

APPLICATION OF STATISTICAL METHODS OF ANALYSIS TO PREDICT THE COURSE OF THE COVID-19 EPIDEMIC

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Introduction. Mankind has been constantly experiencing epidemiological challenges for many millennia. More than one pandemic could have destroyed the human population, but human being still inhabits the planet because he was able to overcome disease. This includes plague, cholera, typhus and others. Needless to say, there have been many epidemics in the last XX-XXI centuries, namely: smallpox, typhus, Spanish, Asian, Hong Kong, swine flu, HIV/AIDS, etc.

A new pandemic, COVID-19, has been around the world moreover a year now. The media scares people with the second wave of coronavirus, but is it really so? Where is the evidence for this? With the help of mathematical statistics and data from the Ministry of Health, it is possible to prove, refute media data or predict other waves of the virus in Ukraine.

Aim. Using the method of mathematical statistics to build a model of the first wave of the epidemic COVID-19 in Ukraine and predict further mortality.

Materials and methods. For statistical analysis of the incidence of coronavirus in Ukraine, we used methods of mathematical statistics.

Mathematical statistics is a branch of mathematical knowledge that develops rational methods (ways) of systematization, processing and analysis of data of statistical observations of mass phenomena in order to establish their characteristic statistical patterns, use for scientific and practical conclusions and forecasting.

When constructing graphs used:

Approximation – approximation of one function, for example, given graphically, by some other function, usually given analytically. Such a problem arises in the following cases:

Interpolation – a kind of approximation in which the curve of the constructed function passes exactly through the available data points.

Extrapolation – a special type of approximation, in which the function is approximated outside the specified interval, and not between the specified values.

Prognostication – sound judgment about the possible values of the characteristics of the object or process, based on certain real data.

Trend line – is a graph of the approximating function, which represents the direction of change of a series of data in the diagram. Trend lines allow you to graphically display trends in data and predict their future changes.

We used MS Office 16 Excel to process data and plot graphs.

Results and discussion. We processed data from the Ministry of Health (MOH) for the period 20.03.2020-03.12.2020. We plotted the dependence of sick and dead people per day at a difference of 2, 3, 4 weeks. The largest value of the reliability of the approximation (R^2) of the trend line was the graph, which was constructed in the difference of 3 weeks (Fig. 1).

That is, analyzing the number of sick, recovered and dead from COVID-19 for each day, it should be noted that from the beginning of infection to death due to chronic diseases, takes an average of 3 weeks. This is what we used to predict the number of deaths per day. Based on the equation of the trend line, which has a polynomial character, predicted the number of deaths per day, taking x – the number of patients in the difference of 3 weeks.

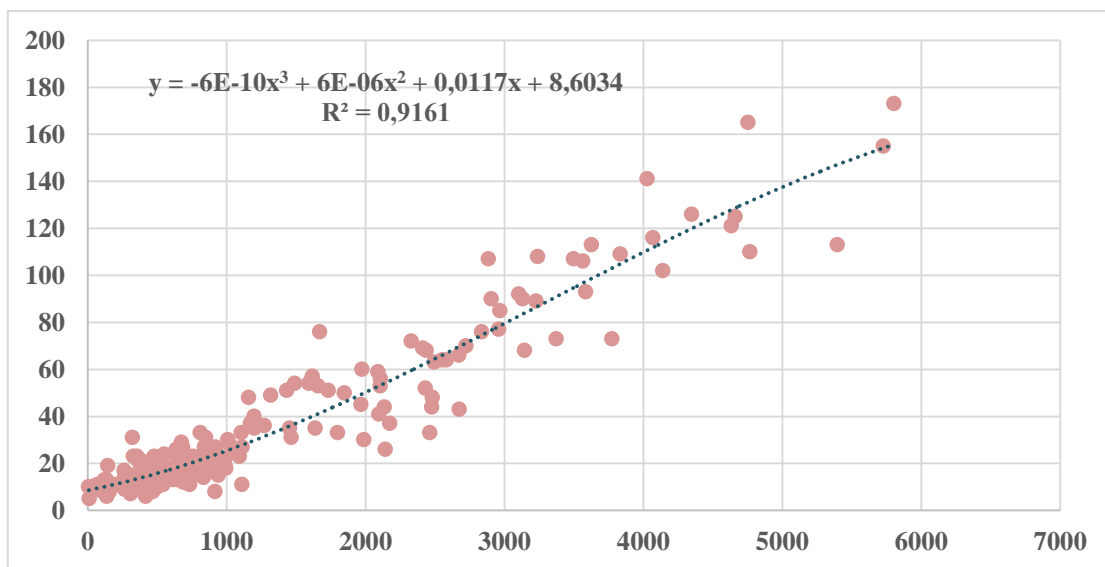


Fig. 1. Dependence of sick and dead people per day

Comparing the predicted and real values, we can conclude that the trend line of the chart has changed, both charts are the same, ie the peak incidence was overcome in mid-November around 11-19.

The maximum number of deaths for the entire period is 285, which corresponds to the days of mortality and morbidity – 10.12.2020 and 19.11.2020, respectively.

