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Causes Of Epidemic Risks Of Vaccine-Preventable Diseases On The Example Of Measles In The Republic Of Uzbekistan.

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ABSTRACT

The article presents the results of a retrospective analysis of the incidence of measles in the Republic of Uzbekistan over 20 years (from 2001 to 2023). In 2017, Uzbekistan received a WHO certificate of measles elimination in the country, but in 2018-2019 and 2023 there were large outbreaks of measles worldwide. Imported cases of measles contributed to the spread of this infection in Uzbekistan. The article describes in detail the measles outbreak that arose during this period in the republic, and characterizes the epidemiological features of measles at the present stage.

Keywords: *Measles, morbidity dynamics, intensive rate, measles strains, vaccine prevention, specific prevention, social and hygienic risk factors, immunity, antibodies, epidemic rise.*

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1. INTRODUCTIO

Measles has been known to mankind for a long time under the name "child's plague," as it was characterized by a high incidence of disease among children and a high mortality rate. Evidence of the existence of measles dates back to the 7th century. In the 10th century, the Persian physician Razes described measles as a more severe disease than smallpox [1].

Children aged 2-5 years were the most frequently affected, while children under 1 year of age had lower rates of infection due to transplacental immunity from their mothers.

Large measles epidemics occurred every 2-3 years and resulted in more than 2.6 million deaths. The incidence cycled between 500 and 1200 cases per 100,000 people per year, with an average of 30 cases per outbreak, and a 17% incidence of single cases, with a mortality rate of 0.15% [2,3].

In the 10th century, the Persian physician Razes was the first to describe the clinical picture of measles in his work. Razes considered measles to be a mild form of smallpox. In 1670, a major measles epidemic occurred in London. English physicians Sydenham and Morton provided a detailed description of the disease and clearly distinguished between measles, scarlet fever, and smallpox. In 1846, measles was introduced to the Faroe Islands, where 96% of the island's population contracted the disease. During this pandemic, Dr. Panum studied the epidemiology and clinical picture of measles, and identified the high contagiousness of measles. From 1890 to 1896, scientists Belsky, Filatov, and Koplik described a characteristic, differentially significant measles enanthema on the mucous membranes of the cheeks opposite the molars 3-4 days before the appearance of skin rashes. In honor of the researchers, small whitish spots on the oral mucosa were named Belsky-Filatov-Koplik spots. In 1910, D. Goldberger proved the viral nature of measles by infecting monkeys with nasopharyngeal mucus taken from a sick child. But the virus could not be isolated at that time. 1954 – D. Enderes and T. Peebles isolated the measles virus from an 11-year-old boy, David Edmonson, who was ill during an outbreak in Boston, Massachusetts. 1960 – D. Enderes created a vaccine against the Edmonson strain of measles. In 1963, specialists from the Leningrad Institute of Epidemiology and Microbiology named after Louis Pasteur worked on developing a domestic vaccine in the USSR, under the guidance of the renowned Soviet bacteriologist and virologist Anatoly Alexandrovich Smorodintsev. Since 1967, the vaccine has been widely used in the USSR, reducing the incidence of measles in the Soviet Union by a factor of 650. Due to the favorable epidemiological situation in the USSR and Russia over the past 50 years, most doctors had only a theoretical understanding of measles and lacked practical experience in diagnosis and treatment at the beginning of the 2011-2014 measles outbreak. This led to a large number of diagnostic errors, which contributed to the spread of the disease. The implementation of COVID-19 measures worldwide led to disruptions in the vaccination against measles and paralyzed efforts to prevent and minimize the outbreak. By the end of 2020, more than 94 million people were

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at risk of not receiving vaccinations due to the lack of vaccines, as a result of the suspension of measles campaigns in 26 countries. In 2020, outbreaks were reported in India (3,495), Uzbekistan (3,341), the Philippines (3,623), Bangladesh (2,758), Kazakhstan (2,297), Turkey (604), Romania (604), and Kyrgyzstan (547) [7]....

A single vaccination against measles has changed some of the characteristics of the epidemic process of infection. The incidence has decreased by almost 5 times in various age and social groups of the population, and there has been a slight increase in the interepidemic period and a decrease in the duration of the seasonal increase in the incidence [4].

