

MODELING OF COVID CASES WITH SYSTEM DYNAMICS

Analyzing with COVID-19 in many countries, be analyzed the number of vaccinated population and the situation with access to the vaccine for the population. Today in Ukraine (as of the beginning of December 2021) in Ukraine about 13.9 million people were vaccinated with the first dose and 12 million people received a full course of vaccination. 27.3% of the population of Ukraine is vaccinated, in this situation it should be said that in the world this figure is 42.7%. For example, in India this figure is 35.8%. Low vaccination of the population creates risks of permanent economic lockdowns and increased burden on the medical system of Ukraine. It should be noted that the cost of treating a patient with COVID-19 is 60 times higher than the cost of vaccination for the Government of Ukraine. The cost of treating one patient is UAH 35,000, and the cost of two doses of vaccine for the government is about UAH 550 [1]. In this way, vaccination reduces government spending on future treatment of Ukrainians and reduces mortality during the pandemic (3rd place among Ukrainians, after heart disease and oncology[2]).

It is these facts that determine the relevance of this topic. System dynamics - as a type of simulation allows you to consider a large list of variables and factors for the analysis of vaccination in Ukraine. At the same time, the methods of system dynamics allow to consider the costs and impact on the economy of the lack of vaccination of the population. I created a simplified model of the effectiveness of vaccination in reducing economic losses from Covid-19.

The model consists of several elements: vaccine flows, healthy labor flows, tax revenues and population flows.

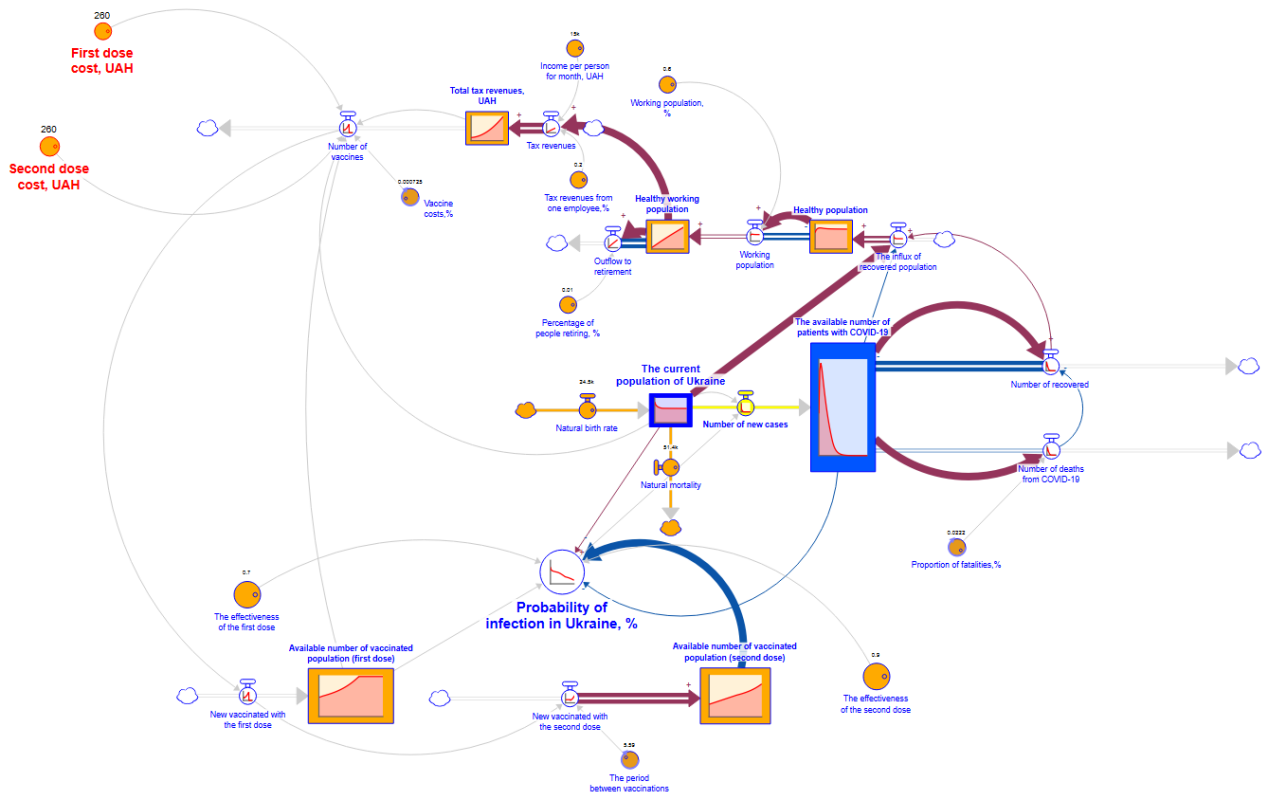


Figure 1. Model for assessing the effect of vaccination on the epidemiological situation in Ukraine in 2021

The central element of the model is the indicator "probability of infection in Ukraine", which is calculated using the coefficients of vaccine effectiveness, the number of patients with the virus and the number of vaccinated.

