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Statistical Scenario of COVID-19 Cumulative Patients in Maharashtra by Forecasting

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Abstract:

The prediction number of cumulative COVID-19 patientsfor the coming period is important as basis for further decision making. Least Square method as the method of calculation to determine the scores prediction. The study was aimed to help increase hospital capacity, in best- and worst-case scenarios of surges in the number of patients with COVID-19, the needed total capacity for hospital beds, ICU beds and ventilators .The prediction number of cumulative COVID -19 patients,so it will be easier to make decisions in determining the next steps and estimating the financial matters. Here we want to forecast i.e. prediction for 21 April-27April.The prediction of the number of cumulativeCOVID-19 patients will facilitates Heath system department to determine the number of hospitals, beds, ICU beds, ventilators etc. From the results of the study, it can be concluded that prediction analysis by using Least Square Method can be used to predict the number of cumulative COVID-19 patients for the coming period.Because it produces valid results or closer to the truth. We also have to study trend of COVID-19 patients by using scatter diagram.

Keywords:

MS-Excel, Least Square, second degree curve,Exponential curve trend, R square.

Introduction:

The coronavirus disease 2019 (COVID-19) pandemic challenges hospital leaders to make time-sensitive, critical decisions about clinical operations and resource allocations.The first case of the 2019–20 coronavirus pandemic was confirmed in the Indian state of Maharashtra on 9 March 2020. The state has confirmed a total of 1,364 cases, including 97 deaths and 125 recoveries, as of 9 April 2020.The data of COVID-19 patients in Maharashtra for prediction of cumulative COVID-19 patients for upcoming period is taken from *arogya.maharashtra.gov.in* website.Several places in the state, where multiple confirmed cases were reported, were sealed off to prevent community spread. The data was collected through websites about previous month. From 3march -10 April. We take cumulative data means data was added day by day.

Methodology:

Regression analysis is non-linear combination of model parameters and depends on one or more variables .The data are fitted by equation of successive approximations. In regression analysis for goodness of fit we have to measures R – squared for all Equations i.e. for linear and non-linear equations .so we can fit best equation for forecasting cumulative cases in Maharashtra.R-squared measures the strength of relationship between model and dependent variable. R-squared also known as coefficient of determination. It is lies between 0 and 100%.here we can check R^2 for linear and non- linear also.so we can fit best equation to the data.

1.**Linear Regression Equation**:

The Linear equation is,

$$Y= aX +b$$

a is slope of line and b is y-intercept. Linear regression analysis is most powerful technique used for prediction unknown values of variable which depends on independent variable**.**By linear equation ,we can models one independent and one dependent variable.The dependent variable known

as predicted and another independent whose known values is used for prediction.

2.**Second Degree Equation**:

The equation is,

$Y=a+bX+cX^2$

Here a, b, c are the constants. The equation is relationship between two sets of variables. The result in is a equation which used to find predictions.

3.**Exponential Curve:-**

Sometimes linear regression can be used with relationship which is not inherently linear, but can be made equation after transformation .In this ,we consider the following exponential equation. The equation is,

$Y= ab^x$

Here a and b are constants.

Observation table:-Table 1 for Number ofcumulative corona cases in Maharashtra

Day	No. of positive corona patients	Day	No. of positive corona patients
09-Mar	2	25-Mar	122
10-Mar	5	26-Mar	130
11-Mar	11	27-Mar	153
12-Mar	11	28-Mar	186
13-Mar	19	29-Mar	203
14-Mar	31	30-Mar	220
15-Mar	33	31-Mar	302
16-Mar	39	01-Apr	335
17-Mar	41	02-Apr	423
18-Mar	45	03-Apr	490
19-Mar	48	04-Apr	635
20-Mar	52	05-Apr	748
21-Mar	64	06-Apr	868
22-Mar	74	07-Apr	1018
23-Mar	97	08-Apr	1135
24-Mar	107	09-Apr	1364
		10-Apr	1574

Statistical analysis:-

First we fit linear equation to our data.

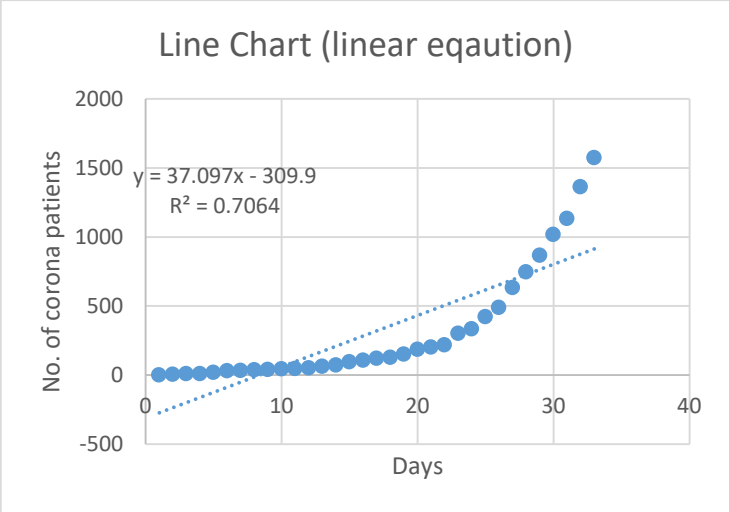
1. **Linear Equation**:

The Linear equation is,

$Y= aX+b$

a is slope of line and b is y-intercept

We consider X is No. of days as dependent and Y variable is no. of cumulative corona cases in Maharashtra as independent variable.



