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VACCINATION AS ONE OF THE COST-EFFECTIVE HEALTH MEASURES

Vaccination is the basis of global health security, as well as one of the most effective types of investments in human health protection. One of the effective methods of preventing infectious diseases is vaccination.

The article is devoted to the study of the problems of vaccination of the population against COVID-19. Based on the study and the study, the authors proceed from the fact that the problem of vaccination of the population not only from COVID-19, but also from a number of other diseases is paid attention, but at the same time it is not sufficiently studied, which determines the relevance of this topic.

The paper analyzes the coverage of the population of the Republic of Kazakhstan with certain types of vaccines for the period from 2015-2020, the coverage of immunization in the world in 2019, and also presents a forecast with scenarios of the number and timing of the vaccinated population.

Keywords: *vaccination, immunization, vaccine coverage, healthcare, cost-effective measures, forecast scenarios, anti-vaccination, population, health economics, Kazakhstan.*

Кілт сөздер: *вакцинация, иммундау, вакцинамен қамту, денсаулық сақтау, экономикалық тиімді шаралар, болжам сценарийлері, вакцинацияға қарсы күрес, халық, денсаулық сақтау экономикасы, Қазақстан.*

Ключевые слова: *вакцинация, иммунизация, охват вакциной, здравоохранение, экономически эффективные меры, сценарии прогноза, антивакцинаторство, население, экономика здравоохранения, Казахстан.*

JEL classification: I15

Introduction. Vaccination is the most effective and safe way to prevent infectious diseases, both from an economic and medical point of view. With the help of vaccination, it is possible to protect not only human health and life, but also to protect people around him from harmful infections. After all, it is known that diseases such as polio, tuberculosis, smallpox, measles, mumps, diphtheria, tetanus and others are prevented only by timely vaccination. Vaccination saves the lives of about three million people every year.

The article analyzes the coverage of the population of the Republic of Kazakhstan with certain types of vaccines for the period from 2015-2020, the coverage of immunization in the world in 2019, and also presents a forecast with scenarios of the number and timing of vaccination of the population. At the same time, attention is paid not only to the problems of immunization, but also to measures to activate and strengthen public confidence in vaccination, as well as awareness-raising about the disease and the threat of the spread of COVID-19. Healthcare workers should be able to correctly convey to the population information about the need for vaccination in various forms, both orally and in printed materials. Mass immunization coverage is one of the factors of economic growth and contributes to an increase in investment consumption, as well as poverty reduction.

Literature review. Immunization is one of the key components of primary health care and an indisputable human right. This is one of the most productive types of investment in human health protection. Vaccines are also crucial for preventing and suppressing outbreaks of infectious diseases. Global health security is based on them, and they will remain a vital tool in the fight against the problem of antimicrobial resistance [1].

The World Health Organization (WHO), together with UNICEF, is monitoring immunization coverage in States. The immunization program is one of the drivers of improving the efficiency of the national health system of any state. Immunization makes it possible to prevent more than a million people's lives every year and is currently one of the most cost-effective health measures.

There is a category of people who are not recommended for certain personal indicators of the introduction of certain vaccines, but it follows that their lives depend on people who are vaccinated, thereby reducing the spread of diseases. During the COVID-19 pandemic, the number of children undergoing routine immunization decreased, and this in turn can lead to more severe consequences than coronavirus, that is, an increase in morbidity and mortality from preventable diseases. One of the important tasks of public health in many countries is to continue the vaccination program of the population.

The problems of vaccination of the population against COVID-19 are one of the global issues after the consequences of climate change. The main purpose of vaccination against coronavirus is to stop the spread of the disease and strengthen human immunity. One of the constant questions of the population are the following: «Why get vaccinated if I can get sick? Is vaccination mandatory? Is the vaccination free?». In vaccinated people, the disease is less painful, and there is also a process of breaking the chain of infection of the virus. Equal access of the population to a safe and effective vaccine is a factor that is important for stopping the spread of COVID-19.

Vaccination in Kazakhstan against COVID-19 is carried out on a voluntary basis. It should also be noted that vaccination against COVID-19 is carried out free of charge for citizens of the Republic of Kazakhstan who have a residence permit permanently residing in Kazakhstan.

