

Mathematical Modeling: A Study of Growth of Corona Virus (COVID19)

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Abstract: *Mathematical modeling technique is used to measure “Growth of Corona Virus” in the society. The purpose of this study of growth of Corona Virus in the society is to give tentative prediction about this dangerous killer. Then it will be destroyed completely from the society. Therefore, the main purpose is, ‘Escape peoples from Corona Virus19 and they will live freely, happily in the society of any country of the world.*

Keywords: *mathematical thinking, covid mentality, modeling, virus ineffectuality, applicability*

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I. Introduction:

Mathematical modeling technique is used to measure “Growth of Corona Virus” in the society. We have seen as record a global public health emergency, there are affecting more than 219 countries and territories around the world as of February 28, 2021, World meter, (2021). Also the total corona cases are 114,468,838, death cases are 2,539,109, recovered cases are 90,009,083 and total world populations are 7,848,991,074 around the world. Therefore the growth rate of corona virus is 0.014583892 of the society of world.

In Wuhan and Hubei Province, China (Li et al; (2020); Zhou et al; (2020)), Corona Virus (COVID19) is a respiratory disease by the Novel Corona Virus (SARS-CoV-2) and it was first spotted on December, 2019. Also we have seen the corona virus have been started transmitting rapidly since January 30, 2020 around the world. Therefore the WHO has declared the outbreak as a Public Health Emergency of International Concern and announced corona virus 19 is a global pandemic. In most of the countries, infected patients are struggling to get the proper treatment due to highly transmissible and virulent nature of the virus. The Corona Virus 19 mitigation strategies have been promoted so far such as isolation, quarantine, travel restrictions, lockdown, promoting the wearing of face masks and social distancing (2 m.) with a view to reducing community transmission of the COVID19 disease.

Therefore, Mathematical modeling technique is used to measure “Growth of Corona Virus” in the society of world. The purpose of this study of growth of Corona Virus in the society is to give tentative prediction about this dangerous killer. Then it will be destroyed completely from the society. Therefore, the main purpose is, ‘Escape peoples from Corona Virus19 and they will live freely, happily in the society of any country of the world. Nothing any established effective treatment or a vaccine, the already fragile health care systems in different developed and developing countries could be overburdened due to the continuous surge of infections in the coming months provided that the outbreak is not controlled. This pandemic is highly responsible for an upsurge in multifarious noteworthy socio-economic and public health concerns and has highlighted the significance of unearthing the evolution of the disease and forecasting of disease future dynamics which will contribute to the disease prevention and control strategies effective public health policies and economical activity guidelines.

Different mathematical paradigms have always played a notable role in providing deeper understanding of the transmission mechanisms of a disease outbreak, contributing considerable insights for controlling the disease outbreak. One of the familiar models for human-to-human transmission which is reasonably predictive as susceptible-infectious-removed(SIR) epidemic model proposed by Kermack-Mckendrick in 1927. In population based model, it is always really challenging to incorporate certain real –world complexities. In fact, analysis and prediction could go wrong in the absence of adequate historical real data. On the other hand, various agent-based often stochastic models where individuals interact on a network structure and get infected stochastically have been treated as useful tools for tracing fine-grained effects of heterogeneous intervention policies in diverse disease outbreaks. However, accuracy of this approach can be a vital issue due to the time-varying nature of network-structure.

II. Methodology:

The Mathematical Results for measuring “Growth of Corona Virus” in the society. These mathematical results are as follows:

- i. Mathematical Growth of Corona Virus Model Formula:

$$C = C_0(K + 1)^t$$

- ii. Mathematical relation between Corona Virus and Development Model Formula:

$$D(C) = D(0) [1 + K]^C$$

- iv. Mathematical C-virus Constant Model with Related Time Formula:

$$K = \left[\frac{C(t)}{C(0)} \right]^{\frac{1}{t}} - 1, -1 < K < 1$$

- v. Mathematical C-virus Constant Model with Related Corona Virus Formula:

$$K = \left[\frac{D(C)}{D(0)} \right]^{\frac{1}{C}} - 1, -1 < K < 1$$

Note that if the value of K is more than 1 then we choose or take the value approximately to 1 but not equal to 1. We have to use the seven steps of mathematical modeling process for solving the problem of growth of corona virus (COVID19) in the society of any country of the world. Also we can represent mathematical modeling process in the form “Visual”. Therefore it is known as visual mathematical modeling process. It is as follows:

