*International Journal for Modern Trends in Science and Technology*, 6(10): 130-133, 2020

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST061023
Available online at: http://www.ijmtst.com/vol6issue10.html

# Relevence and Effectiveness of Mathematical Models Dealing with Covid-19 Pandemic

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**To Cite this Article**
Dr. Uma Shankar Shukla, "Relevence and Effectiveness of Mathematical Models Dealing with Covid-19 Pandemic", *International Journal for Modern Trends in Science and Technology*, 6(10): 130-133, 2020.

**Article Info**
Received on 30-September-2020, Revised on 12-October-2020, Accepted on 15-October-2020, Published on 25-October-2020.

## ABSTRACT

*How does COVID-19 pandemic affect the India? How many people can be hit in a state and how many of them will succumb to the disease? When is it going to peak? How long should the government continue with the lockdown? What is the damage to the economy and what is its impact on each sector? These are some of the questions that haunt not only the decision makers but every sensible people in India. Mathematical models developed by mathematicians and epidemiologists has come to assist decision makers in evaluating the effects of countermeasures to an epidemic before they actually deploy them. The model could give political and beuricatic person's critical insights into the best steps they could take to counter the spread of disease in the face of pandemics. Mathematicians use modeling to represent, analyze and make predictions or otherwise provide insight into real world phenomena. Real world scenarios can be designed into a mathematical model to bring clarity to big messy questions amid fast changing variables. These models aim to make simplifying assumptions in order to arrive at tractable equations.*

*Dealing with the novel coronavirus is an unprecedented situation which the world could not have foreseen. In order to track the COVID-19 pandemic, make predictions about the disease's progression and take decisions, as of now, the government is solely dependent on data from doctors and health workers.*

***Key words:*** *Covid19, Mathematical models, pandemic, viral diseases, zoonotic spread*

## INTRODUCTION

Modeling and simulation are important decision tools that can be useful to control human and animal diseases. However, since each disease exhibits its own particular biological characteristics, the models need to be adapted to each specific case in order to be able to tackle real situations (**Brauer and Castillo 2001**)[2].

Pneumonia like symptoms of unknown cause detected in Wuhan, China was first reported to the WHO Country Office in China on 31 December 2019. WHO is working 24/7 to analyze data, provide advice, coordinate with partners, help countries prepare, increase supplies and manage expert networks (**Organization W.H.**)[16&17]. The outbreak was declared a Public Health Emergency of International Concern on 30 January 2020.On 11 February 2020, WHO announced a name for the new coronavirus disease: COVID-19.

Countries are racing to slow the spread of the virus by testing and treating patients, carrying out contact tracing, limiting travel, quarantining citizens, and cancelling large gatherings such as sporting events, concerts, and schools. The pandemic is moving like a wave—one that may yet crash on those least able to cope (**Thieme, 2003**)[23].

There is a new public health crises threatening the world with the emergence and spread of 2019 novel coronavirus (2019-nCoV) or the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus originated in bats and was transmitted to humans through yet unknown intermediary animals in Wuhan, Hubei province, China in December 2019. There have been around 96,000 reported cases of coronavirus disease 2019 (COVID2019) and 3300 reported deaths to date (05/03/2020). The disease is transmitted by inhalation or contact with infected droplets and the incubation period ranges from 2 to 14 d (**Surya Prakash Mishra**)[21]. The symptoms are usually fever, cough, sore throat, breathlessness, fatigue, malaise among others. The disease is mild in most people; in some (usually the elderly and those with comorbidities), it may progress to pneumonia, acute respiratory distress syndrome (ARDS) and multi organ dysfunction (**Ivorra et. al. 2020**)[6&7]. Many people are asymptomatic (**Surya Prakash Mishra**)[22]. The case fatality rate is estimated to range from 2 to 3%. Diagnosis is by demonstration of the virus in respiratory secretions by special molecular tests (**Anderson, 1979**)[1]. Common laboratory findings include normal/ low white cell counts with elevated Creative protein (CRP). The computerized tomographic chest scan is usually abnormal even in those with no symptoms or mild disease. Treatment is essentially supportive; role of antiviral agents is yet to be established (**Martínez-López et. aql. 2011**)[14]. Prevention entails home isolation of suspected cases and those with mild illnesses and strict infection control measures at hospitals that include contact and droplet precautions (**Mizumoto et. al. 2020**)[15]. The virus spreads faster than its two ancestors the SARS-Co. V and Middle East respiratory syndrome coronavirus (MERS-Co. V), but has lower fatality. The global impact of this new epidemic is yet uncertain.

