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L.T. Yeraliyeva[2,3], A.M. Issayeva[1,2*], G.Z. Tanbayeva[1], A.K. Saidakhmetova[4]

[1]Al-Farabi Kazakh National University, Almaty, Kazakhstan
[2]S.D. Asfendiyarov National Medical University", Almaty, Kazakhstan
[3]"National Scientific Center for Phthisiopulmonology of the Republic of Kazakhstan" of the Ministry of Health of the Republic of Kazakhstan, Almaty, Kazakhstan
[4] CSE on REM "City Polyclinic No. 3", Almaty, Kazakhstan
*e-mail: issayeva17@mail.ru

CHANGES IN COVERAGE OF PNEUMOCOCCAL PREVENTION ACTIVITIES DURING THE COVID-19 PANDEMIC

Abstract. The World Health Organization estimates that in 2020, around 13.5 million children around the world did not receive routine immunizations, as expected, due to a shift in focus to fight a deadly pandemic.

Determine how the COVID-19 pandemic has affected the routine immunization of children using the example of vaccination against pneumococcal infection.

The ongoing retrospective study in the city polyclinic No. 3 of the city of Almaty of the Republic of Kazakhstan covered the period from 2019 to 2021. Statistical analysis was performed to determine significance ($p < 0.05$) using Z-score.

Annual coverage of the first vaccination in children aged 2 months in 2019 was 98%, and in 2020 it decreased to 86.1% ($Z = 4.112431$; $P = 0.000039$). In 2021, the indicator increased again, and reached the level of 96.8%. For the second dose of pneumococcal vaccine, coverage decreased from 98% (2019) to 80% (2020) ($Z = 5.056653$; $P = 0.000001$). In the next 2021, coverage was 96.7%. The null hypothesis is also rejected for the third dose of pneumococcal vaccine in children aged 12-15 months. If in 2019 the implementation of the annual plan was 98.5%, then in 2020 it decreased significantly, and showed only 85.4% ($Z = 5.562573$; $P = 0.000001$). Coverage recovery was successful in 2021, meeting the target by 96.6%. According to the data, coverage was lowest in 2020 and also for the second dose of pneumococcal vaccine.

The current study demonstrates the decline in vaccination coverage among Kazakh children during the 2020 COVID-19 pandemic.

Key words: routine immunization, COVID-19, national immunization schedule, Kazakhstan, pneumococcal vaccine, children.

Introduction

Thanks to scientific breakthroughs, there are now vaccines to prevent more than 20 life-threatening diseases, helping people of all ages to be healthy and live longer. Immunization is recognized worldwide as a cost-effective intervention, preventing 2–3 million deaths, illnesses, and disabilities from vaccine-preventable diseases each year [1].

The COVID-19 pandemic began in Wuhan, China in December 2019 and was declared a Public Health Emergency of International Concern in March 2020 by WHO. It has had a profound impact on individuals, families, communities and societies around the world. The pandemic has not only disrupted health systems, but also significantly affected routine immunization and the global economy. To mitigate transmission and reduce the impact, all countries have introduced control measures that have unfortunately disrupted health systems. The United Nations International Children's Emergency Fund (UNICEF), the World Health Organization (WHO) and the Global Alliance for Vaccines and Immunization (GABI) have warned that at least 80 million children under the age of 1 are at risk of contracting vaccine-preventable diseases during pandemics [2,3]. WHO has developed guidelines for immunization services and priorities to strengthen and sustain primary health care, including routine immunization during this rapidly growing pandemic [4,5,6,7].

WHO estimates, in 2020, about 13.5 million children worldwide did not receive routine immunization, as expected, due to a shift in focus to combat a deadly pandemic [8,9,10,11].

The aim of the article is to determine how the COVID-19 pandemic has affected the routine immunization of children using the example of vaccination against pneumococcal infection.

Materials and methods

To reveal the picture of the impact of the COVID -19 pandemic on routine immunization, retrospective data collection was carried out in the city polyclinic No. 3 in Almaty. The study covered the period from 2019 to 2021. The first cases of coronavirus infection were registered on March 13, 2020. Then on March 15, by decree of the President of the Republic of Kazakhstan, a state of emergency was introduced in the country.

