**Report on Application of Regression Analysis on Impact of COVID-19 Mortality rate in 20 countries.**

**Introduction**

**Coronavirus disease 2019** (**COVID-19**) is a contagious [disease](https://en.wikipedia.org/wiki/Disease) caused by [severe acute respiratory syndrome coronavirus 2](https://en.wikipedia.org/wiki/Severe_acute_respiratory_syndrome_coronavirus_2) (SARS-CoV-2). The first case was identified in [Wuhan](https://en.wikipedia.org/wiki/Wuhan), China, in December 2019. It has since spread worldwide, leading to an [ongoing pandemic](https://en.wikipedia.org/wiki/COVID-19_pandemic). [Symptoms of COVID-19](https://en.wikipedia.org/wiki/Symptoms_of_COVID-19) are variable, but often include fever, cough, fatigue, [breathing difficulties](https://en.wikipedia.org/wiki/Breathing_difficulties), and [loss of smell](https://en.wikipedia.org/wiki/Anosmia) and [taste](https://en.wikipedia.org/wiki/Ageusia). Symptoms begin one to fourteen days [after exposure](https://en.wikipedia.org/wiki/Incubation_period) to the [virus](https://en.wikipedia.org/wiki/Virus). **Mortality rate**, or **death rate**  is a [measure](https://en.wikipedia.org/wiki/Measurement) of the number of [deaths](https://en.wikipedia.org/wiki/Death) (in general, or due to a specific cause) in a particular [population](https://en.wikipedia.org/wiki/Statistical_population), scaled to the size of that population, per unit of time.

**Aim and objectives of the report.**

The aim of this project is to investigate the impact of Covid-19 Mortality rate on 20 countries, the objectives are follows:

1. To evaluate the reported effect of Mortality rate on Tested patients (in millions)
2. To estimate the influence of average yearly temperature of the country on Mortality rate of COVID-19.
3. To estimate the effect of spread of COVID-19 which result to mortality on (human inhabitants) density of the country (population/km2).
4. To evaluate the effect of COVID-19 Mortality on country GDP (Gross domestic product)
5. To estimate the average age of the country population i.e. (Median age between male and female) on COVID-19 Mortality rate.

**Variables Explanation**

**Number of test/millions**: This is the number of reported tests of COVID-19 patients per millions in the country selected.

**Density of the country (Population/area km2):** Density of a country is measured by the number of [human](https://en.wikipedia.org/wiki/Human) inhabitants per [square kilometres](https://en.wikipedia.org/wiki/Square_kilometer), and also sortable by total area and by population.

**Average yearly temperature of the country**: Average yearly temperature is calculated by averaging the minimum and maximum daily temperatures in the country.

**Gross domestic product** (**GDP**) is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time period.

**Average age of the country**: Median age is the age that divides a population into two numerically equally sized groups - that is, half the people are younger than this age and half are older. It is a single index that summarizes the age distribution of a population.

**Data Collection**

The data for the 20 countries is collected from worldometers.info/coronavirus/ and Wikipedia list of countries on Density, Average age, GDP, and Average yearly temperature.

**Method of data collection**

The data was extracted from the world records list of numbers of death cases, recovered cases, test cases/million and Wikipedia list of world records on Density, Average age, GDP, and Average yearly temperature.

**DATA**



**Regression Analysis**

Regression analysis is one of the statistical analysis to verify the linear relationship between one dependent variable and one or more independent variables.

1. Effect of Number of test/million on COVID-19 Mortality rate

|  |  |
| --- | --- |
| Number of test/million | Mortality Rate |
| 81021364 | 0.021780236 |
| 5605071 | 0.008802304 |
| 30494036 | 0.022431803 |
| 28023593 | 0.245857045 |
| 12226406 | 0.035650288 |
| 23676174 | 0.057422384 |
| 8256533 | 0.011987151 |
| 6586361 | 0.026580678 |
| 6191181 | 0.302748349 |
| 401859 | 0.034172594 |
| 4838979 | 0.030177834 |
| 4805677 | 0.019930067 |
| 4356567 | 0.028925869 |
| 399409 | 0.013979774 |
| 3517016 | 0.00928572 |
| 368807 | 0.015202974 |
| 3269653 | 0.018335678 |
| 2985976 | 0.019791111 |
| 2540044 | 0.252264391 |
| 2421445 | 0.010962835 |



**Conclusion**

The estimate coefficient shows that for every increase in the number of test/million cases of corona patient in the selected countries there is 1.188E-10 increase in the Mortality rate in the country.

**Results**

From the general conclusion of the results since P value is greater than 0.05 so we accept the null-hypothesis and we can conclude that there is no statistical significance effect of the number of test/million cases on COVID-19 Mortality rate in the selected countries.

The plot above show that the rate of mortality on the result of the number of tested patients for corona is disperse.

1. Effect of average yearly temperature of the country on Covid-19 Mortality rate.

|  |  |
| --- | --- |
| Average yearly temperature | Mortality Rate |
| -5.10 | 0.021780236 |
| 20.2 | 0.008802304 |
| 8.5 | 0.022431803 |
| 10.7 | 0.245857045 |
| -5.35 | 0.035650288 |
| 13.45 | 0.057422384 |
| 2.7 | 0.011987151 |
| 7.85 | 0.026580678 |
| 9.55 | 0.302748349 |
| 21.65 | 0.034172594 |
| 8.3 | 0.030177834 |
| 15.15 | 0.019930067 |
| 8.8 | 0.028925869 |
| 5.1 | 0.013979774 |
| 6.15 | 0.00928572 |
| 6.35 | 0.015202974 |
| 7.55 | 0.018335678 |
| 5.5 | 0.019791111 |
| 14.44 | 0.252264391 |
| 1.5 | 0.010962835 |



**Conclusion**

The estimate coefficient shows that for every one unit increase in the selected countries average yearly temperature there is 0.002874 increase on Covid-19 Mortality rate in the countries.