Nevertheless, measles remained a "childhood" infection, with a ratio of 1 adult to 8.9 children. However, the quality of the measles epidemic process did not change, which was due to insufficient vaccination coverage with live measles vaccine (LMV) [5].

The introduction of revaccination in 1987 led to a 9.14-fold decrease in the incidence rate (the average annual rate was 18.6 per 100,000 population), a 6-fold decrease in the mortality rate, and a 10-fold decrease in the mortality rate from measles compared to the period of single vaccination.

A two-dose immunization schedule (vaccination and revaccination) can help eliminate measles at the national level [6]. The Global Laboratory Network for Measles Diagnosis has been established to monitor measles and prove its elimination [7].

In the 1980s and 1990s, global vaccination coverage increased from 40% to 80%. The strategy for combating measles included routine immunization, urgent immunization campaigns for specific areas and populations, patient care, and case investigation. The number of reported cases of measles worldwide decreased from 4 million in 1983 to 800,000 in 1994, remaining at approximately this level until 1998. However, with 800,000 reported cases of measles per year, the true incidence was estimated to be 36 million cases, and the mortality rate was estimated to be 0.9-1 million cases, with measles accounting for 7% of child mortality [8].

In 1997, the European Region of the World Health Organization set the goal of completely eradicating measles in Europe. This was estimated to require reducing the number of unvaccinated individuals to 15% for the 1-4 year old group (considering unvaccinated children under one year old), 10% for the 5-9 year old group, and 5% for any other age cohort [9].

Objective. To study the causes of epidemic outbreaks of vaccine-preventable diseases using measles as an example in the Republic of Uzbekistan.

Materials and methods. For epidemiological analysis, statistical data and materials on the incidence of measles infection were used by the Service for Sanitary and Epidemiological Well-Being and Public Health of the Republic of Uzbekistan. Epidemiological research methods were applied, in particular, operational epidemiological analysis.

2. RESULTS AND DISCUSSIONS.

In Uzbekistan, the fight against measles has been conducted since 1968. Vaccination against this infection is included in the calendar of preventive vaccinations. In the 1990s, there was a decrease in the incidence of measles among the child population until the early 2000s (Fig.1)

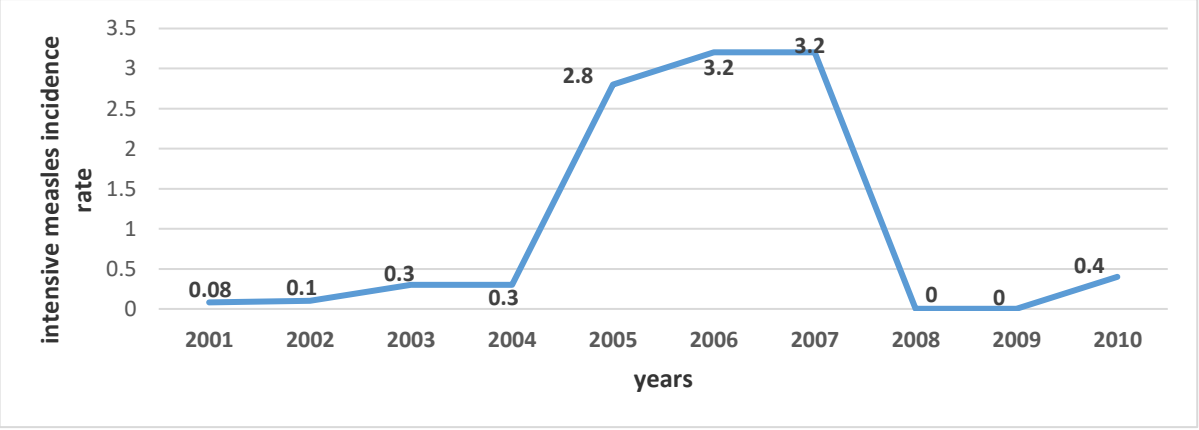

Fig. 1 Long-term dynamics of measles incidence in Uzbekistan per 100,000 population (2001-2010, intensive indicator)

The incidence rate of measles in Uzbekistan varied over a 10-year period (2001-2010), ranging from 0.08 in 2001 to 0.4 in 2010 (per 100,000 population). In 2005, 2006, and 2007, there was a slight increase in the incidence rate, which rose from 2.8 in 2005 to 3.2 in 2006 and 2007. However, there was a decline to 0 and 0.4 in 2008-2010.

