Can covid19 epidemic be described by mathematical models?

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Abstratct:

This technical report presents different results to verify the assumption that mathematical functions such as those of Gompertz, Logistica and Richard, are capable of describing the Covid-19 pandemic and, if so, whether they have predictive capacity. The Study used data collected from the worldometers website for the duration of the first pandemic day until the 4th of July 2020. The tool used to develop the tests was Matlab R2020a. The group has been working around the clock to adjust the predictive model and obtain reliable results for publication.

I. Introduction:

The Corona Virus Disease 2019 - Covid-19 global pandemic and its consequences forced a social reorganization with direct impacts on people's daily lives, on the organization of public health authorities and especially on the economy, turning the Covid-19 a threat for life and governments.

The constant search for information, especially those based on epidemic curves, has led to a series of speculation about the evolution of the disease, estimated from different perspectives, providing different data, that cause expectation for substantial elements capable to offer an accurate prediction of relevant information such as peaks and temporal trends.

In addition to the epidemiological data, clinical and other factors that influence the contamination rate and its consequences, we believe that the statistical data on the number of events related to the contamination rate, recovery and death rate are sufficient for the determination of a predictive curve to determine the peak, stationary and above all disease retraction period.

Thus, several scientific works [1] [2] [3] [4] have been published. Tsang et.al, in [1], has analyzed the specific case of China using an exponential model to analyze data and propose useful information for clinical proposes. Ademir [2], presents an algorithm written in c ++ to predict the total number of new daily infected cases in a given population. Although he uses a logistic model function, the strong restrictions of the parameters are limiting factors of the model presented. The work presented by Svetoslav in [3], on the other hand, uses the logistic model to evaluate the spread of Covid-19 in the state of New York. In this work the author defends the usage of the logistic model to predict the evolution's curve with certain precision. Despite the work has presented relevant information for logistic model usage, its sins for not study a more complete series leaving the work unfinished. Finally, Batista in [4] presents an estimative of the evolution of the Covid-19 epidemiologic curve in China and in the world, using the logistic model.

In this case, we observe that mathematical functions can, apparently, describe the pandemic evaluation an also can be used for predict the outbreak stabilization

Starting from the premise that the logistic model can be used to model pandemics' evolution [5], analyzing the statistical data available on public bases such as [6][7] , and based on the previously works reviews, we are performing several tests with mathematical functions such as Logistic, Gompertz and Richard´s functions to verify its description and prediction capability over several countries data.

II. Performed Tests :

To perform tests we decide to choose the countries that had better lead to the covid-19 outbreak finish such as Germany, New Zeland, France and China.

Analyzing the description ability of each one functions, experimental results have shown that all tested mathematical functions can describe the disease evolution with a good precision. Regardless of, it was observed small variations on it functions for the same dataset. Generically, the Logistic function have obtained the worst result while the Gompertz and Richard´s function demonstrate better fit.

Once we have proved the mathematical functions capability for pandemic description, we start studying its prediction ability. In this scenario, the experimental results has demonstrated the unstable behavior of Richard´s and Gompertz function.

At this time the research group are performing additional tests for a solid conclusion and paper submission.

