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An Analysis Of The COVID-19 Scenario In Kerala

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Abstract : Corona viruses are a large family of viruses that are known to be cause illness ranging from the common cold to more severe diseases. A novel corona virus disease (COVID-19) was identified in Wuhan,China. COVID-19 is a disease caused by a virus named SARS-CoV-2. It is very contagious and has quickly spread around the world. India, being a developing country is facing severe problems with COVID-19.In this investigation , I aim to construct a mathematical model/analysis to find some pattern in disease spread in all districts of Kerala, India. This Analysis is an algebraic expression with least square fitting, also Trial & Error method is involved for prediction accuracy. The corresponding R^2 values have been used to verify the goodness of fit. I've used cumulative statistics between 9th April 2020 to 14th May 2021 obtained from GoK Dashboard to find out a mathematical explanation of ups and downs of the representing curve. I've illustrated trend lines and explained how it might be possible to use them to predict how an infection will spread in the future so that the appropriate security measures can be put in place beforehand.

Keywords : COVID-19, Least Square method, Goodness of fit, Trend model

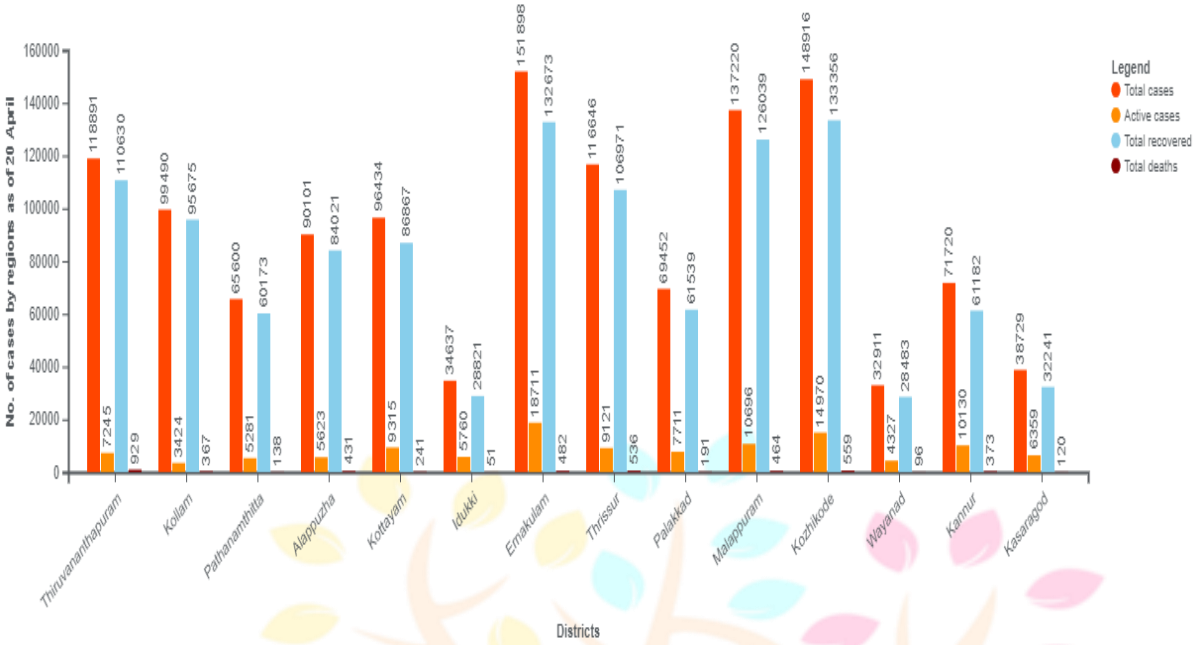
1.Introduction: The new corona virus outbreak, which originated in Wuhan ,China to be a pandemic by The World Health organization (WHO). As of September 20, amid more than 30.8 million cases, the global death toll surpassed 957,000 . According to the data collected , over 21 million people have recovered from the disease worldwide. According to Worldometer ,as on 9th September 2022, more than 264 million people are infected with the death toll of more than 5 million. The second wave once more plunged India and the rest of the world into total chaos. From several angles, scientists looked into the causes and transmission of disease and attempted to model the phenomenon. Researchers still don't know definitely whether surviving a COVID-19 infections means you gain long-lasting immunity and if so for how long? In order to understand , this study may lead to better guessing the spread of pandemic in future. Some of the models prepared by Researchers are given; Khoshnaw et al(2020) built a mathematical model of Covid-19 pandemic considering the global health care system .They tried identify the severe or critical conditioned patients based on the inflammation indicators and also they noticed that the virus is very contagious along with high mortality rate and concluded that sooner the identification of critical patients , better recovery. Fanelli et al (2020) explored the temporal outbreak of corona virus among China, Italy and France . He suggested that the implementation of containment may lessen the infection rate rapidly. Price et al (2020) made an overview of COVID-19 outbreak in the Australian population. Sharma et al (2020) studied covid situation in Karnataka, India considering different attributes such as age ,group, sex etc.. Satyajit Pal and team prepared a trend model of covid-19 in West Bengal and this research is the extension of that research. From the above models ,it was concluded that human to human contact is the potential cause of outbreaks of covid-19.