After analyzing the data of the Ministry of Health, it was found that fluctuations in morbidity and mortality schedules depend on the day of the week. This is due to the fact that the mentality of our country is accustomed to taking tests not at the end of the working week, but at the beginning. The peak of the identified people fell ill on Wednesday, Thursday and Friday, because these people took the test for COVID-19 on Monday or Tuesday (Fig. 2).

If we take into account that people have been coming from abroad and meeting all acquaintances and strangers, we can assume that the first wave began in July-

August. Since the peak was in mid-November, we can say that from the beginning to the middle of the wave is 3.5-4.5 months, so the approximate end of the first wave will be in February-March 2021, given the fact that the decline is faster than the flash (Fig. 3).

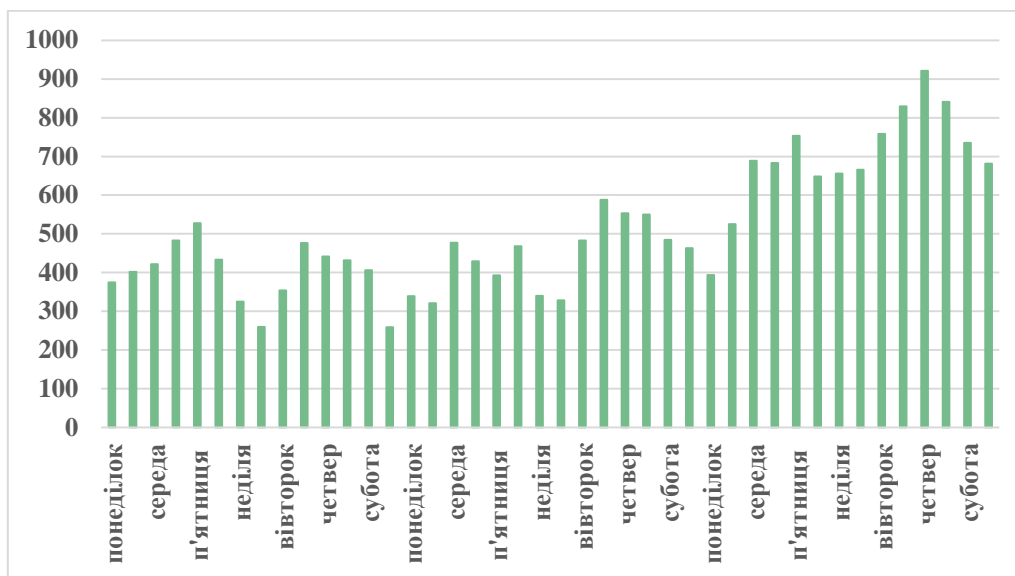


Fig.2. Graph of dependence of the number of identified patients in Ukraine from the day of the week (for the period 11.05.2020 – 21.06.2020)

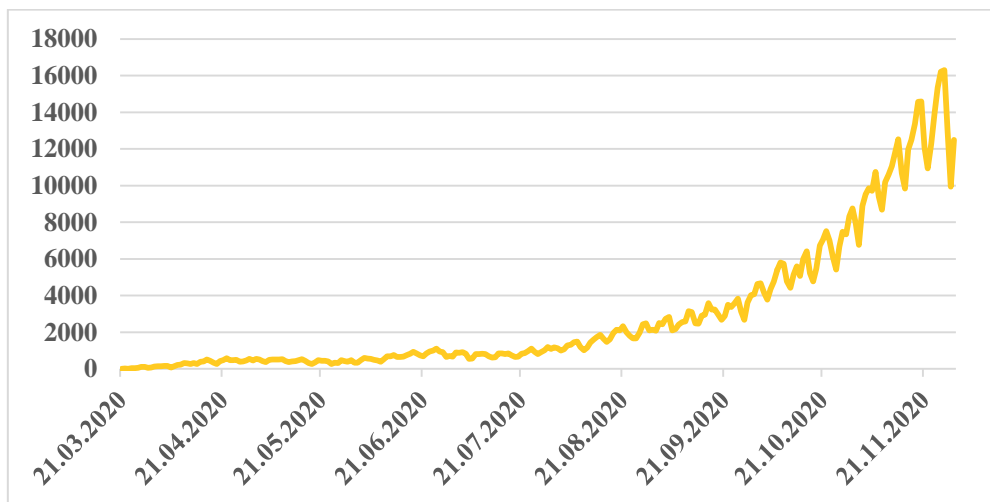


Fig.3. Graph of dependence of sick people per day on the date

Conclusions. The mortality rate from coronavirus in Ukraine has been set at 1.85%. When plotting and mathematically analyzing pandemics, we need to focus more on mortality than on morbidity. On average, 3 weeks pass from the beginning of COVID-19 infection to death due to chronic diseases. The peak incidence of the first wave in Ukraine occurred on November 11–19, 2020. From the beginning of the wave to the peak is 3.5–4.5 months. With the beginning of the second wave, we see the correspondence of observations to the developed model.