International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

A Data Driven Regression Analysis for the Estimation of the Case Fatality Rate of COVID-19 in India

Akansha Singh[1], Kavita Bhatnagar[2]

[1]*Assistant Professor, Mathematics Department, NIET Greater Noida, UP, India*
[2]*Assistant Professor, Mathematics Department, NIET Greater Noida, UP, India*

Abstract - *First time in India, the Government of India had declared 21 days nationwide lock down on 24th March 2020 due to COVID- 19 outbreak. After this period, lockdown again extended four times. Unlock 1 phase has started from 8th June. During this time, it was observed that the number of cases of Covid 19 increased rapidly. We studied the period when corona spread rapidly. We collected the data for Maharashtra, Tamilnadu, Delhi, Uttar Pradesh and India from 1st June 2020 to 21st June 2020 to analyze the statistics of unlock 1 period. In this period, the trend analysis between the total number of cases and the total number of death has performed. Simple linear regression analysis is applied on the data during the period 1st June 2020 to 21stIn this study, a data driven method is proposed to estimate the case fatality rate during the period 1st June 2020 to 21st June 2020 of COVID 19 outbreak. Proposed approach of finding CFR is based on real time collected data. This study could be used in predicting the future trend of CFR as well as causalities.*

Key Words: **COVID 19, Regression analysis, Coefficient of determination**

1. INTRODUCTION

The whole world is effected by the COVID-19 pandemic, also known as the coronavirus pandemic, caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2)[1]. The outbreak was first identified in Wuhan, China, in December 2019[2]. The World Health Organization declared the breakout in a Public Health Emergency of International Concern on 30 January 2020 as a pandemic on 11 March 2020[3]. As of 21st June 2020, more than 9.04 million cases of COVID-19 have been reported in more than 188 countries and territories. It resulting in more than 497,255 deaths and more than 5.32 million people have been recovered according to the official site of World Health Organization.

The common symptoms of COVID 19 virus experienced by most of the people are related to the respiratory illness[4]. Older people and those having problems like cancer, respiratory disease, diabetes and cardiovascular disease are more likely to catch the infection of COVID 19[5]. Primarily, this virus spread among the people through the droplets of salvia or discharge from the nose when infected person cough or sneezes. Common signs and symptoms of this virus can include fever, cough, Shortness of breath or difficulty breathing, tiredness, sore throat, headache, lost of taste or smell and body aches[6]. Other less common symptoms have been reported, such as rash, nausea, vomiting and diarrhea. Children have similar symptoms to adults and generally have mild illness.

The best ways to protect from this virus are to practice respiratory etiquettes, washing hands after regular interval, sanitized work area regularly by an alcohol based sanitizer and not touching face. Social distancing is also proved as an important tool against this virus.

The first case of COVID 19 in India was confirmed on 30 January 2020 in the state of Kerela[7]. The affected has return from Wuhan, China. The second case in India was reported in Kerela where a student had returned from Wuhan, China. India took 64 days for the number of COVID 19 cases to rise from 100 to 100,000 according to the ministry of family health and welfare. India has again reported a sharp spike in the number of coronavirus cases, with its total rising to 457,656. Around 14,505 people have died in the country from Covid-19 so far.

Indian government has taking all important steps to fight against Coronavirus. Now, people of India are well informed and prepared to face the challenge and threat for the pandemic of COVID-19 the Corona Virus. The most important factor in preventing the spread of the Virus locally is to empower the citizens with the right information and taking precautions as per the advisories being issued by Ministry of Health & Family Welfare.

First time in India, the Government of India had declared nationwide lockdown for 21 days on 24th March 2020[8]. After this period again on 14th April, lock down was extended till 3rd May 2020. On 1st May 2020, lockdown was again extended further for two weeks until 17th May. After that it was again extended till 31st May. After lockdown 1, total period till 30th June is divided in to five phases. Phase 1 was from 25th March 2020 to 14th April 2020. Second phase was from 15th April to 3rd May. Third phase started from 4th may till 17th May. Fourth phase is from 18th May to 31st May. And fifth phase started from 1st June. After the lockdown period, many relaxations had been given in unlock 1 period, which started from 8thJune . During this time, it was observed that the number of cases of COVID 19 increased rapidly. We studied the period when corona spread rapidly.