2. Methods and Materials

2.1 Data Base: I used data base from https://dashboard.kerala.gov.in, https://en.m.wiki/COVID-19 pandemic in Kerala and https://www.worldometers.info from 9th April 2020 to 14th May 2022

2.2 Graphs and Analysis: First I've collected a bar graph to visually show the spread of infections in Kerala taken district wise.

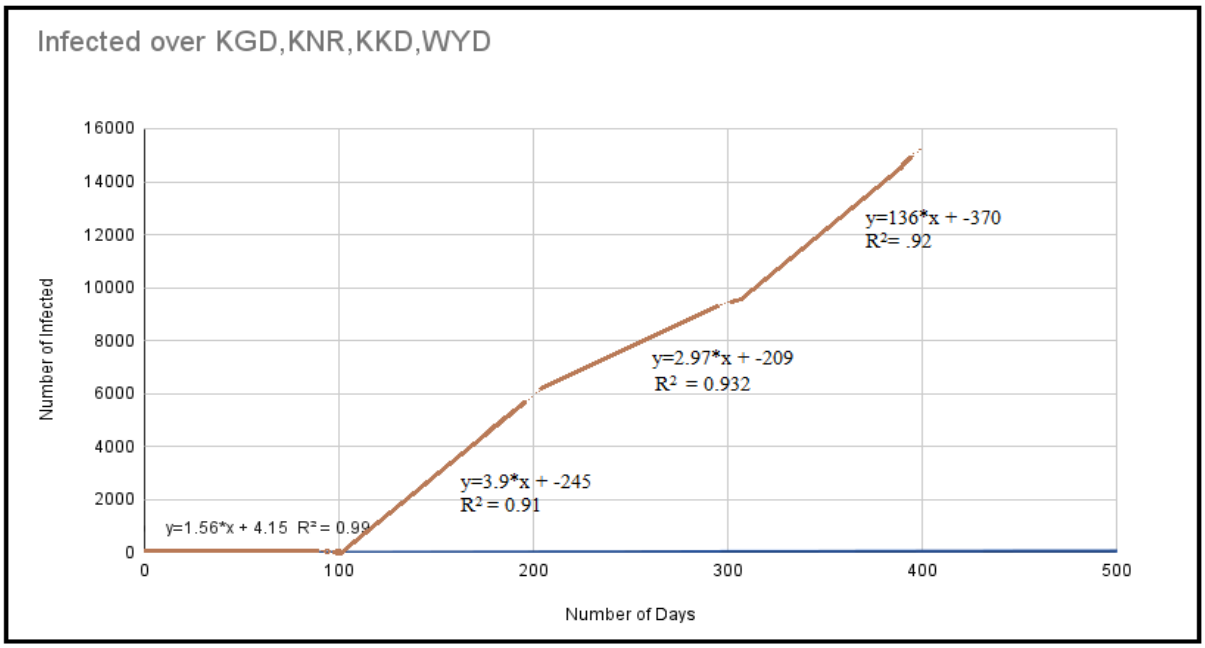
Number of Infected in Different Districts