PIMAT
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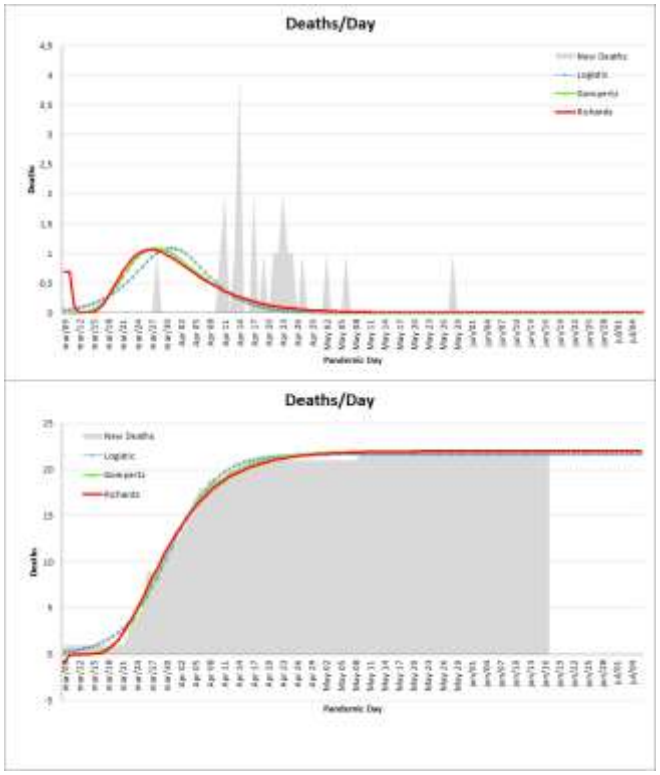
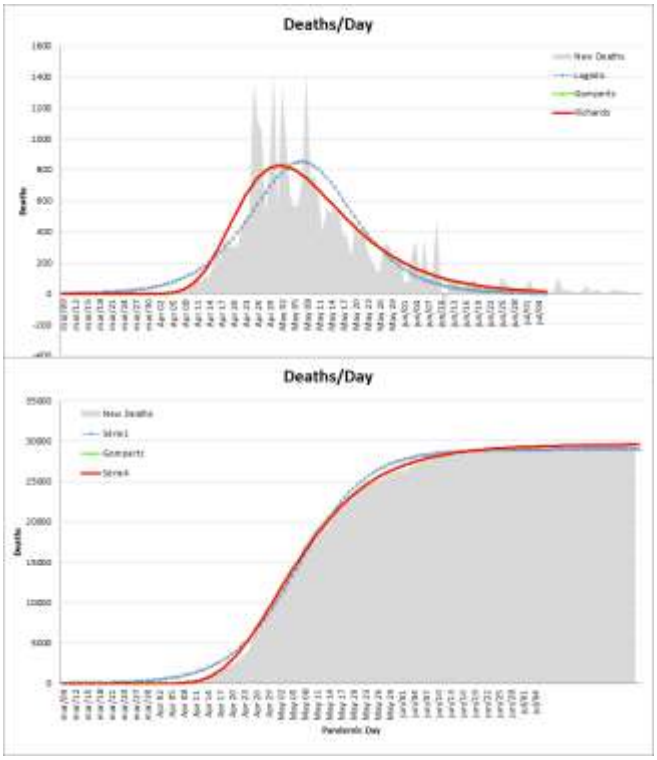
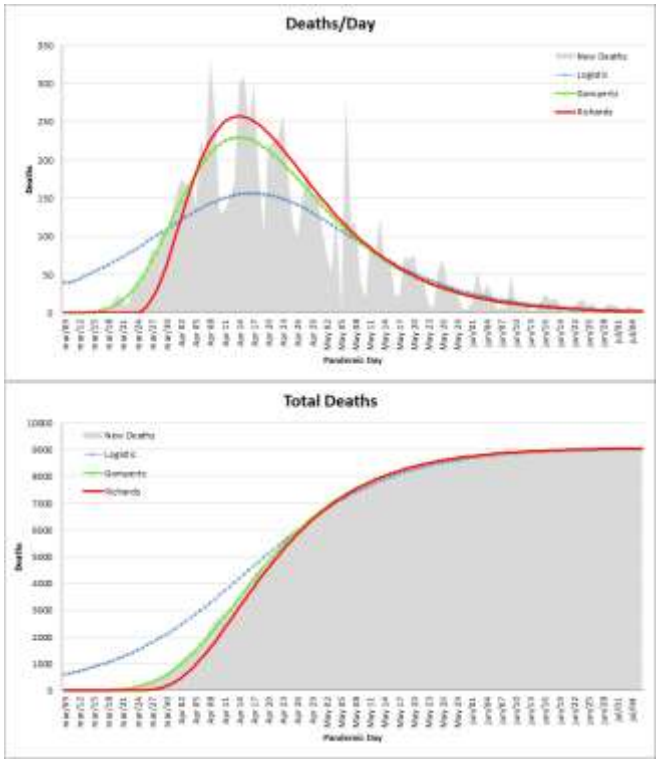
New Zeland Results



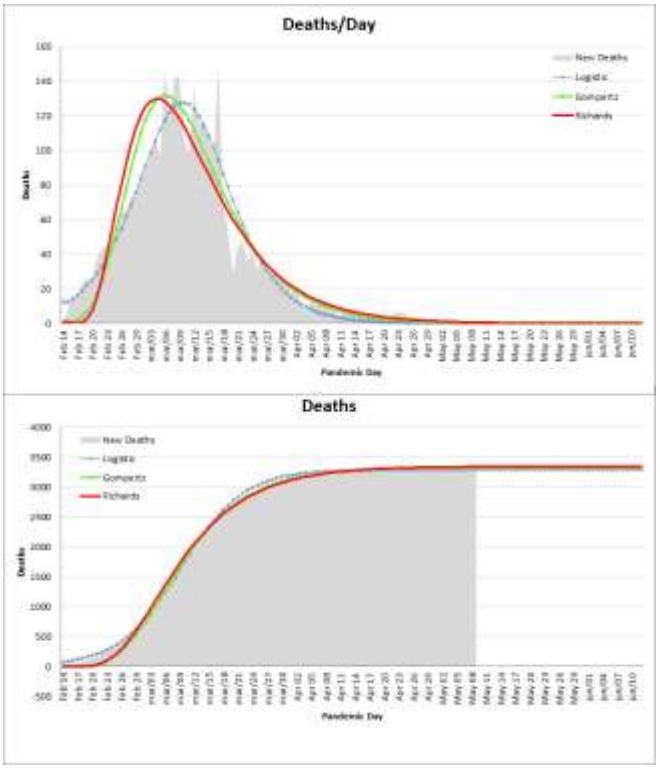
France results:



Germany results:



China results:



References:

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