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IMPACT OF LOCKDOWN MEASURE ON COVID-19 INCIDENCE AND MORTALITY IN THE TOP 31 COUNTRIES OF THE WORLD.

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Abstract: As a non-pharmacological intervention measure, lockdown had been implemented by several countries' governments across the world to control the COVID-19 pandemic. We aimed to determine the impact of lockdown on the daily average number of COVID-19 cases and deaths in several countries worldwide. Epidemiological data from European Center for Disease Control and Prevention (ECDC) was linked with lockdown measures data from "The Assessment Capacities Project" (ACAPS) for the duration December 31, 2019, and June 13, 2020. Upon comparative analysis, i.e., between 'lockdown' and 'no lockdown' groups, we observed that countries like India, China, France, Germany, and Mexico had significantly ($p<0.05$) higher number of COVID-19 cases and deaths during the 'lockdown' as compared to that of 'no lockdown' duration. However, countries like Colombia, Ukraine, and UAE showed an ideal situation where 'lockdown' decreased the number of confirmed cases and deaths compared to that of 'no lockdown' ($p<0.05$).Our results suggest differential effects of lockdown worldwide where few countries responding well to lockdown with decreased cases and rest did not show any changes or opposite of what was expected.

Keywords: COVID-19, Lockdown, SARS-CoV-2

Introduction:

Lockdown as an intervention measure had been implemented by several countries' governments across the world to control the COVID-19 pandemic. The term lockdown is used for actions related to mass quarantines or stay-at-home orders. There are quite a few studies that studied the role of lockdown on COVID-19 transmission at a specific country level. However, in our knowledge, there has not been a study that examined the role of lockdown in different countries across the world. Also, given the emerging and unpredictable nature of the COVID-19 pandemic, it remains unclear whether lockdown as a non-pharmacologic intervention measure has any significant impact on the spread of the Coronavirus (SARS-CoV-2) positive cases and COVID-19 deaths. Therefore, we aimed to determine the impact of lockdown on the daily average number of COVID-19 cases and deaths in several countries worldwide.

Methods:

Data Collection:

Epidemiological data on the number of COVID-19 cases and deaths were downloaded from the European Center for Disease Control and Prevention (ECDC). This dataset contains daily reports on the above-mentioned epidemiological data for all Countries and Territories (1). For this study, we used data between December 31, 2019, and June 13, 2020. Information on intervention measures taken by different countries' governments was downloaded from "The Assessment Capacities Project" (ACAPS) (2).

Data Analysis:

To achieve our study aim, we looked at the start and end dates of lockdown in the top 50 countries (based on Johns Hopkins University Center for Systems Science and Engineering data) with COVID-19 cases (2, 3). Among those, only 31 countries have taken country-wide lockdown measures and have a clear start and end dates. Two-tailed unpaired T-tests were conducted on each of 31 countries' epidemiological data to compare the means of daily cases or deaths between 'lockdown' and 'no lockdown' groups. P-value < 0.05 was considered as significance measure. Microsoft® Excel Version 16 was used for data entry and data analysis.

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Results and Discussion:

Comparative analysis of the top 31 countries was performed for cases or deaths between 'lockdown' and 'no lockdown' groups. Minimum values for average daily cases during 'lockdown,' cases during 'no lockdown,' deaths during 'lockdown,' and deaths during 'no lockdown' were 41.4, 2.5, 0.3, 0, with maximum values being 4793.5, 3708.9, 652.1 and 107. Several interesting trends were observed with significant differences. India and China, the top two highly populated countries, had increased cases and deaths during 'lockdown' as compared to that of 'no lockdown' ($P<0.05$), which is unexpected as the lockdown was supposed to decrease the number of confirmed cases and COVID-19 deaths (Table-1).

Table 1: Results for comparison of cases and deaths with and without lockdown.