2. PROPOSED METHODOLOGY

Whole world is struggling with the pandemic situation of COVID 19. During this period India became the 6th country in the list of highest corona confirmed cases as on 21st June 2020[9] .In India, as on 21st June 2020, the top three states which have higher number of cases are Maharashtra, Tamilnadu and Delhi. Uttar Pradesh is the most populated states of India and it is still on 5th position in India as on 21st June 2020.Daily data was collected for Maharashtra, Tamilnadu , Delhi and Uttar Pradesh from the official platform of Government of India . We analyzed the daily data during the period 1st June 2020 to 21st June 2020. In this period, the trend analysis between the total number of cases and the total number of death has performed. In this study, number of cases is taken as the predictor value and total number of death as outcome value. Simple linear regression analysis was applied on the data during the period 1st June 2020 to 21st June 2020. Also coefficient of determination(R square) is evaluated which is a measure of goodness of the model. Regression analysis of data is used finding the best fit relation between the variables as well as in predicting the outcome variable.Casuality fatality rate (CFR) is estimated from the slope of the fitted line and the confidence interval of CFR can be calculated from the standard error of the slope.

3. RESULT AND ANALYSIS

In this section, fitting of linear regression over the data of four states during the period 1st June 2020 to 21st June 2020 is discussed.

Maharashtra is the highly affected states by corona in India. Regression analysis of Maharashtra is depicted by the figure 1a. Analysis of data fitted as line of regression[10] shows the value of coefficient of determination is 0.9197 and CFR is 6.38 % (95% CI: 5.54–7.29%).

Delhi is second highly affected states by corona in India. Figure 2 depicts the regression analysis of Delhi. Analysis of data fitted as line of regression shows the value of coefficient of determination is 0.9743 and CFR is 4.88 % (95% CI: 4.49–5.26%).

In India, Tamilnadu is third highly affected states by corona. Regression analysis of Tamlnadu is shown by figure 3. Analysis of data fitted as line of regression shows the value of coefficient of determination is 0.9672 and CFR is 1.52 % (95% CI: 1.39–1.65%).

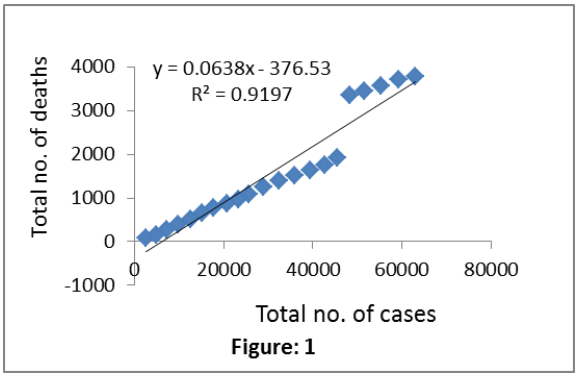

Figure: 1

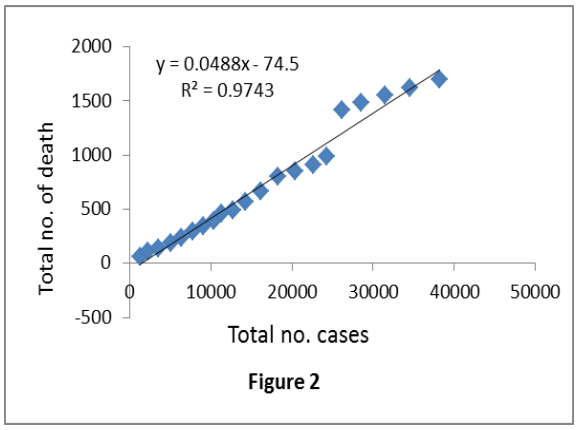

Figure 2

Uttar Pradesh is the most populated state in India and in the covid 19 affected list, it is on fifth position. Figure 4 depicts the regression analysis of Uttar Pradesh. Analysis of data fitted as line of regression shows the value of coefficient of determination is 0.9888 and CFR is 3.54 % (95% CI: 3.36–5.35%).

