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*The influence of prophylactic vaccination on epidemic situation  
of infectious diseases illustrated by the epidemiology of measles  
in Poland in the years 1968-1998*

Infectious diseases accompany humanity from the beginning of its existence. They were the issue of interest not only of medicine, but of the whole societies as well. These diseases provoked fear and terror because their mass appearance in the form of epidemics could devastate whole countries causing economic and political ruin, thus changing the history.

Such state lasted until the 19th century, to the times when Louis Pasteur's great inventions caused a breakthrough in the field of bacteriology, giving the bases of the modern knowledge of infectious diseases.

The 20th century brought an enormous progress in the field of fight against infectious diseases. Antibiotics and preventive vaccination reduced the incidence of most infectious diseases, some of which were even eliminated (*variola vera*). Also measles is included in the group of diseases in which the fight was largely successful. The epidemiology of this disease can serve as an example illustrating the effectiveness of the introduced prophylactic vaccinations. The aim of the paper is the analysis of the incidence and mortality from measles in Poland in the years 1968-1998 illustrating the natural course of measles as well as changes in its epidemiology caused by introduction of prophylactic vaccination.

MATERIAL AND METHODS

There were gathered demographic data collected by the Main Statistical Office (GUS) concerning Polish society (9). There were analysed the incidence, morbidity and mortality rates as well as the number of cases and number of deaths from measles in Poland in the years 1968-1998. Such a period of time is sufficiently long in order to allow the analysis of epidemiological trends on measles.

RESULTS AND DISCUSSION

The gathered data are presented in Table 1. The epidemiological trends in incidence and mortality are presented in Figures 1 and 2, respectively.

Table 1. Number of cases, incidence (per 100,000), number of deaths and mortality (per 100,000) from measles in Poland in the years 1968-1998

Year	Number of cases	Incidence	Number of deaths	Mortality
1968	112 008	347.8	106	0.3
1969	192 147	590.2	140	0.4
1970	125 572	382.8	94	0.3
1971	184 304	562.8	154	0.5
1972	109 112	330.5	77	0.2
1973	196 109	587.8	109	0.3
1974	70 857	210.3	27	0.1
1975	146 930	431.1	61	0.2
1976	125 168	364.3	72	0.2
1977	44 949	129.5	22	0.06
1978	84 073	240.1	37	0.11
1979	30 653	87.0	11	0.03
1980	24 882	69.9	6	0.017
1981	35 283	98.3	10	0.028
1982	7 620	21.0	2	0.006
1983	11 271	30.8	5	0.014
1984	54 403	147.7	16	0.043
1985	35 680	95.9	5	0.01
1986	6 806	18.2	1	0.00
1987	1 286	3.4	0	-
1988	1 005	2.7	2	0.005
1989	7 225	19.1	0	-
1990	56 471	148.1	12	0.031
1991	2 419	6.3	1	0.003
1992	3 695	9.6	0	-
1993	1 410	3.7	0	-
1994	864	2.2	0	-
1995	752	1.9	0	-
1996	639	1.7	0	-
1997	338	0.9	0	-
1998	2 255	5.8	1	0.003

Measles is an infectious disease characterized in its clinical course by subsequent catarrho-pyretic and eruptive period followed by convalescence. The etiologic factor is an RNA-morbillivirus from the family of *Paramyxoviridae*. The virus reservoir is man. The source of infection is man and the viruses are present in the nasopharyngeal secretions. The infection path is air and droplets or direct contact. The incubation period ranges from 9 to 14 days. The infectiousness begins about 5 days before the appearance of eruptions and lasts until its regression. After many years following measles due to latent infection there can develop subacute sclerosing panencephalitis (11).

In its natural course measles was characterized by a large number of cases and occurrence of epidemic increases every 2 years. It is confirmed by the analysis of the incidence of measles in Poland at the beginning of the analysed period that is in the years 1968-1973. The introduction of prophylactic vaccination against this disease disturbed this pattern. In Poland the prophylactic vaccinations against measles were initiated in 1972 and were permanently placed in the calendar of vaccinations in 1975 (7). The mandatory vaccination against measles is performed in children from 13 to 15 months of age (1).



Fig. 1. Incidence rates in measles (per 100,000) in Poland in the years 1968-1998

In the first years after the introduction of the vaccine the percentage of vaccinated children was low – about 20-50%. The vaccinations were performed reluctantly and with delay so they could not terminate the periodicity. They only caused the flattening of the curve of incidence (Fig. 1-7). Similar changes were noted in mortality from measles (Fig. 2).

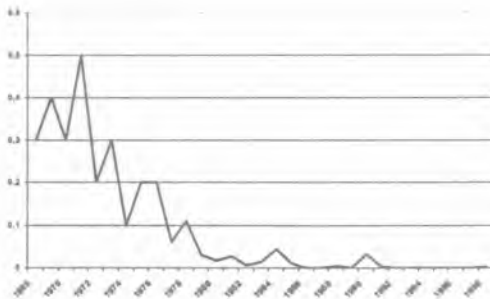


Fig. 2. Mortality rates from measles (per 100,000) in Poland in the years 1968-1998

The confirmation of the thesis are epidemic trends of incidence of measles in Poland in the years 1974-1979. The first symptoms of effectiveness of anti-measles vaccination and the disturbances in the 2-year periodicity of measles epidemics appeared at the beginning of the 1980s. In the years 1979-1984 there were noted epidemic increases every 3 years and 2-year interepidemic periods characterized by low incidence. This improvement shall be connected with the increasing number of performed vaccinations.