Country	Daily average Cases During lockdown	Daily Average Cases During no lockdown	P value	Daily average Deaths During lockdown	Daily Average Deaths During no lockdown	P value
Russia	4793.5	2424.3	0.00	43.6	39.2	0.58
India	2364.2	1442.5	0.04	67	42.2	0.06
United Kingdom	4366.1	706.5	8.58	652.1	86.2	5.26
Peru	1160.2	3708.9	6.72	32.3	107	1.24
Spain	3449.3	777.7	8.51	520.6	38.9	6.48
Chile	1323.4	2078.4	0.10	13.6	55	0.04
Italy	3591	290	1.21	500.2	52.3	3.41
France	2386.4	205.8	2.86	468.8	28.3	1.53
Germany	3371.1	308.7	7.59	150.1	17.8	4.71
Mexico	1351.2	577.2	9.82	151.5	73.4	0.00
Saudi Arabia	1190	1216	0.91	6.4	13.3	0.01
Bangladesh	679.3	1383.1	0.01	9.1	18.5	0.01
South Africa	137.1	919.1	1.17	2.8	20.1	1.70
Qatar	456.9	477.2	0.80	0.3	0.4	0.22
China	1287.3	30.3	1.84	51.8	13.3	0.01
Colombia	366.2	1036.4	0.00	11.5	36.3	0.00
Belgium	1030.4	95.6	2.93	165.1	15.8	3.74
Ecuador	265.3	288.3	0.85	11.8	26.2	0.01
Indonesia	356.1	165.3	1.06	21.9	8.33	3.81
United Arab Emirates	77.6	271.1	0.00	0.6	1.8	0.01
Argentina	270.7	379	0.43	7.9	7.7	0.92
Singapore	603.4	166.3	4.76	0.4	0.09	0.01
Kuwait	449.1	94.8	4.14	3.5	0.8	1.35
Ukraine	289.7	418.7	0.03	8.5	12.1	0.06
Iraq	69.6	126.8	0.07	2.4	3.3	0.27
Philippines	212.7	135.9	0.01	14.5	4.19	1.70
Oman	257.6	108.3	0.00	1.12	0.5	0.02
Ireland	510.3	42.7	9.46	33.3	3.2	8.00

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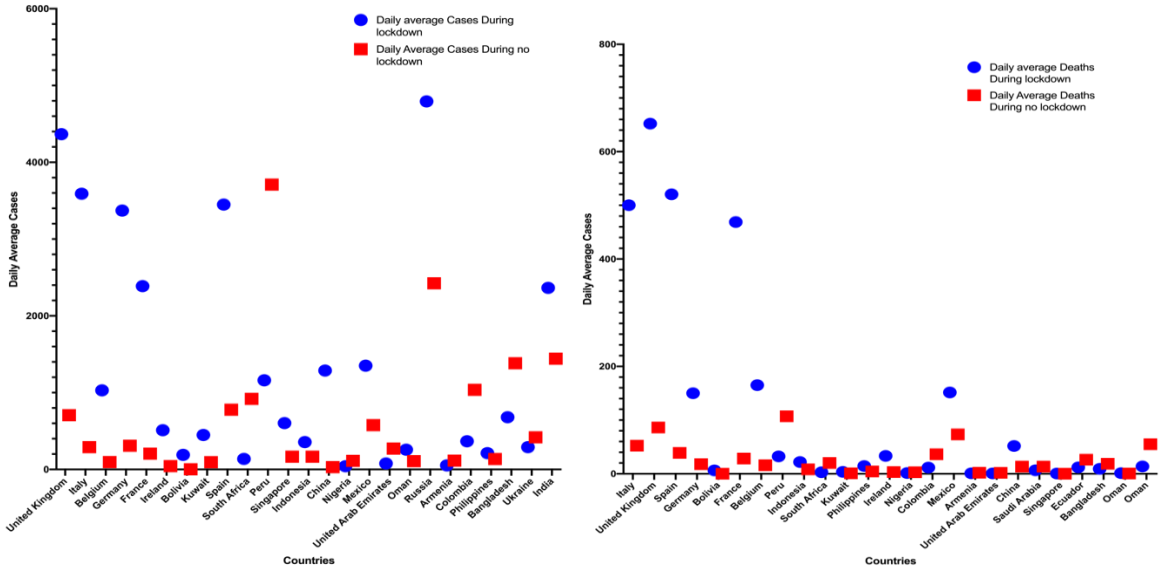
Bolivia	190.1	2.5	2.19	6.28	0	8.14
Armenia	52.2	113.7	0.00	0.8	1.93	0.00
Nigeria	41.4	111.5	2.34	1.3	2.88	0.00