The aim of the study is to study the problems and negative attitudes towards vaccination against COVID-19 coronavirus.

In the works of M.K. Akmatova, A.Zh. Baibusinova, M.G. Moskvicheva, A.V. Vitebsk T.A. Kaliuzhnaia, B.S. Belov, N.A. Ozeretskovsky the problems and barriers of vaccination against various diseases of adults and children are considered [2-4].

Studies by B. Standart, H. Christensen, M.J. Postman, M. Drummond are devoted to the cost-effectiveness of vaccination [5-6].

It is also necessary to note the research of Kazakhstani scientists (Zakaria K., Kutumbetov L., Orynbayev M., Abduraimov E., Sultankulova K., Kassenov M. and others) devoted to the study of the vaccine against coronavirus infection QazCovid-in (QazVac).

In connection with the above, we are faced with the task of investigating the problem of vaccination against COVID-19. This determines the relevance of the topic of this article. In connection with the above, we are faced with the task of investigating the problem of vaccination against COVID-19. This determines the relevance of the topic of this article.

Main part. In this study, the methods of analysis and the graphical method were applied. Using the method of analysis and statistical data, the following were studied: coverage of the population of the Republic of Kazakhstan with certain types of vaccines for the period from 2015-2020, immunization coverage in the world in 2019. For greater clarity of the indicators, a graphical method was used that reflects the dynamics of their changes through diagrams and graphs. Based on the analysis, several scenarios for the prediction of vaccination against COVID-19 in the Republic of Kazakhstan were predicted. The calculations of Figures 1, 2 are performed by constructing an exponential trend line.

Discussion. Vaccination in developed countries is an inseparable part of the prevention of medical services but even in developed countries, there is a refusal of vaccination. The most common reason for refusal is uncertainty about the safety of the vaccine. Figure 1 shows the coverage of the population of the Republic of Kazakhstan with certain types of vaccines for the period from 2015-2020.

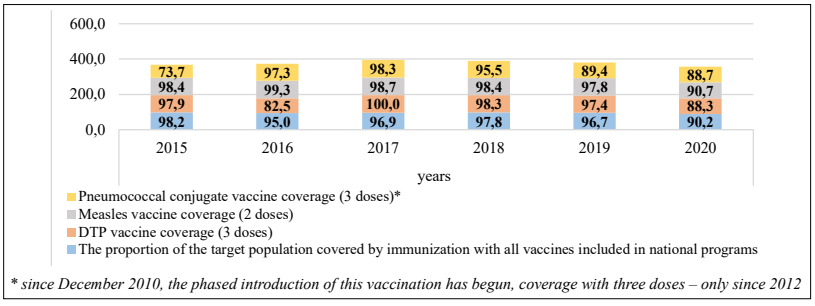

Figure 1. **Coverage of the population of the Republic of Kazakhstan with certain types of vaccines for the period from 2015-2020***

** Compiled by the authors according to the source [7]*

From Figure 1, there is a decrease in indicators in 2020 compared to 2015 in the following positions: the proportion of the target population covered by immunization with all vaccines included in national programs by 8%; coverage of DTP (3 doses) by 9.6%; coverage of measles vaccine (2 doses) by 7.7%. At the same time, there is a reverse dynamics of indicators in 2020 compared to 2015 in terms of coverage with pneumococcal conjugate vaccine (3 doses), i.e. an increase of 15%.

After the collapse of the Soviet Union, the countries of Central Asia have undergone great changes. In Kazakhstan, vaccination coverage decreased between 1990 and 1995, which led to an increase in the incidence of certain vaccine-preventable diseases, such as diphtheria and measles [8]. Figure 2 shows data on immunization coverage in the world in 2019.