In 2010-2011, Uzbekistan conducted a mass immunization campaign against this disease among individuals under the age of 30, vaccinating 9 million people.

In the next 7 years (2011-2017), the incidence of measles was significantly lower (Fig. 2).

Since 2012, active epidemiological surveillance of measles in Uzbekistan has been conducted [10].

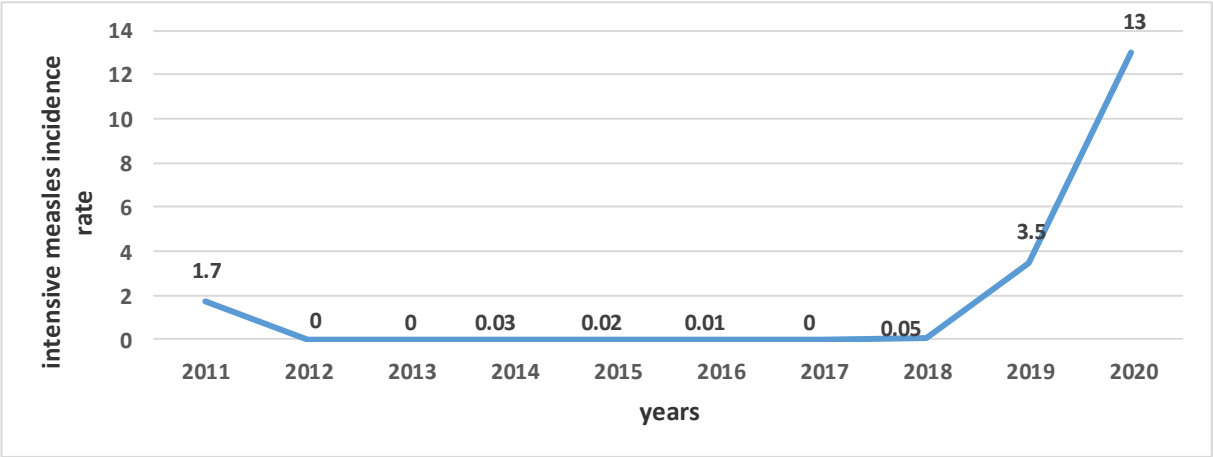

Fig. 2 Long-term dynamics of measles incidence in Uzbekistan per 100,000 population (2011-2020, intensive indicator)

In 2017, Uzbekistan received a WHO certificate of measles elimination in the country, but this does not mean that the disease has been completely eliminated.

The World Health Organization states that any type of infection can be introduced during the elimination process in any country, city, or region [10].

Each country has its own indicators. For Uzbekistan, the indicator is more than 600 cases of measles per 33 million people [10].

In 2018-2019, there were major outbreaks of measles worldwide. In 2018, the number of measles cases in Europe reached a record high in the last 10 years. The number of infections reached up to 82,000, with 72 deaths.

In March 2019, UNICEF reported an increase in measles cases worldwide, including in countries previously declared free of measles. According to the Foundation, in 2017, no cases of measles were reported in Uzbekistan, but in 2018, 179 suspected cases of measles were reported in the Republic of Uzbekistan, and 22 cases were confirmed, including 4 imported cases from the Russian Federation, Turkey, Saudi Arabia, and Kazakhstan (Figure 3). All the strains were imported and atypical for Uzbekistan