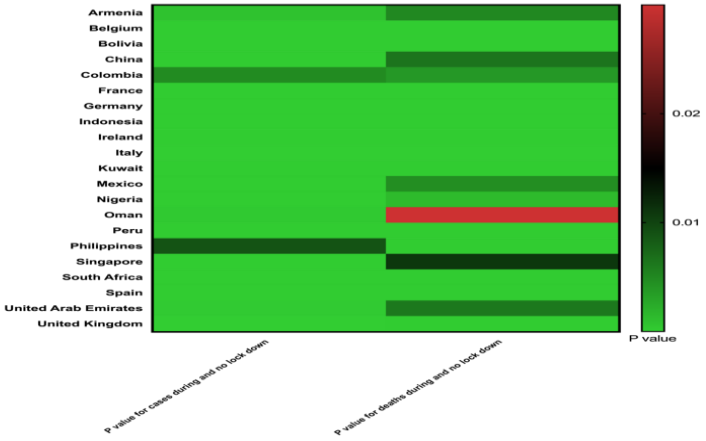
A similar pattern was observed with France, Germany, and Mexico (Table-1). Whereas, countries like Colombia, Ukraine, and UAE showed an ideal situation where 'lockdown' did decrease the number of confirmed cases and deaths, while 'no lockdown' did increase the cases ($P<0.05$) (Table-1). Figure 1 compares daily averages for cases (Left) and deaths (Right) with and without lockdown for different countries. From the list, 10 countries were left out for case differences and 8 countries were left out for death differences with insignificant P value.

Figure 1: Comparison of daily averages for cases (Left) and deaths (Right) with and without lockdown for different countries (Significant P values only).



Countries like United Kingdom, Italy, Belgium, Germany, Kuwait and Russia had maximum cases during lockdown, while countries Italy, United Kingdom, Spain and Bolivia had maximum deaths during lockdown. We further compared P values for cases and deaths with and without lockdown for all the countries to observe which specific countries had maximum impact and found (Figure 2) 12 countries (solid green band) were predominately affected with significant differences within cases and deaths for with and without lockdown conditions.

Figure 2: Comparison of P values for cases and deaths with and without lockdown for different countries.



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de Figueiredo AM et al., studied the impact of lockdown on COVID-19 incidence and mortality in China and found that there was a significant reduction in daily incidence and mortality rates during lockdown time period. These results are contrary to what we found in out study. It could be because de Figueiredo AM et al., conducted their study during a substantially shorter timeframe (i.e., between January 2020 and March 2020) as compared to our study (i.e., December 2019 and June 2020) (4). In a different study, Yuan Z et al., modeled the effectiveness of lockdown measures on COVID-19 transmission rates in China and found that lockdown measures were effective in controlling the spread of COVID-19 across China. However, their study period was also substantially shorter (i.e., between January 2020 and March 2020) as compared to our study (i.e., between December 2019 and June 2020) (5). In a similar study by Guzzetta G et al., in Italy, it was found that implementation of lockdown for fourteen days was significantly effective in reducing the net reproduction number of cases below the epidemic threshold (6). All the above-mentioned studies were conducted with shorter study periods which limits the comprehensiveness of the studies. One possible hypothesis to explain the reason for increase in number of cases during lockdown is following: Lockdown forces people to stay indoors which leads to reduced sun exposure and reduced vitamin D levels. It is well known that low vitamin D levels enhances the risk of viral infections especially in elderly people. In a review by Weir EK et al., it was discussed that low vitamin D levels are associated with increase in inflammatory cytokines which significantly enhances the risk of pneumonia and viral upper respiratory tract infections. In addition, vitamin D deficiency is associated with an increase in thrombotic episodes which is a characteristic feature of COVID-19 related deaths (7) (8). Another hypothesis that could explain the increase in cases during lockdown is – depression and alcohol consumption was high during the lockdown period. It is well known that depression and alcohol consumption enhance the risk of viral infections (9) (10).

Conclusion:

Our results suggest differential effects of lockdown worldwide where few countries responding well to lockdown with decreased cases and rest did not show any changes or opposite of what was expected. Not all countries have the same degree of lockdown enforcement, and the limitation of our study is that we did not account for such enforcement differences. However, these results are of significant importance for worldwide efforts to control the acceleration of COVID-19 pandemic.

Supplementary Files:

Supplementary data 1.xlsx: Master sheet with data used in this study.

Conflict of Interest: None

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