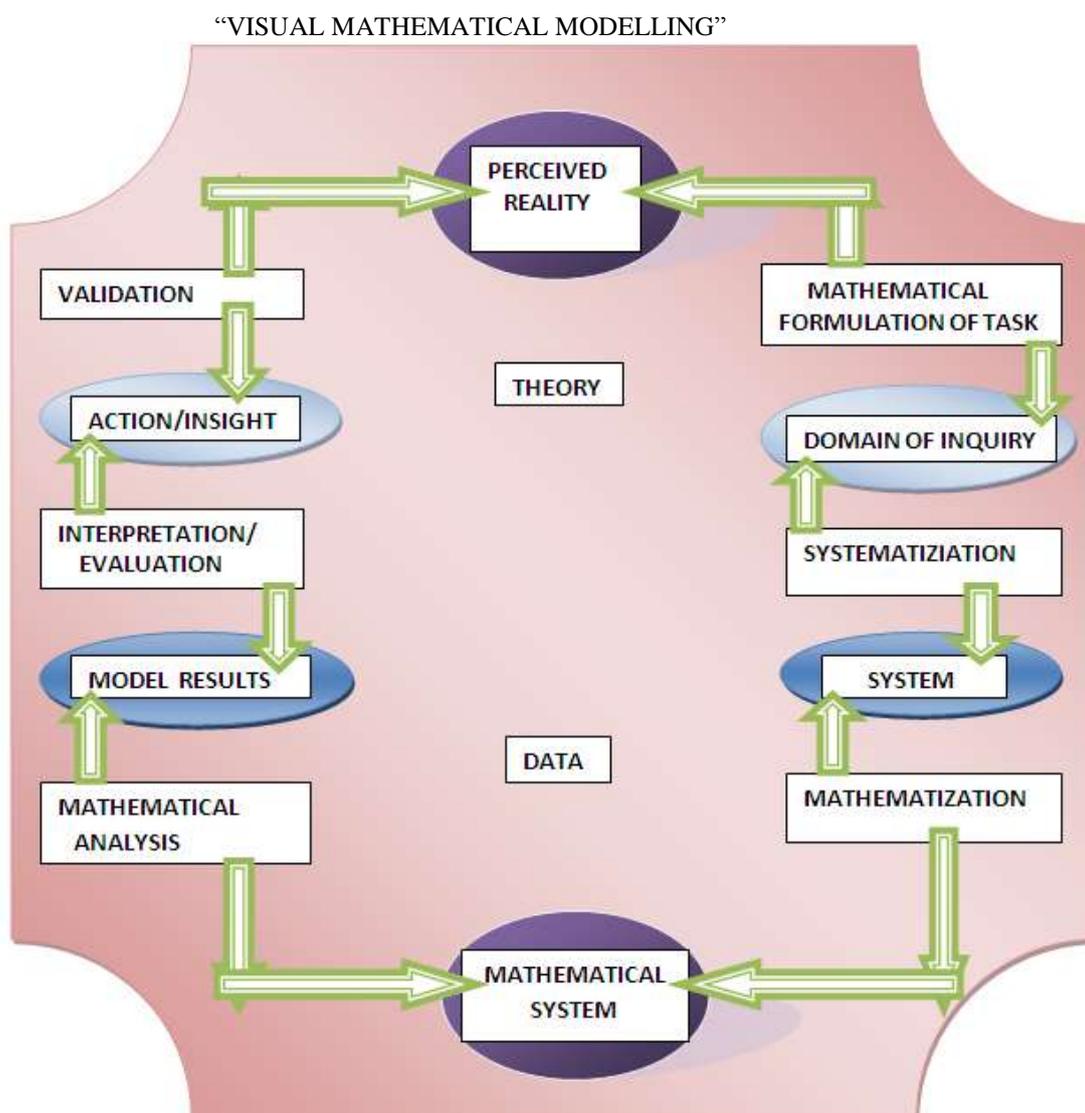


Fig-1: A Visual representation of the Mathematical Modeling process

Mathematical modeling means “Translation from real world problems into Mathematics world.”