Graph 1: shows that trend line for linear Regression equation

By MS-Excel,we get equation as,

y = 37.097x - 309.9

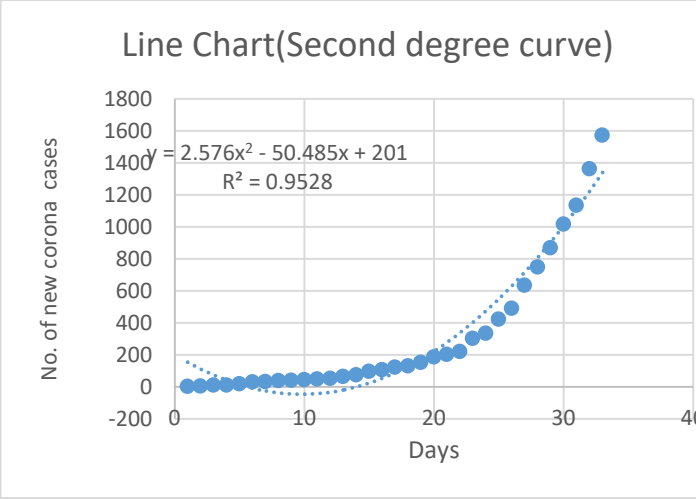
i.e. a=37.097 and b=-309.9 and coefficient of determination $R^2 = 0.7064$

2. **Second Degree Equation**:

The equation is,

$Y=a+bX+cX^2$

Here a, b, c are the constants,also we consider,X is No. of days as dependent and Y variable is no. of cumulative corona cases in Maharashtra as independent variable.We can fit non-linear also so we can decide which line is best fitted by R^2.



Graph 2: shows that trend line for non- linear second degree equation

Here we get,

$y = 2.576x^2 - 50.485x + 201$

i.e. a=201, b=-50.485, c=2.576 and coefficient of determination $R^2 = 0.9528$

here coefficient of determination $R^2 = 0.9528$of(linear equation) is greater than $R^2 = 0.7064$ of(Second degree curve).so we fit Second degree curve and predict the values for further days as below table.by equation of variable Y by putting values of variable X.

Table 2: Forecasted /predicted values of No. of cumulative positive corona patients in Maharashtra

(By Second Degree curve)

Days(X)	No. of cumulative positive corona patients(Y) Y=2.576x2 - 50.485x + 201
17-Apr	**2303**
18-Apr	**2462**
19-Apr	**2625**
20-Apr	**2793**
21-Apr	**2967**
22-Apr	**3146**
23-Apr	**3330**
24-Apr	**3519**
25-Apr	**3713**
26-Apr	**3942**
27-Apr	**4117**

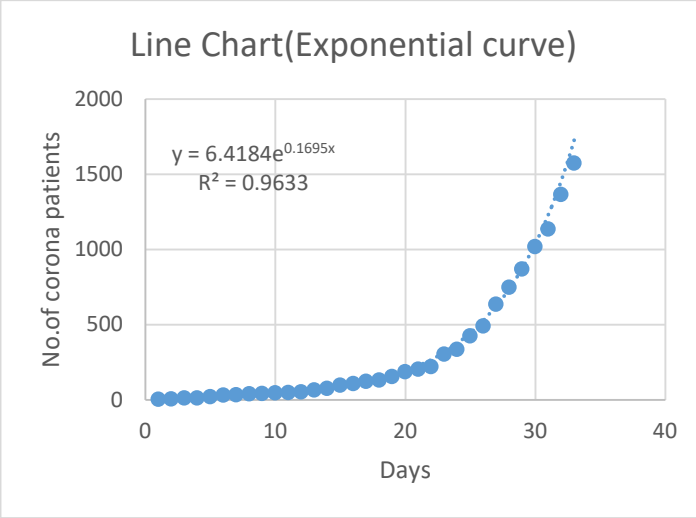
3. **Exponential Curve:-**

The equation is,

$Y= ab^x$

Here a and b are constants and we consider,X is No. of days as dependent and Y variable is no. of cumulative corona cases in Maharashtra as independent variable

Now,



Graph 3: shows that trend line for Exponential equation

Here by using MS-Excel we get Exponential equation as

$Y = 6.4184e^{0.1695x}$

Here we get, a=6.418441 and b=1.184766and coefficient of determination $R^2 = 0.9633$.so we can fit exponential equation to our data to see further values of **cumulative positive corona patients in Maharashtra.** And also compare to table no.2 because here we get $R^2 = 0.9633$i.e.very high so it is actually best fitted equation to our data. But as it is multiple model then predicted values will also we get high.so by putting values of variable X in equation $Y = 6.4184e^{0.1695x}$

We get following values shown in below table.