**Results**

From the general conclusion of the results since P value is greater than 0.05 so we accept the null-hypothesis and we can conclude that there is no statistical significance effect of the average yearly temperature on COVID-19 Mortality rate in the selected countries.

1. Effect of Covid-19 Mortality rate on 20 countries Population density

|  |  |
| --- | --- |
| Density of the country | Mortality Rate |
| 9 | 0.021780236 |
| 421 | 0.008802304 |
| 232 | 0.022431803 |
| 123 | 0.245857045 |
| 4 | 0.035650288 |
| 200 | 0.057422384 |
| 135 | 0.011987151 |
| 123 | 0.026580678 |
| 376 | 0.302748349 |
| 3 | 0.034172594 |
| 73 | 0.030177834 |
| 112 | 0.019930067 |
| 82 | 0.028925869 |
| 29 | 0.013979774 |
| 46 | 0.00928572 |
| 106 | 0.015202974 |
| 135 | 0.018335678 |
| 206 | 0.019791111 |
| 82 | 0.252264391 |
| 14 | 0.010962835 |



**Conclusion**

For every unit increases in the Population density of the inhabitants of the selected country there is 0.000228 increase in Covid-19 Mortality rates.

Generally, since the P value is greater than 0.05, we then conclude that there is no statistically significant effect of population density on Mortality rate in the 20 countries.

The plot above reveals the mortality rate towards the population density is scattered and randomly distributed across all the 20 countries.

1. Effect of Mortality rate on GDP (Gross domestic product)

|  |  |
| --- | --- |
| GDP ($) | Mortality Rate |
| 9972 | 0.021780236 |
| 41560 | 0.008802304 |
| 45466 | 0.022431803 |
| 39257 | 0.245857045 |
| 42080 | 0.035650288 |
| 30657 | 0.057422384 |
| 58439 | 0.011987151 |
| 15304 | 0.026580678 |
| 43814 | 0.302748349 |
| 51885 | 0.034172594 |
| 3425 | 0.030177834 |
| 21608 | 0.019930067 |
| 12813 | 0.028925869 |
| 22986 | 0.013979774 |
| 6134 | 0.00928572 |
| 48634 | 0.015202974 |
| 22627 | 0.018335678 |
| 81867 | 0.019791111 |
| 18168 | 0.252264391 |
| 67989 | 0.010962835 |



**Conclusion**

The coefficient estimate shows that for every one unit increase in the gross domestic product there is decrease of 6.5E-08 on Covid-19 Mortality rate, this shows that if the country economy is buoyant the government can provide enough infrastructure to tackle Covid-19 and this can reduce mortality rate in the selected countries.

So general, since the p value is greater than 0.05, we can conclude that there is no statistically significant effect of the covid-19 mortality rate on gross domestic product.

The plot shows the effect of GDP growth rate on mortality, the movement is in decreasing order.

1. Effect of Mortality on Average of age of population

|  |  |
| --- | --- |
| Average age of the population | Mortality Rate |
| 39.6 | 0.02178024 |
| 29.9 | 0.0088023 |
| 47.1 | 0.0224318 |
| 41.4 | 0.24585705 |
| 42.2 | 0.03565029 |
| 45.5 | 0.05742238 |
| 42.2 | 0.01198715 |
| 40.7 | 0.02658068 |
| 41.4 | 0.30274835 |
| 38.7 | 0.03417259 |
| 40.6 | 0.03017783 |
| 42.2 | 0.01993007 |
| 41.1 | 0.02892587 |
| 42.7 | 0.01397977 |
| 40 | 0.00928572 |
| 44 | 0.01520297 |
| 42.1 | 0.01833568 |
| 42.4 | 0.01979111 |
| 44.5 | 0.25226439 |
| 39.2 | 0.01096284 |



**Conclusion**

The result of the estimate shows that for every increase in the median age of the population of the 20 countries there is an increase in Covid-19 Mortality rate.

Since the P value > 0.05 we accept the null hypothesis and conclude that there is no statistically significant effect of average age of population on Covid-19 Mortality rate.

The age distribution on Mortality rate is within the age bracket 30-50, its not randomly distributed to all age group.

1. Joint effect of all the variables on Covid-19 Mortality rate

This is perform using the Multiple linear regression to estimate the significant linear effect of the predictor variables on the response.





**Conclusion**

The results show that none of the variables is statistically significance to have effect on the Covid-19 Mortality rate on the selected 20 countries.

1. The Non-linear regression method for estimating the significant non-linear effect of the independent variables on the dependent variables.

The estimation was carried out using an exponential non-linear function of the following model:



**Conclusion**

From the result above we can deduce that for every one percent log increase of numbers of tested cases /million and density of population there is 1% log increase of 15.9 and 8.1% on Covid-19 Mortality rate of the selected country.

Thus, since the P value is greater than 0.05 so we accept null hypothesis and conclude that there is no statistically significant of the numbers of tested cases and density of population on Covid-19 Mortality rate of the 20 countries.