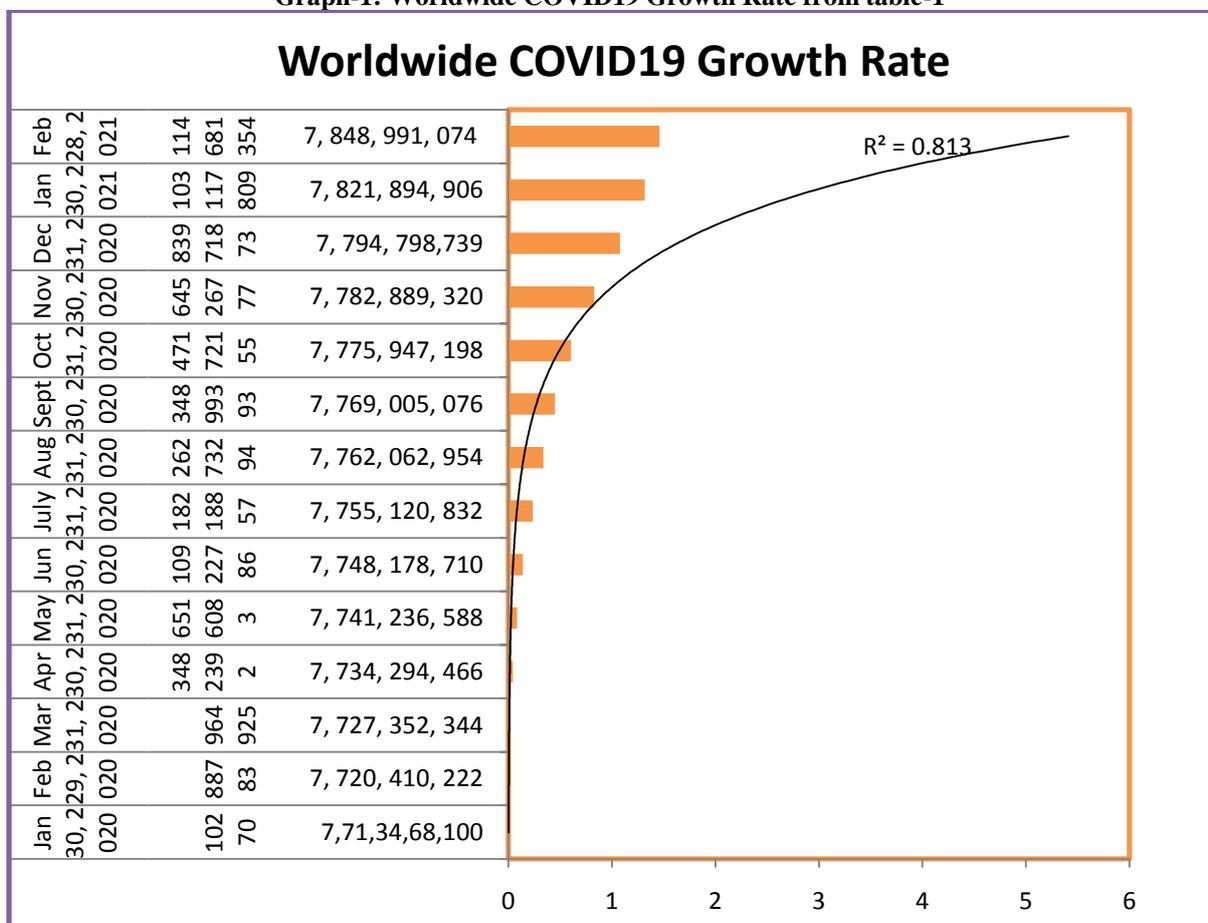
III. Growth of COVID19 Infection:

Countries cases distribution: From worldometer (Source: **Worldometer** - www.worldometers.info ) , Distribution of cases are United States: 25.50 % (29,257,672 cases) , India: 9.69 % (11,121,186 cases), Brazil: 9.19 % (10,551,259 cases), Russia: 3.71 % (4,257,650 cases), United Kingdom: 3.64 % (4,176,554 cases), France: 3.27 % (3,755,968 cases), Spain: 2.78 % (3,188,553 cases), Italy: 2.55 % (2,925,265 cases), Turkey: 2.35 % (2,701,588 cases), Germany: 2.14 % (2,451,822 cases) and Colombia: 1.96 % (2,251,690 cases)