Table 3:Forecasted /predicted values of No. of cumulative positive corona patients in Maharashtra

(ByExponential equation)

Days	No. of cumulative positive corona patients(Y) Y = 6.4184e0.1695x
17-Apr	**5536**
18-Apr	**6556**
19-Apr	**7763**
20-Apr	**9192**
21-Apr	**10885**
22-Apr	**12889**
23-Apr	**15262**
24-Apr	**18072**
25-Apr	**21399**
26-Apr	**25339**
27-Apr	**30005**

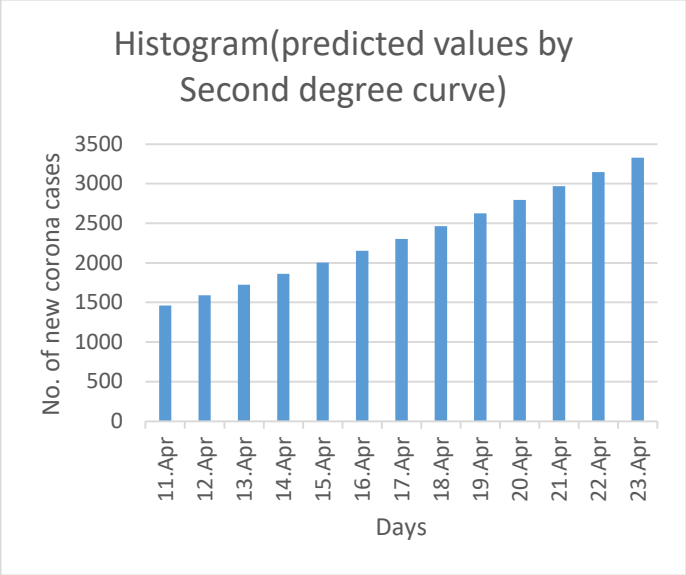
*__Observation table for Number of cumulative corona patients in Maharashtra__

Table 4:

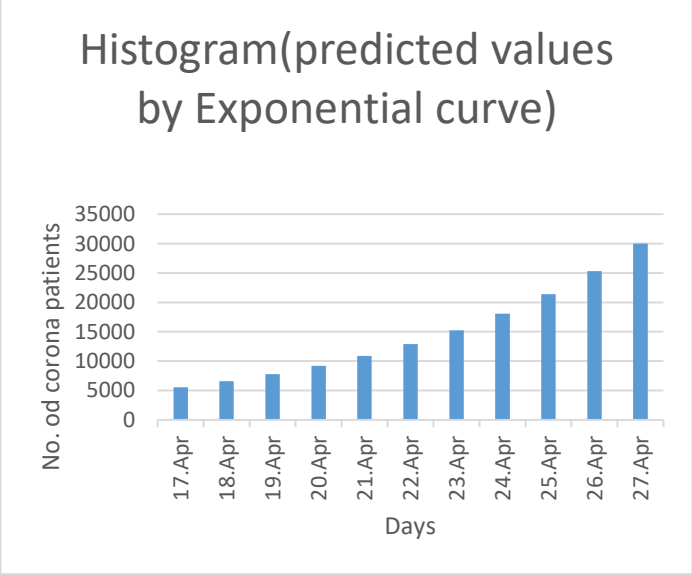
Dates	By Second degree curve	Actual Current values	By Exponential curve
11-Apr	1462	1761	200
12-Apr	1589	1982	2378
13-Apr	1722	2334	2816
14-Apr	1860	2684	3335
15-Apr	2002	2916	3949
16-Apr	2150	3202	4676

Above Table shows that the actual status of Maharashtra is neither in addition nor in multiplication. ***The study of COVID-19 the values of predicted patients is between addition and multiplication.by the analysis of non-linear equations***.i.e. values shown in 2nd column and 4th column.

***Graphical Representation**:



Graph 4: above graph represent that in Maharashtra there will be cumulative positive corona casesare increasing in huge amount.



Graph 5: above graph represent that in Maharashtra there will be cumulative positive corona casesare increasing in huge amount in multiple of previous values.

Conclusion:

According to above cumulative COVID-19 patient's prediction values of second degree curve and exponential curve i.e. table no. 2 & 3.We can conclude that the actual status of Maharashtra is neither in addition nor in multiplication. The study of COVID-19 the values ofpatients is between addition and multiplication,by the analysis of non-linear equations as shown in table 4. We can also conclude that the values are increases in huge amounts. The Indian Government and especially Maharashtra also will face a surge in healthcare costs, demands. This study alsohelp to our Health system for increase hospital capacity, the needed total capacity for hospital beds, ICU, Isolation ward and ventilators etc.in Maharashtra.

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