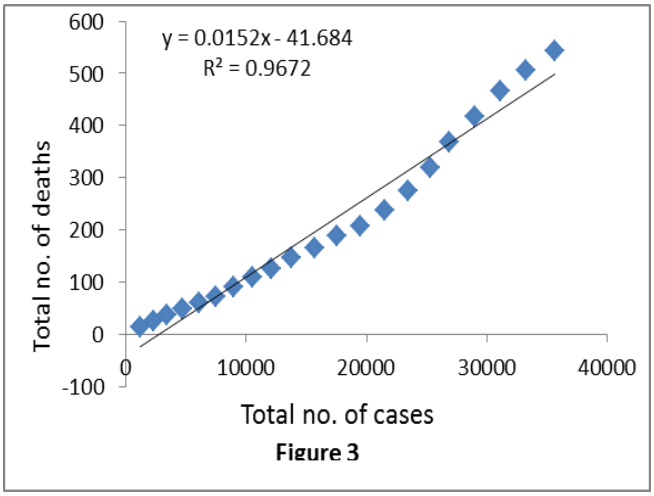

Figure 3

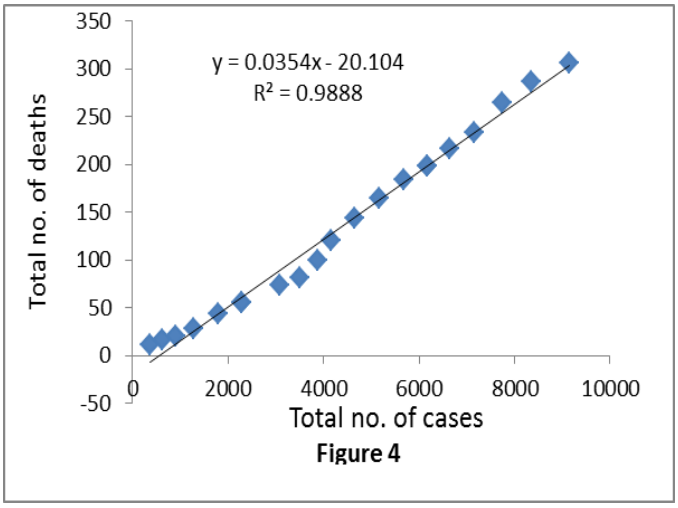

Figure 4

Regression analysis of India is depicted by figure 5. Result of analysis shows that the coefficient of determination is 0.9667 and CFR is 3.76 % (95% CI: 3.42–4.09%).

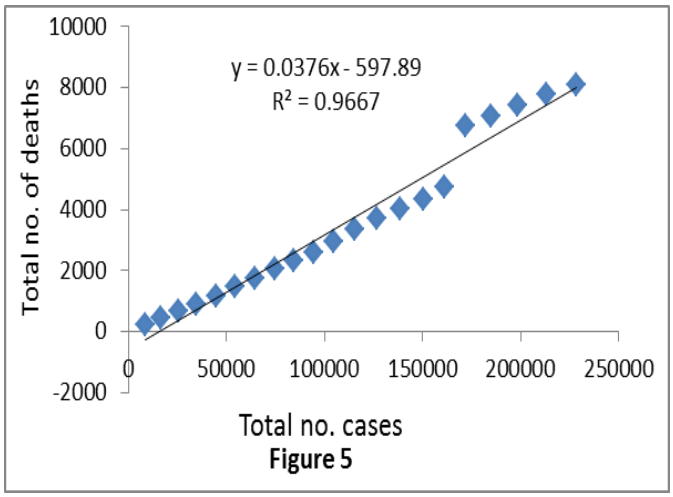

Figure 5

The situation was under control in initial phases of COVID 19 outbreak in India. Proper lockdown of the country was the major reason. But Covid 19 cases increased rapidly as there were some relaxation given in unlock 1 in certain areas. After unlock 1 phase that started From 8th June 2020, COVID 19 cases increased. Regression analysis results of the period 1st June 2020 to 20th June 2020 shows that CFR of Maharashtra 6.38 % (95% CI: 5.54–7.29%) is highest in the country. Whereas considering the confidence interval, the CFR of Tamilnadu will be less than 2%