Table-1: Total Corona Cases (Worldwide)

Date of Month	Total Corona Cases	Total Population	Growth Rate
Jan 30, 2020	10270	7,713,468,100	0.0001331437
Feb 29, 2020	88783	7,720,410,222	0.0011499778
Mar 31, 2020	964925	7,727,352,344	0.012487136
Apr 30, 2020	3482392	7,734,294,466	0.0450253351
May 31, 2020	6516083	7,741,236,588	0.0841736708
Jun 30, 2020	10922786	7,748,178,710	0.1409723034
July 31, 2020	18218857	7,755,120,832	0.2349267973
Aug 31, 2020	26273294	7,762,062,954	0.3384833923
Sept 30, 2020	34899393	7,769,005,076	0.4492131574
Oct 31, 2020	47172155	7,775,947,198	0.6066419151
Nov 30, 2020	64526777	7,782,889,320	0.8290851167
Dec 31, 2020	83971873	7,794,798,739	1.0772808357
Jan 30, 2021	103117809	7,821,894,906	1.318322609
Feb 28, 2021	114681354	7,848,991,074	1.4610967565

Graph-1: Worldwide COVID19 Growth Rate from table-1



We have seen that the Assume Growth Rate: 0.35 and Assume Corona Cases = 34899393 on September-2020 Here we use the mathematical growth model formula is of the form,

$$C = C_0(K + 1)^t \quad \text{----- (1)}$$

At initial stage $t = 0$, $C_0 = 34899393$, $K = 0.35$ that means on three months up to September-2020 then we find growth of Corona cases of each quarterly(or two months) periods.

At $t = 1$, that is on October-December-2020, from (1), $C = 34899393 \times (0.35 + 1)^1$
 $= 34899393 \times 1.35 = 47114181$

Therefore on September-October-2020, **C = 4,71, 14, 181**

At $t = 2$, that is on October-November-2020, from (1), $C = 34899393 \times (0.35 + 1)^2$
 $= 63604144$

Therefore on October-November-2020, **C = 6, 36, 04, 144**

At $t = 3$, that is on November-December-2020, from (1), $C = 34899393 \times (0.35 + 1)^3$
 $= 85865594$

Therefore on up to November-December-2020, **C = 8, 58, 65, 594**

At $t = 4$, that is on January-March-2021, from (1), $C = 34899393 \times (0.35 + 1)^4$
 $= 115918552$

Therefore on up to Jan-Feb-2021, **C = 11, 59, 18, 552**

At $t = 5$, that is on February-March-2021, from (1), $C = 34899393 \times (0.35 + 1)^5$
 $= 156490045$

Therefore on up to March-2021, **C = 15, 64, 90, 045**

At $t = 6$, that is on April-June-2021, from (1), $C = 34899393 \times (0.35 + 1)^6$
 $= 211261561$

Therefore on April-May-2021, **C = 21, 12, 61, 561**

At $t = 7$, that is on May-June-2021, from (1), $C = 34899393 \times (0.35 + 1)^7$
 $= 285203107$

Therefore on up to June-2021, **C = 28, 52, 03, 107**

At $t = 8$, that is on July-September-2021, from (1), $C = 34899393 \times (0.35 + 1)^8$
 $= 385024195$

Therefore on July-August-2021, **C = 38, 50, 24, 195**

At $t = 9$, that is on August-September-2021, from (1), $C = 34899393 \times (0.35 + 1)^9$
 $= 519782663$

Therefore on up to September-2021, **C = 51, 97, 82, 663**

At $t = 10$, that is on October - December-2021, from (1), $C = 34899393 \times (0.35 + 1)^{10}$
 $= 701706595$

Therefore on October-November-2021, **C = 70, 17, 06, 595**

At $t = 11$, that is on November-December-2021, from (1), $C = 34899393 \times (0.35 + 1)^{11}$
 $= 947303903$

Therefore on up to December-2021, **C = 94, 73, 03, 903**

At $t = 12$, that is on January-March-2022, from (1), $C = 34899393 \times (0.35 + 1)^{12}$
 $= 1278860270$

Therefore on January-February-2022, **C = 1, 27, 88, 60, 270**

At $t = 13$, that is on February-March-2022, from (1), $C = 34899393 \times (0.35 + 1)^{13}$
 $= 1726461364$

