

# A COVID-19 SPREAD MODEL PROVIDES INSIGHT INTO PANDEMIC VACCINATION

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In a given country, weather conditions, humidity, and winds can all affect the spreading of an epidemic. In light of these considerations, professor Maria Alessandra Ragusa of RUDN University constructed separate models of the COVID-19 distribution for three groups of countries with diverse climatic conditions. Based on the model's prediction, the epidemic's future course is accurately predicted, but only until vaccination takes effect. Mathematicians have identified three groups of countries. For the first category, 180 days was the duration of the pandemic's first wave. They have an annual average temperature between 15-38° and they have the lowest spreading rates (for example, Saudi Arabia, Egypt). In the second group of countries (for example, Britain, Germany, Italy) with annual temperatures ranging from 25 to 31°C, the first wave lasted 90 days. In the third group are countries that have the greatest spreading rate, no stopping periods, and average average temperatures of 2-18 degrees Celsius annually. The United States and Russia are examples of these countries. They selected regression models as the best methods for studying the influence of several variables on one value. Among the methods for modeling COVID-19 cases, Fourier series and sum of sine waves were most accurate. In practice, these curves are either represented as Fourier functions (waves of a certain frequency and amplitude) or as ordinary sine waves. As a result, Professor Ragusa could calculate the peak of the second or third wave for the various countries analyzed. Models gave close forecasts with a difference of several days. A comparison was made between the obtained predictions and the data at the time. In the event that the country does not introduce widespread vaccination, the model provides fairly accurate predictions.

According to the calculations, the peak of new cases in Egypt occurred on January 11, 2021, with 1481 new cases; the peak really was on December 31, with 1418 new cases. In other countries, the model provides an accurate prediction until the beginning of 2021. A vaccination effect occurs afterward, resulting in different calculated values from reality. According to the German Statistical Service, the predicted and actual values are close until around January 15, 2021, and they differ by 2.5 times by February 15.