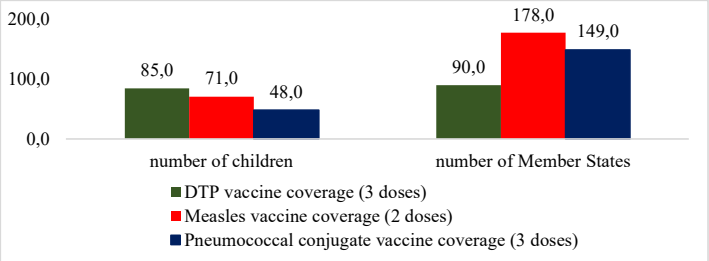

Figure 2. **Global immunization coverage in 2019***

** Compiled by the authors according to the source [9].*

According to the WHO, during 2019, approximately 85% of infants in the world (116 million) received three doses of the vaccine against diphtheria – tetanus – pertussis (DTP), which protects them from infectious diseases that can cause great suffering, disability or death. By 2019, 125 WHO Member States have achieved at least 90% coverage of DTP.

By the end of 2019 85% of children received one dose of measles vaccine before their second birthday, 178 States included a second dose in routine immunization programs and 71% of children were covered with two doses of measles vaccine in accordance with national vaccination calendars.

By the end of 2019, the pneumococcal vaccine was introduced in 149 states, three of which used it on part of their territory, and the global coverage of the third dose of the vaccine was estimated at 48% [9].

Over the past few years, global vaccination coverage (the proportion of children in the world receiving recommended vaccines) has remained at the same level [9].

Immunization is one of the most effective methods of preventing infectious diseases. Currently, there is a need to intensify the explanatory work of medical official bodies among the population and the public about the real effect of vaccination, since there is quite a lot of fake information in the Internet space.

The vaccination campaign for citizens of the Republic of Kazakhstan began on February 01, 2021. Two doses of the following vaccines were available to the population: domestic «QazVac», Russian drug «Sputnik V», Arab-Chinese «Hayat-Vax», Chinese drug «Sinovac Biotech», American drug «Pfizer». The supply of drugs is carried out according to the schedule. In 2021, 95 billion tenge was allocated for the purchase of COVID-19 vaccines for Kazakhstanis. It is also planned to allocate 80 billion tenge from the state budget for prevention and treatment.

Funding is a critical component of sustainable immunization programs. Immunization financing cannot be considered separately from financing, planning and budgeting for the entire health sector. In most countries, the State budget is the main source of funding for immunization programs. Salaries of medical workers are paid at the expense of the state budget, expenses for the provision of services are paid and vaccines, materials and equipment are purchased.

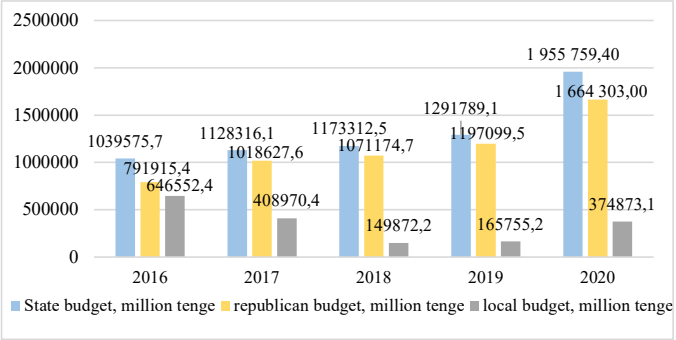

Figure 3. **Dynamics of healthcare cost, million tenge***

** Compiled by the authors according to the source [10]*

In the dynamics of costs, the largest share falls on expenditures from the state budget, which increased by 88.1% compared to 2016, the same change is observed in the costs of the republican budget. Regarding the costs from the local budget, they decreased by 42.01% or 271679.3 million tenge. This happened due to the fact that the health care budget was cut, the costs from the republican budget were increased.

The main reasons for the population's refusal to vaccinate: fear of side effects, distrust of the drug and medicine in general, religious beliefs. Thanks to vaccination, collective immunity from polio and infantile paralysis has been formed in Europe and in the territory of the former Soviet Union. The formation of collective immunity will protect children under 12 years of age and people with chronic diseases, as they will be in a protected vaccinated environment. To reduce the incidence of COVID-19, it is necessary to reach the threshold of collective immunity (HIT).