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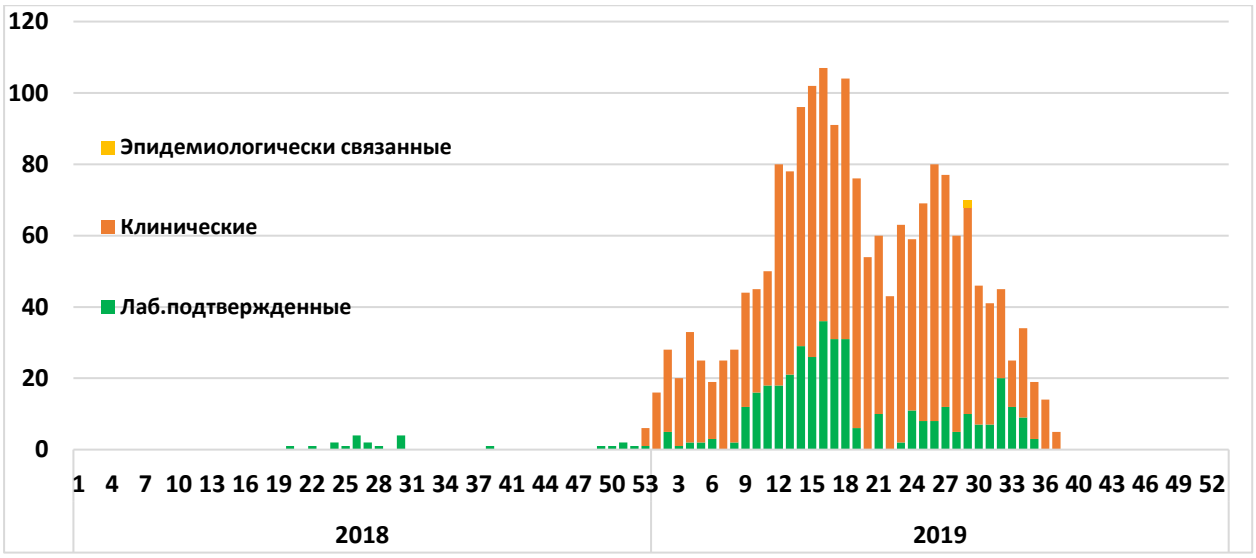

Fig. 3 Measles incidence in Uzbekistan in 2018-2019

In 2019, cases of measles classified as resulting from endemic transmission of the virus began to be reported.

In 2019, 2,161 cases of measles were reported in Uzbekistan, including 685 laboratory-confirmed cases, 947 clinically confirmed cases, 40 epidemiologically linked cases, and 489 unconfirmed cases. The highest number of cases was reported in Namangan, Samarkand, Surkhandara, Kashkadara, Tashkent, and Tashkent City.

The peak of measles incidence in 2020 occurred in February, when 34.6% of the total number of reported measles cases were recorded (Figure 4).

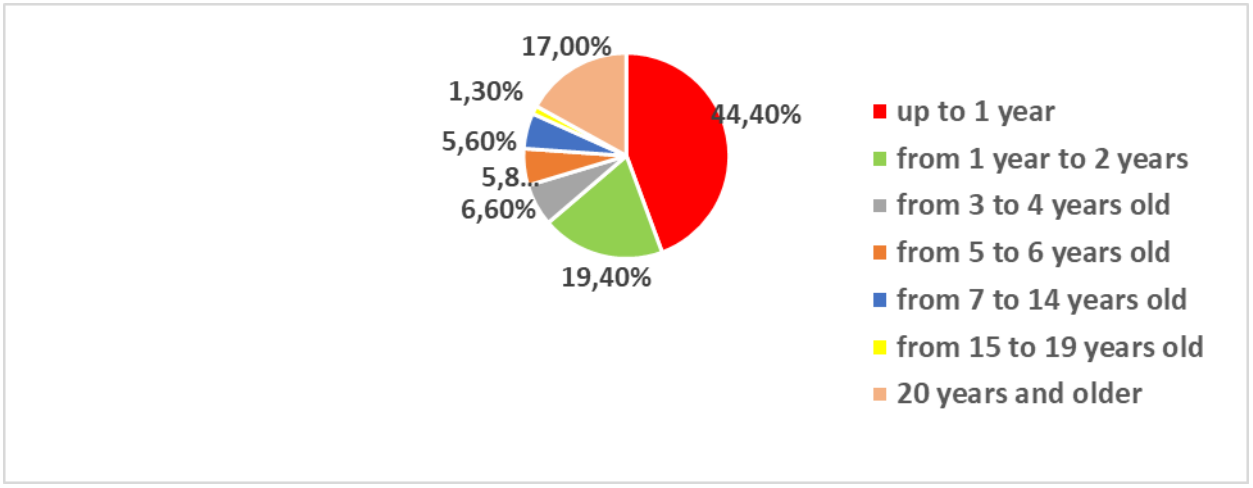

Fig. 4 Registered cases of measles by age in Uzbekistan in 2020 (in %)

In 2020, the largest percentage of cases again occurred in children under the age of 1 (44.4%), in children aged 1 to 2 (19.4%) and in people aged 20 and over (17.0%) (Fig.10).

A high percentage of measles cases was observed among unorganized children-74.29%, followed by 17.62% among the adult population, and the lowest percentage among organized children (i.e., among children attending kindergartens and schools) – 2.08% (Fig.5).