Statistical analysis was performed to determine significance ($p < 0.05$) using Z – score. The null hypothesis is no change in immunization routine in 2020 compared to the previous year 2019 and the following year 2021.

Results and Discussion

CSE on REM "City Polyclinic No. 3" is one of the largest outpatient clinics in the city of Almaty and serves the adult and child population of the Bostandyk and Almaly districts. The planned capacity of the polyclinic is 500 visits per shift.

During the analysis, we revealed the presence of a change in vaccination coverage during the pandemic due to the introduction of restrictive measures. For all three pneumococcal vaccines (pneumococcal vaccine – PCV) given at 2 months, 4 months and 12-15 months of a child's life (respectively: PCV 1, PCV 2, PCV 3) there were changes in coverage in 2020 compared to with 2019.

Based on the above, we compared the periods according to the quarterly results of vaccination coverage of children against pneumococcal infection.

The first pneumococcal vaccine is given to children at 2 months of age (Figure 1). In the first quarter of 2019, 23.9% of children under 1 year old received the first dose of pneumococcal vaccine. In 2020, this indicator was higher and amounted to 29.7%. In 2021, vaccination coverage in the first quarter was 22.4%. The first cases of coronavirus infection were registered on March 13, 2020, and at the same time, quarantine measures were introduced with the isolation of contacts. At the same time, the level of routine vaccination against pneumococcal infection decreased already in the second quarter of 2020.

In 2019, in the second quarter, vaccination coverage was 20.6%, and in 2021 – 24.3%. In 2020, in the second quarter, the vaccination rate for children under 1 year of age with the first dose of pneumococcal vaccine decreased to 11.5%. It is worth noting that in April 2020, not a single child out of 970 children subject to vaccination according to the annual plan was vaccinated with the first and second doses of pneumococcal vaccine, which affected the low level of vaccination in the second quarter of 2020.

In the third quarter of 2020, the vaccination coverage rate was 17% of the annual plan. The indicators for the III quarters of 2019 and 2021, vaccination coverage, respectively, amounted to 21.7% and 22.7%. At the same time, in the 4th quarter of 2020, there was a weakening of anti-epidemic easing, the work of primary health care (primary health care) was intensified, which was reflected in the vaccination coverage in the 4th quarter of 2020. The coverage rate increased to 35.5%, and in 2019 – 23.4%, in 2021 – 25.2%. As can be seen in Figure 1, the 2020 curve shows a change in vaccination coverage.

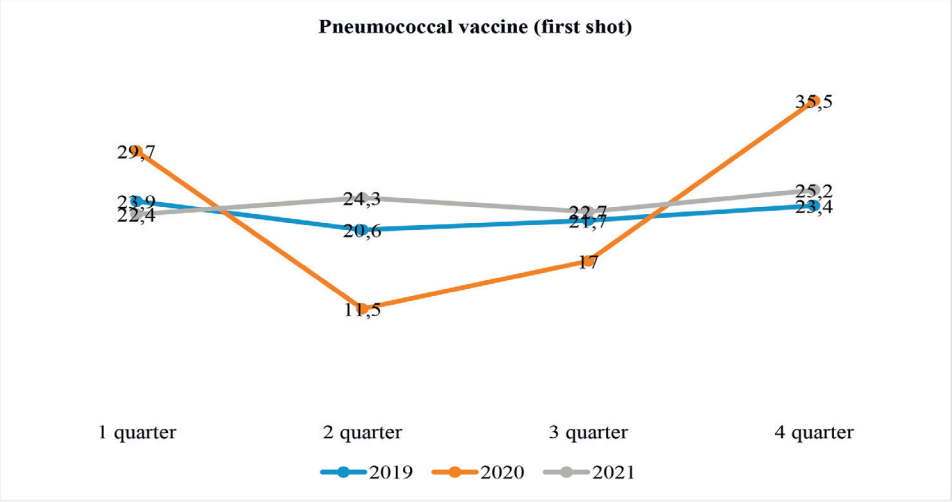

Figure 1 – Coverage rates (out of 100% as an annual) with the first pneumococcal vaccine in children under 1 year of age (vaccinated at 2 months of a child's life), %

At 4 months, the child is given a second vaccination against pneumococcal infection. In the first quarter of 2019, the coverage was 23.9%, in 2020 – 29.7%, and in 2021 the vaccination rate was 22.4%. Further, in the second quarter of 2020, a similar pattern of vaccination coverage is observed, which was during the first PCV vaccination – 2019 – 20.6%, 2020 – 11.5%, 2021 – 24.3%. In general, the results of quarterly coverage are the same as the results of the first stage of vaccination against PVK. (Q3: 2019 – 21.7%, 2020 – 17%, 2021 – 22.7%; Q4: 2019 – 23.4%, 2020 – 35.5%, 2021 – 25.2%). The data is illustrated in Figure 2.