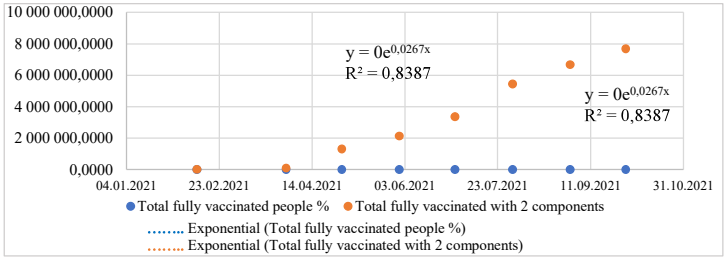

Figure 4. **Actual data on vaccination of the population of the Republic of Kazakhstan from COVID-19***

** Compiled by the authors according to the source [11]*

According to the figure, the following can be seen: the actual percentage of fully vaccinated people, while for the month of February 2021 was 0.07% (13447 people), and at the end of September 40% (7684022 people). The greatest vaccination activity is observed from July 2021 to the present.

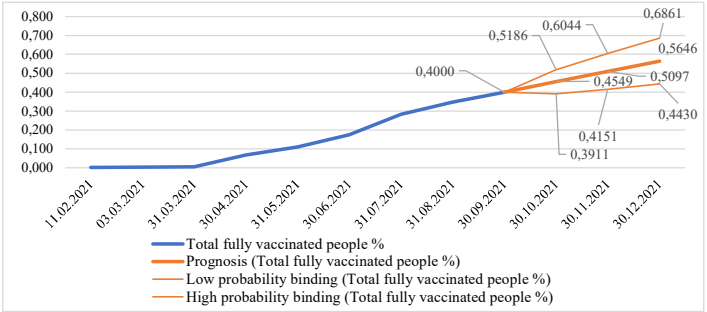

Figure 5. **Forecast values of vaccination indicators of the population of the Republic of Kazakhstan from COVID-19**

** Compiled by the authors.*

Figure 5 shows several scenarios for the vaccination forecast: optimistic – by the end of 2021, the percentage of fully vaccinated against COVID-19 will be 68.6% (13178098 people); pessimistic 44% (8510054 people); optimal forecast – 56% (10745287 people), while it should be noted that this scenario corresponds to the state policy of the Ministry of Health.

Predictive methods based on exponential smoothing are well-known and very popular in the economy, implemented in all major statistical software packages. Generalized models are suitable for both short-term and long-term forecasting of the incidence rate, but, for some reason, are rarely used in works on this topic [12, p.872; 13; 14].

Currently, the real problem of vaccination against COVID-19 in the Republic of Kazakhstan is anti-vaccination (distrust of the vaccine, religious beliefs), namely insufficient official information regarding vaccines (post-vaccination complications, revaccination, vaccination of children, category of persons subject to medical withdrawal). The rational allocation of resources in healthcare is solved through an economic analysis of its methods and assessments. The economic component is one of the key factors in choosing effective disease control measures, especially in epidemiology.

Results. Thus, the analysis of immunization coverage and the prediction of vaccination can indicate problems, the solution of which can ensure the activation of vaccination, and will also contribute to strengthening confidence in vaccines:

Given the reluctance of many people to be vaccinated, it is necessary for organizations and vaccination specialists to carry out awareness-raising work about the need for vaccination and the dangers of COVID-19. It is necessary to promote confidence building as a social norm by expressing their support for vaccination. Through meaningful conversations with people about vaccination, everyone contributes to public health. Historically, there has been a tendency of negative attitude towards vaccination companies. And only later, after the first positive results, people change their opinion in favor of vaccines. In this regard, a tolerant approach is required with the participation of the media space to create a common favorable environment to encourage people to vaccinate. A more subtle approach is required in relation to parents of children who are also subject to vaccination.

«Vaccination against coronavirus is an important factor in overcoming the economic crisis». "Vaccination policy this year, maybe next year, is an economic policy, and it may be even more important than fiscal and monetary policy in terms of overcoming the crisis". This opinion was shared by the Managing Director of the International Monetary Fund Kristallina Georgieva on June 30, 2021 at the International Financial Congress [15].