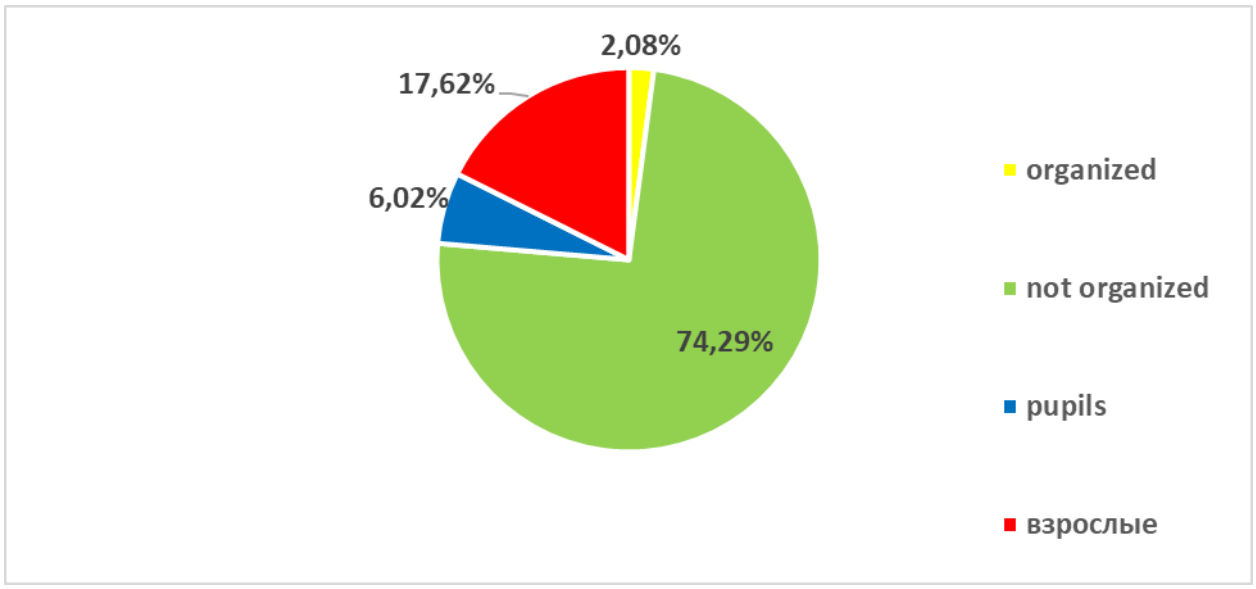

Fig. 5 Registered cases of measles in Tashkent by social status of the patients

As it turned out, a high percentage (82.5%) of cases were among unvaccinated individuals, including those who had not received the vaccine due to not reaching the vaccination age (53.1%), those with medical exemptions (13.4%), those who refused vaccination (11.5%), and in 21.8% of cases, we did not have information about whether these individuals had previously been vaccinated against measles (Figures 6 and 7).

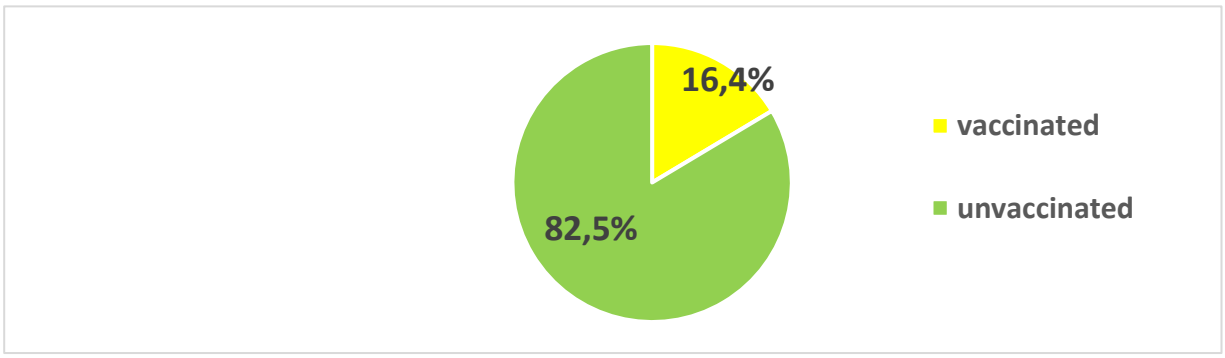

Fig. 6. Number of vaccinated and unvaccinated individuals among measles cases in 2020 (%)