Deep changes in measles epidemiology came in the middle of the 1980s (9). In the Polish population there appeared favourable epidemiologic trends and the duration of interepidemic periods was extended. Also compensatory epidemics occurred (in the years 1984 and 1990) due to gathering of susceptible persons in population (9). They are a consequence of the fact that every year of a certain number of children is left unvaccinated (performance between 95 and 100%) as well as of the delays in vaccination (periodic shortages of vaccine) and the effectiveness of the vaccine itself (about 95%) (5). In order to prevent the occurrence of such compensatory epidemics, from the beginning of the 1980s the WHO propagated booster vaccination in childhood (2, 5). Due to these recommendations the second, booster dose of measles vaccine in the 9<sup>th</sup> year of age has been in the calendar of vaccinations since 1991 (3, 7). In 1994 the age of such vaccination was changed to 7 years (8).

All these factors, that is the introduction of the booster dose and the improvement in performance of vaccinations, produced the epidemiologic situation of measles observed in Poland after 1990. The incidence has decreased to the level under 10 cases per 100,000 population and no deaths from measles were noted. Similar epidemiologic trends were observed in the whole Europe and they influenced the formulation of strategic aims concerning measles in the field of prevention and fight against infectious diseases accepted at the XVth Meeting of the Global Advisory Group for Vaccinations in Jakarta in 1992. The strategic plan comprised decrease in incidence of measles to the level not overcoming 1 case per 100,000 inhabitants and elimination of mortality from this disease in Europe until the year 2000 (3).

Such successes in fight against the measles virus caused by the effectiveness of mass measles vaccinations, enormous decrease in incidence rates, lack of carrier state in this disease as well as the fact that man is the only reservoir of the microbe lead to the discussion on the probability of eradication of measles in many countries (6).

At the end of 1990s in Poland there was observed the phenomenon of "subsiding of cases", that is the lack of new cases in a given area in the period longer than doubled maximum incubation period of the disease. In 1995 in Poland there were noted no cases of measles in 2 regions (voivodships), in 1996 – in 4 regions and in 1997 in 10 regions there were no cases of measles (8). However, this reduction in the area of circulation of the wild virus causes the increase in the number of persons susceptible to the virus of measles (non-vaccinated or ineffectively vaccinated), not having the contact with the virus as it does not occur in the area inhabited by them. It entails the emergence of compensatory epidemics and such an epidemic occurred in Poland in 1998. In that year the incidence rate raised over 1 per 100,000 population, there was registered one death from measles and only in one region there were noted no cases of measles. Similar epidemiologic trends were observed in other European countries and they influenced the rescheduling of the date of elimination of measles in Europe to the year 2007 [10].

## CONCLUSIONS

1. The introduction of prophylactic vaccinations against infectious diseases totally changed their epidemiologic situation.

2. Measles is a good example of the influence of prophylactic vaccinations of the course of disease.

3. The measles vaccinations caused the elimination of periodicity of the disease, increase in the interepidemic periods, decrease in incidence rates and nearly eliminated morbidity from this disease.

4. There is a chance of eradication of measles in Poland provided that mandatory vaccination periods will be strictly kept and 99% of children at the age of two years will be vaccinated.

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#### SUMMARY

There were gathered demographic data collected by the Main Statistical Office (GUS) concerning Polish society. There were analysed the incidence, morbidity and mortality rates as well as the number of cases and number of deaths from measles in Poland in the years 1968-1998. It was stated that the introduction of prophylactic vaccinations against infectious diseases totally changed the epidemiologic situation. It was also stated that measles is a good example of the influence of prophylactic vaccinations on the course of disease. The measles vaccinations caused the elimination of periodicity of the disease, increase in the interepidemic periods, decrease in incidence rates and nearly eliminated morbidity from this disease. There is a chance of eradication of measles in Poland provided that mandatory vaccination periods are strictly kept and 99% of children at the age of two years are vaccinated.

### Wpływ szczepień ochronnych na sytuację epidemiologiczną chorób zakaźnych na przykładzie epidemiologii odry w Polsce w latach 1968-1998

Zebrano dane epidemiologiczne dotyczące społeczeństwa polskiego na podstawie Roczników Statystycznych Głównego Urzędu Statystycznego. Przeanalizowano zapadalność, chorobowość i umieralność, jak również ilość zachorowań i zgonów w odrze w Polsce w latach 1968-1998. Stwierdzono, że wprowadzenie szczepień ochronnych przeciwko chorobom zakaźnym zmieniło całkowicie sytuację epidemiologiczną tych chorób. Widać to na przykładzie wprowadzonych szczepionek przeciw powszechnej do niedawna chorobie wieku dziecięcego, jaką jest odra. W okresie 1968-1998 w Polsce doszło do ogromnych zmian w epidemiologii odry. Rozpoczęte szczepienia zlikwidowały cykliczność epidemii tej choroby, wydłużyły okresy międzyepidemiczne, obniżyły zapadalność do minimalnego poziomu i niemal zlikwidowały umieralność na tę chorobę. Zarysowuje się szansa na eradykację tej choroby w Polsce i w Europie w ciągu nadchodzących kilku lat, pod warunkiem ścisłego przestrzegania terminów szczepień obowiązkowych i objęcia nimi 99% dzieci w wieku 2 lat.