3) Summing up, I would like to say that in recent years healthcare has been facing a number of problems: the deterioration of medical equipment, the shortage of specialists in rural areas, the low level of qualification of medical workers, the reduction of medical institutions, the constant increase in prices for medicines, medicines and services. All this is due to the low level of healthcare financing [16]. The state and prospects of development of the healthcare system of Kazakhstan, improvement of financing are one of the urgent issues today. The coronavirus pandemic has shown how much medicine is not ready for this kind of change. After all, it is the development of the state and its security that directly depend on a healthy population, which is the main productive force. And all this is connected with the effective financing of the country's healthcare system, since no industry can develop effectively without a well – established financing system.

4) Vaccination is the most cost-effective measure to combat COVID-19, which is able to stop the spread of the disease. Given the different attitudes to vaccination, it became necessary to predict several scenarios of the number of vaccinated people. According to the presented forecast on vaccination of an optimistic scenario, the number of fully vaccinated people will reach 13 million people by the end of 2021. However, given the negative attitude towards vaccination in the most pessimistic forecast scenario, the estimated number of fully vaccinated will be 8.5 million people. In order to maintain and implement an optimistic forecast scenario for vaccination, it is necessary to continue active information work.

Conclusions. Immunization saves millions of lives and is widely recognized worldwide as one of the most successful and cost-effective health measures [9]. Both healthcare organizations and non-healthcare organizations are the main drivers in the dissemination of accurate information about the benefits of vaccination. Every citizen can play his role, while having basic knowledge about vac-

cines from official sources by distributing it and expressing his open position about vaccination. In the work, based on statistical data, we calculated the forecast of vaccination of the population and presented optimistic, optimal and pessimistic scenarios. According to the results of an optimistic and optimal forecast scenario, vaccination against COVID-19 is currently a cost-effective measure. At the same time, the effect is achieved by reducing the likelihood of coronavirus infection and further hospitalization.

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ВАКЦИЯНАЦИЯ ДЕНСАУЛЫҚ САҚТАУДЫҢ ЭКОНОМИКАЛЫҚ ТИІМДІ ШАРАЛАРЫНЫҢ БІРІ РЕТІНДЕ

Андатпа

Вакциянация жаһандық денсаулық сақтау саласындағы қауіпсіздіктің негізі, сондай-ақ адам денсаулығын қорғауға инвестициялардың тиімді түрлерінің бірі болып табылады. Жұқпалы аурулардың алудың тиімді әдістерінің бірі – вакцинация.

Мақала халықты COVID-19 вакцинациялау мәселелерін зерттеуге арналған. Зерттеу мен зерттеудің негізінде авторлар халықты вакцинациялау мәселесіне тек COVID-19-дан ғана емес, сонымен қатар бірнеше басқа ауруларға да назар аударылатындығын, бірақ бұл тақырыптың өзектілігі жеткілікті түрде зерттелмегенін білдіреді.

Жұмыста 2015-2019 жылдар кезеңінде Қазақстан Республикасының халқын вакциналардың жекелеген түрлерімен қамтуға талдау жүргізілді, 2019 жылы әлемде иммундаумен қамту, сондай-ақ вакцинацияланған халықтың саны мен мерзімдерінің сценарийлері бар болжам ұсынылды.

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ВАКЦИНАЦИЯ КАК ОДНА ИЗ ЭКОНОМИЧЕСКИ ЭФФЕКТИВНЫХ МЕР ЗДРАВООХРАНЕНИЯ

Аннотация

Вакцинация является основой безопасности в сфере глобального здравоохранения, а также одним из эффективных видов инвестиций в охрану здоровья человека. Одним из эффективных методов профилактики инфекционных заболеваний является вакцинация.

Статья посвящена исследованию проблем вакцинации населения от COVID-19. На основании изучения и проведения исследования авторы исходят из того, что проблеме вакцинации населения не только от COVID-19, но и от ряда других заболеваний уделяется внимание, но при этом она не достаточно изучена, чем и определена актуальность данной темы.

В работе проведен анализ охвата населения Республики Казахстан отдельными видами вакцин за период с 2015-2019 годы, охват иммунизацией в мире в 2019 году, а также представлен прогноз со сценариями количества и сроков вакцинированного населения.