Therefore on up to March-2022, **C = 1, 72, 64, 61, 364**

At $t = 14$, that is on April-June-2022, from (1), $C = 34899393 \times (0.35 + 1)^{14}$
 $= 2330722841$

Therefore on April-May-2022, **C = 2, 33, 07, 22, 841**

At $t = 15$, that is on May-June-2022, from (1), $C = 34899393 \times (0.35 + 1)^{15}$
 $= 3146475836$

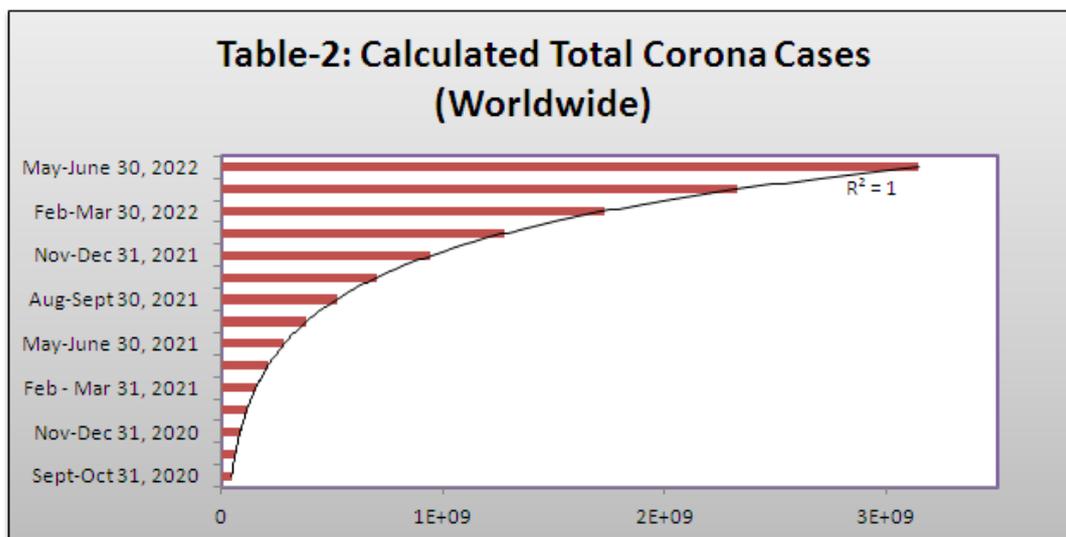
Therefore on up to June-2022, **C = 3, 14, 64, 75, 836**

Table-2: Calculated Total Corona Cases (Worldwide)

Quarterly Periods[or two months]	Total Corona Cases
Sept-Oct 31, 2020	47114181
Oct-Nov 30, 2020	63604144
Nov-Dec 31, 2020	85865594
Jan - Feb 28, 2021	115918552
Feb - Mar 31, 2021	156490045
Apr -May 31, 2021	211261561
May-June 30, 2021	285203107
July- Aug 31, 2021	385024195
Aug-Sept 30, 2021	519782663
Oct-Nov 30, 2021	701706595
Nov-Dec 31, 2021	947303903

Jan-Feb 29, 2022	1278860270
Feb-Mar 30, 2022	1726461364
Apr-May 31, 2022	2330722841
May-June 30, 2022	3146475836

Graph-2: Calculated Total Corona Cases (Worldwide)



IV. Conclusion:

We have seen that the Growth of Corona Virus will spread rapidly to the society of the world if it will not control for following some rules made by WHO such as isolation, quarantine, travel restrictions, lockdown, promoting the wearing of face masks and social distancing (2 m.) with a view to reducing community transmission of the COVID19 disease. Global sensitivity analysis results from table-1 and table-2 depict that home-quarantine or self-quarantine is the most effective measure for controlling the transmission and spread of the novel corona virus infection. To fade out the pandemic, it is compulsory to identify potential carriers and asymptomatic infectious spreaders through massive scale testing scheme. Without sufficient level of evidence of controlled low transmission rate of COVID-19 in any certain country, we cannot afford lifting up strict lockdown measures as well as physical distancing measures. Also, we have concluded that the regression square (R^2) is equal to 1, it shows that our growth model for COVID19 pandemic is statistically as well as mathematically fit and valid.

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