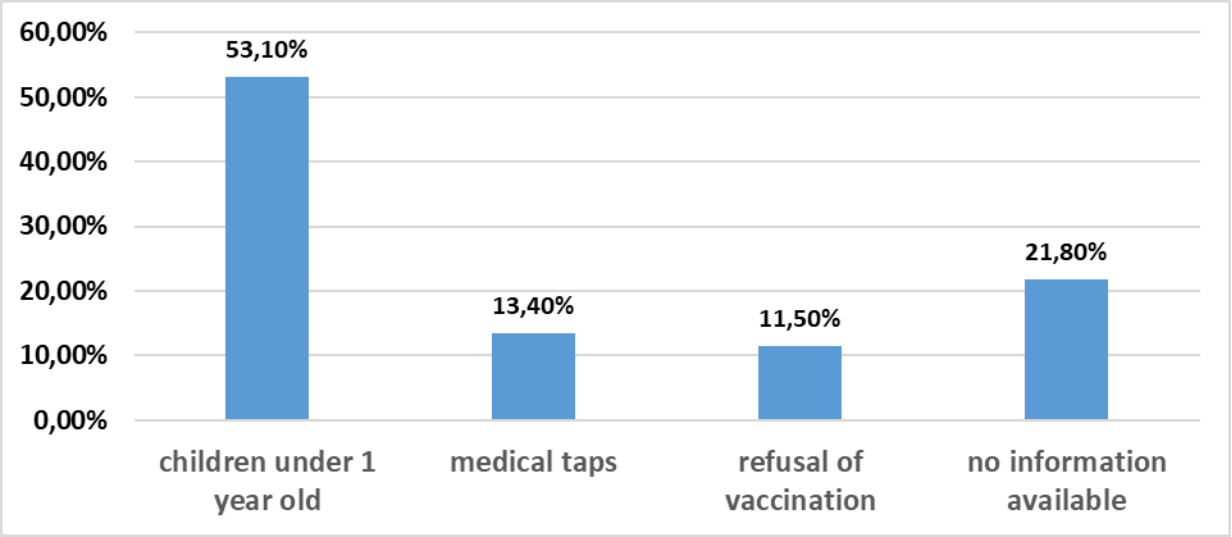

Fig. 7 Causes of measles in unvaccinated individuals (%)

In 16.4% of cases, measles was contracted by children who had received only one measles vaccine at 12 months of age, seronegative individuals, and individuals with proof of previous measles vaccination (form.63).

The main cause of the epidemiological situation in the country was the introduction and circulation of previously non-circulating strains (D8; B3 and B4) in Uzbekistan, which affect children under the age of vaccination and children who have received only one measles vaccine.

Due to the outbreak of measles in Uzbekistan, mass vaccination against measles was carried out in all regions and the city of Tashkent. All individuals in contact with the patients (parents, relatives, and neighbors on a neighborhood or even street level) were vaccinated with the measles vaccine. The measles vaccine "M" was administered to children aged 6 months to 1 year. Children over the age of 1 year received the "MMR" vaccine.

A "catch-up" vaccination was carried out for those who had previously been medically exempted, those who refused vaccination, school and college students, and those leaving and returning to Uzbekistan.

Due to the large-scale immunization against measles in Uzbekistan, no cases of measles were reported in 2021.

During the study period, although there was a wave-like change in the periods of increase and decrease in the incidence of measles, the overall incidence decreased. Between 1991 and 2022, there were four peaks in the incidence of measles, but each peak was approximately half the size of the previous one.

Thus, even during periods of increased measles incidence, there was a downward trend (from 98 to 10 cases per 100,000 population). In 2000-2004; 2007-2008; 2012-2018, the incidence remained at zero. The highest peak of the incidence occurred in 2018-2020, when the incidence reached more than 100 cases per 100,000 population (Fig.8).

Fig. 8. Dynamics of measles incidence depending on vaccination coverage (from 1990 to 2021).

The incidence rate of measles in Uzbekistan varied over a 10-year period (2001-2010), ranging from 0.08 in 2001 to 0.4 in 2010 (per 100,000 population). In 2005, 2006, and 2007, there was a slight increase in the incidence rate, which rose from 2.8 in 2005 to 3.2 in 2006 and 2007. However, there was a decline to 0 and 0.4 in 2008-2010.