COVID-19 is a disease caused by a new virus, which is generating a worldwide emergency situation and needs a model taking in to account its known specific characteristics. In particular, it would be convenient to develop a model which incorporates the following:

(i) The effect of undetected infected people, being able to show the dependence of the impact of COVID-19 on the percentage of detected cases over the real total infected cases.

(ii) The effect of different sanitary and infectiousness conditions of hospitalized people.

(iii) The estimation of the needs of beds in hospitals.

The main goal of this paper is to develop a mathematical model well adapted to COVID-19. The model should be able to estimate, considering different scenarios, the number of cases, death and needs of beds in hospitals, in territories where COVID-19 is (or may be) a very serious health problem.

## SIGNIFICANCE OF MATHEMATICAL MODELS:

There are some mathematical models in the literature that try to describe the dynamics of the evolution of COVID-19. Mathematicians use modeling to represent, analyze and make predictions or otherwise provide insight into real world phenomena (**Lekone and Finkenstadt 2020**)[13]. Real world scenarios can be designed into a mathematical model to bring clarity to big messy questions amid fast changing variables (**Kucharski et. al. 2020**)[8]. These models aim to make simplifying assumptions in order to arrive at tractable equations.

Dealing with the novel coronavirus is an unprecedented situation which the world could not have foreseen. In order to track the COVID-19 pandemic, make predictions about the disease's progression and take decisions, as of now, the government is solely dependent on data from doctors and health workers (**Van den Driessche and Watmough**)[24].

## LIMITATIONS OF MATHEMATICAL MODELS:

The mathematical models developed throughout the World can Found effective when a maximum mass of population get inflected (**Anderson, 1979**)[1]. It also affected by different community, society Immunity and health conditions (**Gorbalenya et. al. 2020**)[5]. The different socio economic differences of population and hygiene conditions also effect on the accuracy of any mathematical models (**Ferrández et. al. 2020**)[4].

We assume that the population inside the considered countries or territories is homogeneously distributed (**Thieme, 2003**)[23]. Thus, the spatial distribution of the epidemic inside a territory is not taken in to account. Additionally the mathematical model is only suitable for countries or territories with a relevant number of people infected by COVID-19, where local transmission is the major cause of the disease spread.

But COVID-19 is much more than a health crisis. By stressing every one of the countries it touches, it has the potential to create devastating social, economic and political crises that will leave deep scars. As the UN's lead agency on socio-economic impact and recovery, UNDP will provide the technical lead in the UN's socio-economic recovery, supporting the role of the Resident Coordinators, with UN teams working as one across all aspects of the response (**Yan and Cao, 2020**)[29].

## CONCLUSION:

We are in uncharted territory. Many of our communities are now unrecognizable. Dozens of the world's greatest cities are deserted as people stay indoors, either by choice or by government order. Across the world, shops, theatres, restaurants and bars are closing. Every day, people are losing jobs and income, with no way of knowing when normality will return. Small island nations, heavily dependent on tourism, have empty hotels and deserted beaches. The International Labour Organization estimates that 195 million jobs could be lost (**Wang et. al. 2020**)[25,26&27].

Mathematical models found effective to prediction of severity of any communicaval zoonotic diseases in population (**Liu et. al. 2020**)[10]. In India outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has led to 174,301 confirmed cases as of May 30, 2020. Understanding the early transmission dynamics of the infection and evaluating the effectiveness of control measures is crucial for assessing the potential for sustained transmission to occur in new areas. Combining a mathematical model of severe SARS-CoV2 transmission with four datasets from within and outside Wuhan, we estimated how transmission in Wuhan varied between December, 2019, and February, 2020 (**Russell et. al. 2020**)[19&20]. We used these estimates to assess the potential for sustained human-to-human transmission to occur in locations outside Wuhan if cases were introduced (**Roosa, et. al. 2020**)[18].

From a general point of view, the outputs returned by the simulation fit quite well the data reported by the WHO. In particular, they estimated reasonably the date and magnitude of the peaks corresponding to the number of new cases, new deaths and amount of hospitalized people (**Liu et. al. 2020**)[11&12]. This indicates that the proposed methodology can be used as a useful decision tools for policy makers. However, considering estimation performed at an early stage of the epidemic could produce poor results (**Verity, et. al. 2020**)[28].

In this work we also point out the fact that we worked with official reported data, where quality has been affected by-(i) Changes in guidelines to count cases, (ii) Uncertainty about the number of undocumented infections, and (iii) Uncertainty about some of the characteristics of SARS-Co.V-2.

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