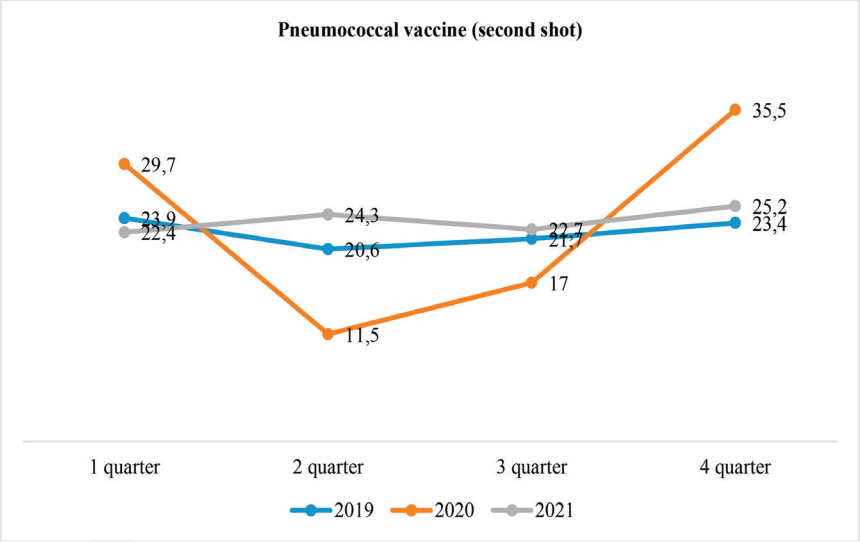

Figure 2 – Coverage rates (out of 100% as an annual) with the second pneumococcal vaccine in children under 1 year of age (vaccinated at 4 months of a child's life), %

The final third PCV vaccination is given at the age of 12-15 months. We decided to include this stage in the study, since children are vaccinated exactly at the age of 1 year. If the previous vaccinations in 2019 and 2021 showed minor changes (within ±5%), then during the third vaccination, the graph created based on the coverage results shows a different picture (Figure 3). In the first quarter, the indicators for 2019 and 2020 are identical, amounting to 30.6% and 30%, respectively. In 2021, coverage showed 23%. In the second quarter of 2020, the percentage, due to quarantine measures, again decreases to 15.2%. The figures for 2019 are 20.3%, and for 2021 – 22.5%. In the third quarter, the percentage of completion of the plan for vaccination with the third dose in 2019 was 25.6%, in 2020 – 17.5%, and in 2021 – 23.1%. Just like in the previous stages, in the fourth quarter of 2020, the highest figure is 32.5%. The previous levels remained unchanged in 2019 (23.9%) and 2021 (25.3%).

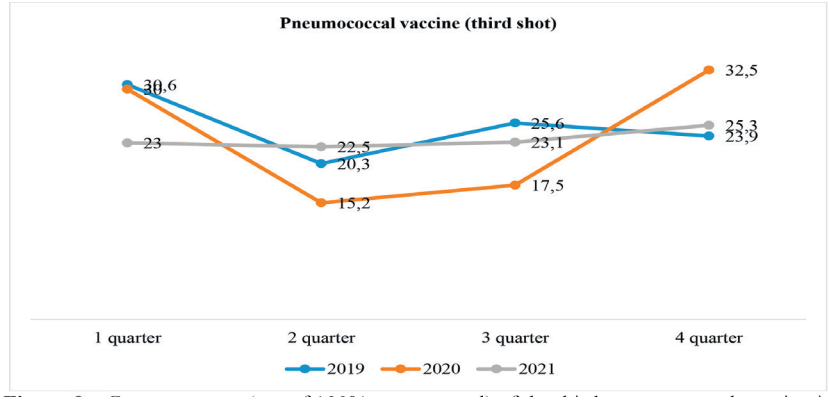

Figure 3 – Coverage rates (out of 100% as an annual) of the third pneumococcal vaccine in children under 1 year old (vaccinated at 12-15 months of a child's life), %

