people in Świętokrzyskie. As in the case of chicken pox, the state of vaccination against pneumococcal infection in Poland in 2012 was analyzed. The number of vaccinated subjects was much greater than in the case of varicella, and most vaccinations were performed in the Mazowieckie (42.236 persons), Silesia (20.310 persons), Wielkopolska (15.755 persons), Małopolska (16.603 people) and Lower Silesia (16.944 persons) [16].

Vaccination against pneumococcal infection in the studied Health Care Centers was higher in relation to smallpox vaccinations and showed that almost half of the children in Lubelskie and slightly more than one third of children in the Health Care Centre from Podkarpackie and almost one third from the Świętokrzyskie received pneumococcal infection vaccination in the vast majority financed by parents.

Optimal implementation of immunization depends on many factors, among which the most commonly mentioned is vaccinology awareness of parents, the availability of free of charge vaccines and sense of responsibility of parents for their health and health of others [20]. It can be assumed that obtaining free access to modern vaccines and good organization of vaccination points combined with an effective parent education will increase the percentage of children vaccinated against pneumococcal infection and also chickenpox.

CONCLUSIONS

1. The number of children vaccinated against varicella and pneumococcal infection varies between years and centers, and does not show an increasing tendency.
2. In all the centers, a higher proportion of children was vaccinated against pneumococcal infection than chickenpox.
3. Despite the high activity of the anti-vaccine movement, the level of implementation of vaccination against pneumococcal infection and varicella can be regarded as a positive phenomenon of parents' vaccinology awareness.

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Corresponding author

Anna Bednarek
Sobianowice 85F, 20-258 Lublin 62
tel. 607-607-115
E-mail: bednarekanna@o2.pl