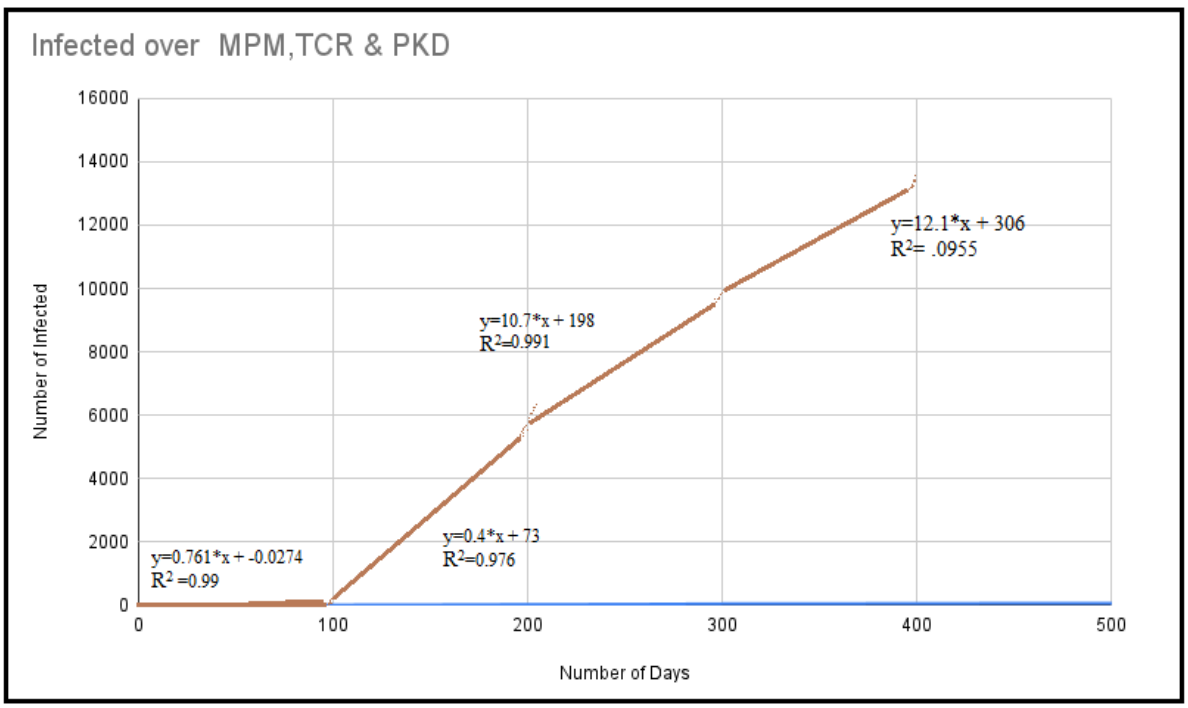
According to this ,the number of infected cases in Ernakulam and Kozhikode are considerably higher. Next comes Malappuram, Thiruvananthapuram in order. So I concentrated on the top four contaminated districts. Then I divided all the 14 districts into 4 regions in such a way that the above mentioned 4 infected districts belong to distinct regions. Now plot the number of COVID-19 infected cases(cumulative) over time of these 4 regions ,so I divided the entire graph into 4 sub-graphs /windows representing time-intervals 1-100 days(9/4/2020 – 18/7/2020),100-200days (18/7/2020 – 26/10/2020),200-300 days(26/10/2020 – 3/2/2021) and 300-400 days(3/2/2021 – 14/5/2021). For each of the sub-graphs I fitted a suitable curve to observe their behaviour and also check whether the fitted curve is able to predict the future.