In Uzbekistan, a mass immunization campaign against this disease was carried out in 2010-2011, and 9 million people were vaccinated.

In the following 7 years (2011-2017), the incidence of measles was significantly lower (Fig.3).

Since 2012, active epidemiological surveillance of measles in Uzbekistan has been conducted [10].

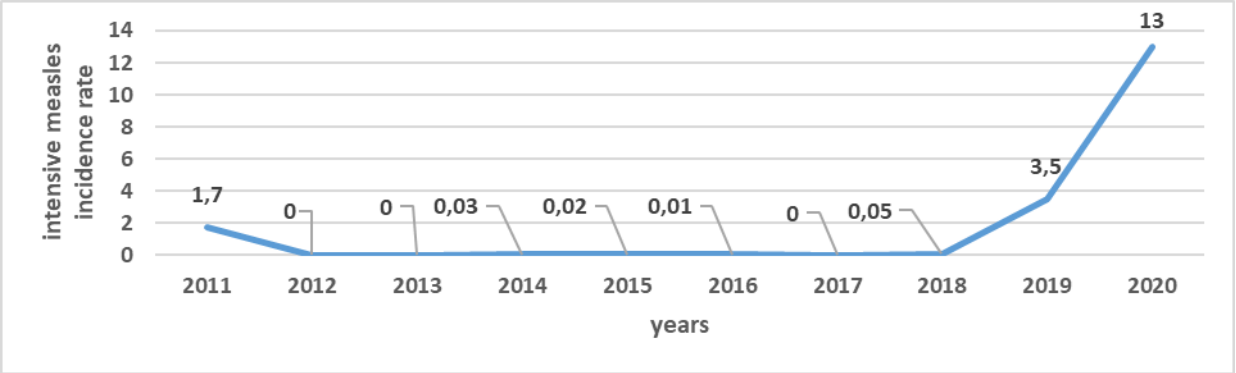

Fig. 9. Long-term dynamics of measles incidence in Uzbekistan per 100,000 population (2011-2020)

In March 2019, UNICEF reported an increase in measles cases worldwide, including in countries previously declared free of measles. According to the Fund, in Uzbekistan, no cases of measles were reported in 2017, but in 2018, 179 suspected cases of measles were reported in the Republic of Uzbekistan, with 22 cases confirmed by laboratory tests, including 4 imported cases from the Russian Federation, Turkey, Saudi Arabia, and Kazakhstan. All the strains were imported and atypical for Uzbekistan.

In 2019, cases of measles classified as resulting from endemic transmission of the virus began to be reported.

In 2019, 2,161 cases of measles were reported in Uzbekistan, including 685 laboratory-confirmed cases, 947 clinically confirmed cases, 40 epidemiologically linked cases, and 489 unconfirmed cases.

According to our observations, at the current stage, children under the age of 1 are more likely to get sick. Previously (in the 1970s and 1990s), children between the ages of 3 and 5 were more likely to get measles, but now a much higher number of cases is being reported among children under the age of 1, which is due to the lack of anti-measles immunity in mothers, which was not passed on to their newborns through the placenta. It suggests that these women may not have had measles as children, and if they were vaccinated, they may have lost their post-vaccination immunity. Children born to non-immune mothers were more susceptible to contracting measles through contact with infected individuals. This led to an increase in cases of measles among newborns and infants, as children under the age of one who had not yet been vaccinated were also affected by the epidemic.

There is also an increase in the age of measles, i.e., people aged 20-30 and older are becoming more involved in the epidemic process, which may be due to the low immune coverage among this age group. It is believed that post-vaccination and post-infection immunity (after a previous infection) lasts a lifetime. However, the emergence of a large number of measles cases among adults (aged 30 and older) suggests that the duration and strength of immunity after measles vaccination are still not fully understood.

3. CONCLUSION.

Thus, the main means of combating this insidious infection remains vaccination. The World Health Organization recommends vaccination of children at the age of nine months in regions where the disease is common, and at the age of twelve months in regions where the disease is rare.

In order to create active immunity, routine vaccination with live measles vaccine (LMV) is carried out in accordance with the vaccination schedule, as well as for children and adults who do not have measles antibodies.

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