According to the results of the statistical analysis, the null hypothesis was rejected, since the impact of the COVID -19 pandemic is statistically significant (Table 1). Annual coverage of the first vaccination in children aged 2 months in 2019 was 98%, and in 2020 it decreased to 86.1% (Z = 4.112431; **P = 0.000039)** . In 2021, the indicator increased again, and reached the level of 96.8%. For the second dose of pneumococcal vaccine, coverage decreased from 98% (2019) to 80% (2020) (Z = 5.056653; **P = 0.000001)** . In the next 2021, coverage was 96.7%. The null hypothesis is also rejected in relation to the third dose of pneumococcal vaccine in children aged 12-15 months. If in 2019 the implementation of the annual plan was 98.5%, then in 2020 it decreased significantly, and showed only 85.4% (Z = 5.562573; P = 0.000001). Coverage recovery was successful in 2021, meeting the target by 96.6%. According to the results, coverage was lowest in 2020 and also for the second dose of pneumococcal vaccine. The schedule for completing the annual pneumococcal vaccination plan is shown in Figure 4.

Table 1 – Implementation of the annual plan for immunization of children with pneumococcal vaccine

	2019			2020			2021			p-value
	Plan	Fact	Coverage	Plan	Fact	Coverage	Plan	Fact	Coverage	
PCV 1	969	950	98%	901	779	86.1%	793	768	96.8%	Z = 4.112431 **P = 0.000039**
PCV 2	969	950	98%	901	742	80%	793	767	96.7%	Z = 5.056653 **P = 0.000001**
PCV 3	981	1018	98.5%	911	782	85.4%	688	665	96.6%	Z = 5.562573 **P = 0.000001**

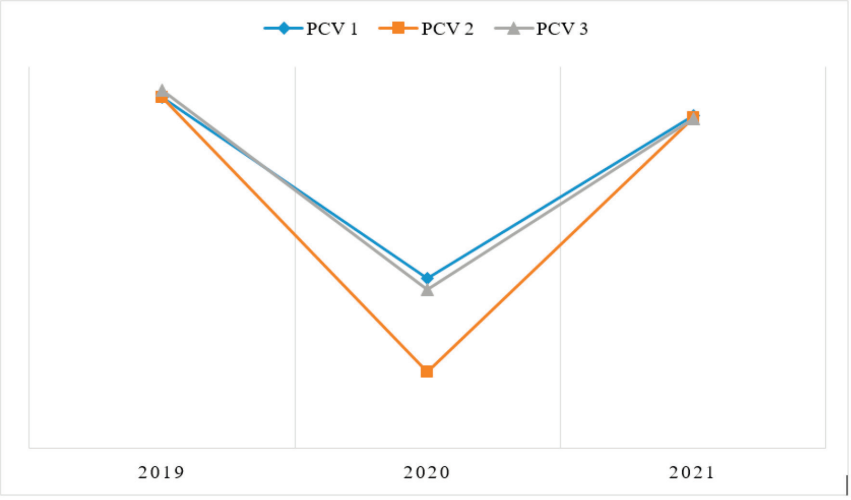

Figure 4 – Pneumococcal vaccination coverage rates (3 stages) in the period 2019-2021, %

Conclusion

The data from City Polyclinic #3 reports and the results of the cross-sectional study presented in this article show that there is a significant decline in vaccination coverage in 2020. This was reflected in a significant overall decline in vaccination coverage in 2020 compared to 2019.

Consistent with this, the data showed that 49 vaccine doses in 2019 were delayed compared to 2869 vaccine doses. In 2019, 98.3% were introduced on time, in 2020 – 98.7%, and in 2021 – 100%.

The current study demonstrates the decline in vaccination coverage of children in the Republic of Kazakhstan during the COVID-19 pandemic. It is important to formulate future strategies to avoid declines in vaccination rates during emergencies.

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