4. CONCLUSIONS

In this study, a data driven method is discussed to estimate the case fatality rate during the period 1st June 2020 to 21st June 2020 of COVID 19 outbreak. Case fatality rate of COVID 19[12] is different for different countries due to different types of medical facility, detection of disease and spread of pandemics. Even CFR varies within the country. Proposed approach of finding CFR is based on real time collected data. Coefficient of determination for selected regions is between 0.919 to 0.988. In this study, model fitting efficiency is very high. This model has predicted that CFR for Maharashtra is very high as compared to India (Maharashtra included). This study could be used in predicting the future trend of CFR as well as causalities. It could also help in providing the guidelines in future.

REFERENCES

[1] Banerjee, Debanjan. "The COVID-19 outbreak: Crucial role the psychiatrists can play." Asian journal of psychiatry 50 (2020): 102014.

[2] Lu, H., Stratton, C. W., & Tang, Y. W. (2020). Outbreak of pneumonia of unknown etiology in Wuhan, China: The mystery and the miracle. Journal of medical virology, 92(4), 401-402.

[3] Adhikari, S. P., Meng, S., Wu, Y. J., Mao, Y. P., Ye, R. X., Wang, Q. Z., ... & Zhou, H. (2020). Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. Infectious diseases of poverty, 9(1), 1-12.

[4] Shereen, M. A., Khan, S., Kazmi, A., Bashir, N., & Siddique, R. (2020). COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. Journal of Advanced Research.

[5] Wu, Z., & McGoogan, J. M. (2020). Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. Jama, 323(13), 1239-1242.

[6] Weinberger, M., & Abu-Hasan, M. (2009). Perceptions and pathophysiology of dyspnea and exercise intolerance. Pediatric clinics of North America, 56(1), 33-48.

[7] Ghosh, P., Ghosh, R., & Chakraborty, B. (2020). COVID-19 in India: State-wise Analysis and Prediction. medRxiv.

[8] Sardar, T., Nadim, S. S., & Chattopadhyay, J. (2020). Assessment of 21 days lockdown effect in some states and overall India: a predictive mathematical study on COVID-19 outbreak. arXiv preprint arXiv:2004.03487.

[9] Aggarwal, V. (2020). Effective ways to make corona virus lockdown: Productive and positive. Purakala with ISSN 0971-2143 is an UGC CARE Journal, 31(4), 1798-1807.

[10] Cleveland, W. S., & Devlin, S. J. (1988). Locally weighted regression: an approach to regression analysis by local fitting. Journal of the American statistical association, 83(403), 596-610.

[11] Naval, R. C. (2012). Potential Evapotranspiration Prediction from other climatic variables. In International Conference on Environmental, Biomedical and Biotechnology. IPCBEE (Vol. 41, pp. 196-199).

[12] Onder, G., Rezza, G., & Brusaferro, S. (2020). Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. Jama, 323(18), 1775-1776.

BIOGRAPHIES

Dr. Akansha Singh is working as an Assistant Professor in Mathematics Department at NIET, Greater Noida. She has completed her Ph.D. degree from Gautam Buddha University, Greater Noida in 2018. She has published many research papers in reputed journals. Her fields of interest is mathematical modeling in WSN. She has around 12 years of teaching experience in the Engineering Colleges.

Dr. Kavita Bhatnagar has been associated with the NIET, Greater Noida for the last three years as a competent, successful and responsible faculty member in Mathematics. She is working as an Assistant Professor in the Department of Applied Sciences there. She is awarded with the degree of Ph.D. by Rajasthan University, Jaipur in 2015. She has published ten research papers in National and International Journals. She has also participated in various workshops. She has around 12 years of teaching experience in the Engineering Colleges.