Now I broadly divide each small sub-graphs in 90-10 style. This implies, I made the curve on the first 90percent data and check its predictability on the remaining 10percent.In the first sub-graph I've fitted a line for the initial 90 days and left 91^{th}-100^{th} days for verification. In the second , I've fitted the graph for 100-190 days using quadratic equation and left 190^{th} -200^{th} days for forecasting. Similarly in the third one ,made a line for 200-290 days & left 290^{th}-300^{th} days for prediction. Lastly, in the fourth one, I've fitted the line for 300-390 days and again left 390^{th}-400^{th} days for forecasting. A solid line in each of the graphs represents the constructed curve and the dotted line represents the prediction made by the curve. The equation of each curve and the corresponding R^2 value have been provided.

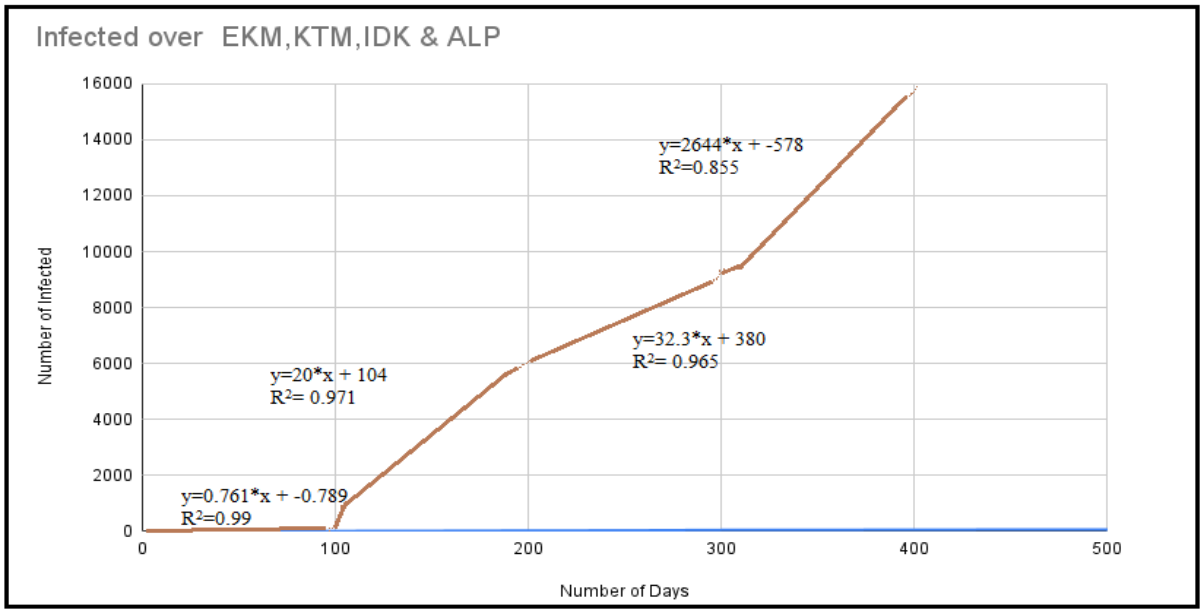
KGD-Kasaragod, KNR-Kannur ,KKD-Kozhikode, WYD-Wayanad