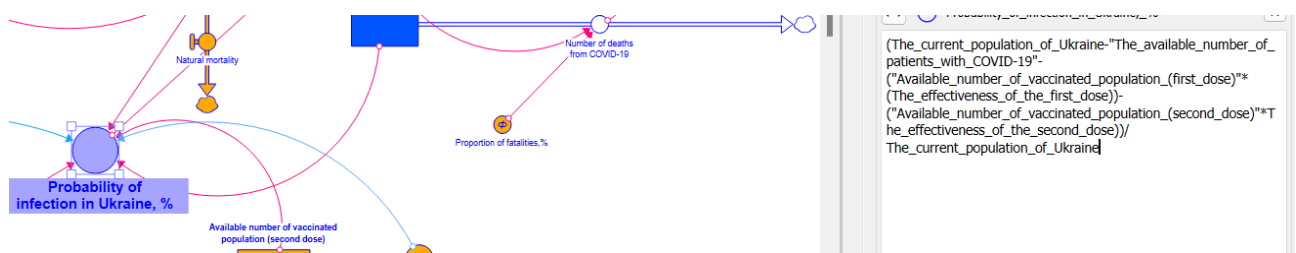


Figure 2. The formula for calculating the probability of infection in Ukraine on Covid-19

The unit of time in the model is months, and the input data are taken from statistical sources of the Government of Ukraine and foreign sites that collect world statistics on Covid-19. The data show the situation in 2021.

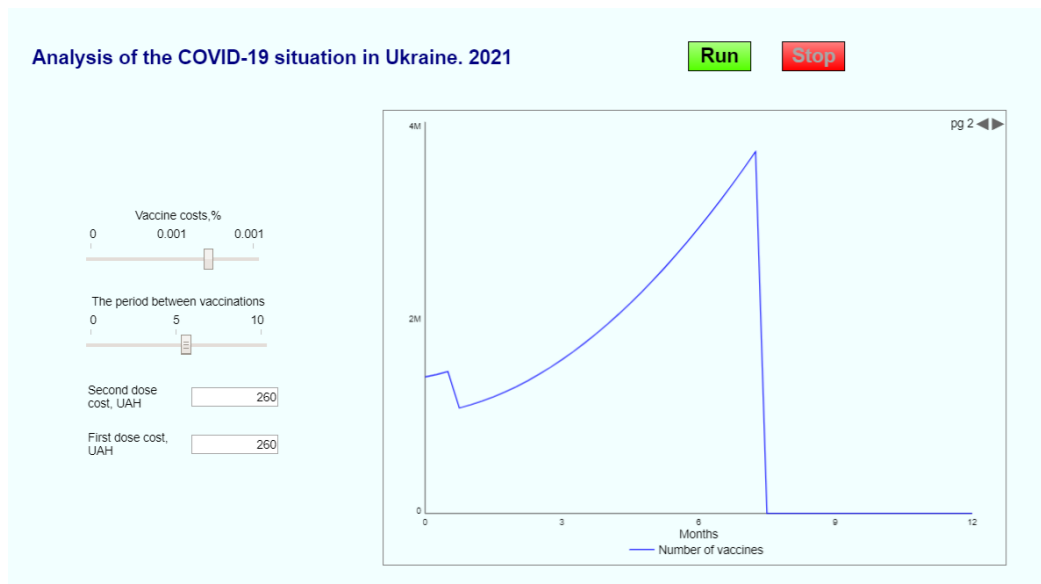


Figure 3. Analysis of the situation with Covid-19 in Ukraine

The software interface allows you to simply and concisely show the essence of the model and allow the user to change the input parameters in the model.

The essence of the model is to simplify the modeling of vaccination effectiveness, analysis of the impact and closure of the labor cycle in Ukraine. The model will allow for better health policies.

Nevertheless, it should be noted that this model is a simplified view of a larger model, which would consider the following indicators: population testing, provision of masks and oxygen to medical institutions of Ukraine, and so on. Also in the future, the model may be supplemented by a booster dose of vaccination.

References

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