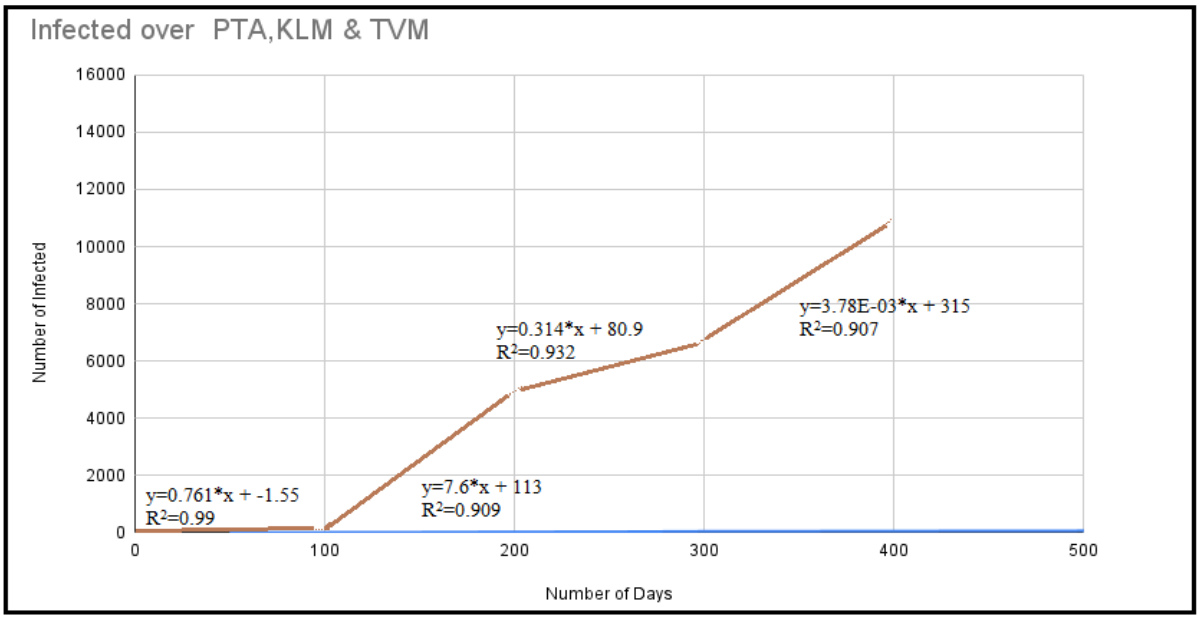
MPM-Malappuram,TCR-Thrissur,PKD-Palakkad



EKM-Ernakulam, KTM-Kottayam, IDK-Idukki, ALP-Alappuzha



PTA-Pathanamthitta, KLM-Kollam, TVM-Thiruvanthapuram



3 Observation: COVID-19 spread rapidly in the first wave and is even more widespread in the second wave. All the four regions have the same pattern. Also, the trendline fits the data represented by the R^2 values very well. Finally ,the hardest part is the prediction part. This is also pretty good as shown by the dotted line. This regional data help us understand it's rapid spread across Kerala.

4 Conclusion: The main purpose of this paper is to investigate and analyze the pattern of COVID-19 spread in Kerala, India as of 9 April 2020. To do this, I consider its 4 most affected districts and divide all districts of Kerala into 4 regions such that the above 4 most affected districts belong to distinct regions. I divided the data into four smaller segments and finally constructed a least-squares curve to model each segment. To check the predictions of the model, I built the model on the first 90% of observations and checked on the last 10%. Looking at the graph, we can see that the dotted line (prediction line) does not deviate significantly from the observed data. This means that we were able to capture real patterns in the data. In the present case, I show that multi-window models with varying degrees of specific trend polynomials fit the real data comprehensively well, so this can be either semi-permanent or anti-permanent. may indicate an uncertain associated spread process of COVID-19 using heterogeneous memories.

5 Future Research: This study can be extended to examine the spread of COVID-19 in other states of India. This is useful for getting general information in that particular state. It can also help extract patterns of disease that spread in the wider environment. Including information about vaccinations and studying their effects in accordance is another approach. This can

elucidate the effectiveness of vaccines in communities in terms of protection. In terms of protection, this can shed light on the impact of vaccinations on communities.

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