

# Lockdown Effectiveness in the Combat Against COVID-19

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The coronavirus (sars-cov-2) pandemic is nevertheless the most important event of the current millennia. Although mankind has already faced other pandemic before, such as the Plague of Athens (430 b.C.), the Black Death (1346) and more recently the Spanish Flu (1918), a few of us had personally witnessed such periods.

While a reliable vaccine or cure is absent, it is stated by many specialists that the better prophylaxis way of being safe is through social distancing. But is this really true?

The present work aims to answer this question analyzing mainly the case of several distinct countries to understand the effects of social distancing into different stages of the pandemic.

The data used for the analysis is public, it is supplied by European Centre for Disease Prevention and Control (<https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide>) and was analyzed on 22<sup>th</sup>, September 2020, using Power BI to produce the graphs shown through this work.

## Section 1: Current data

This section aims to present the current state of the pandemic around the world.

At the moment, there are 31,337,031 cases of COVID-19. It does not mean, however, that this are active cases. The 31 million number stands for the sum of all reported cases and that includes three groups:

- People who were infected once and now are cured (recovered cases)
- People who are sick at this moment (active cases)
- People who passed away due to the disease (confirmed deaths)

The up-to-date count for the last group is 965,681 confirmed deaths, standing for a 3.08% deaths per total cases worldwide.

Fig.1 stands for a bar plot of the total number of new cases by month between January and September (cases are shown in million range).

A first analysis would lead to the conclusion that the number of cases was higher in August and started decreasing in September, however, one must remember that the data was taken on 22<sup>th</sup> of September, so the dataset for this month is still not complete, thus, any confirmation about peaks or saturation can be done at this moment.

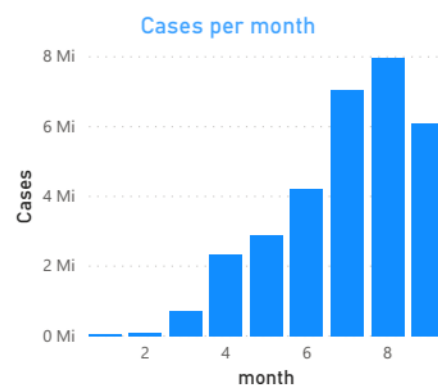


Fig 1: Total COVID-19 new cases per month worldwide.

Currently, American continent is responsible for 50.39% of the total cases and 55.35% of the total number of deaths. This number are pushed up by the total number of cases in United States and Brazil, which are the most prominent countries on the continent, but also other four other American countries appears in the top 10 number of cases list. They are Peru, Colombia, Mexico and Argentina, as can be observed on Fig. 2.

This is an outstandingly high number, since America has 13.13% of the total world population and a population density slightly lower than Europe and six times smaller than Asia. Also, the percentage of deaths per total case is 3.38%, almost 10% higher than the worldwide data. Fig.2 shows also the total number of cases and deaths by countries and continents.

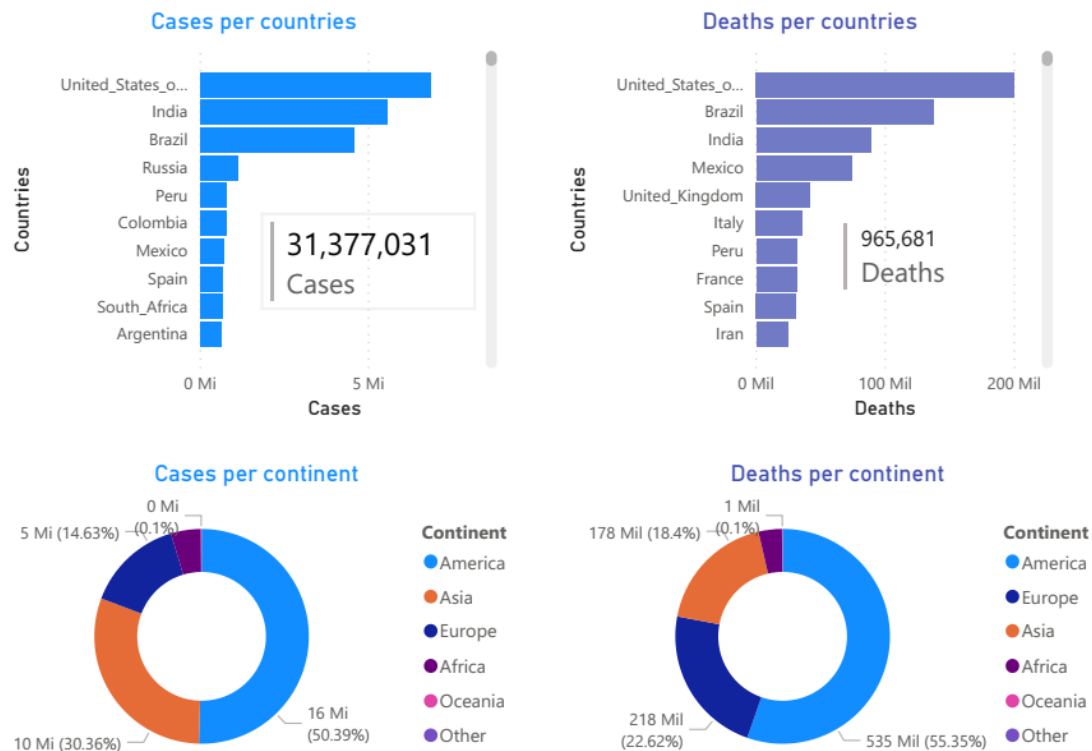


Fig. 2: Bar plots: Total number of cases and death by COVID-19 per country, showing the 10 most affect countries in both cases. Donuts plots: number of cases and deaths by COVID-19 per continent.

## Section 2: A closer look to America

Even though Americas correspond to least than 15% of world's population, it has more than 50% of COVID cases, as shown before. In this section, this numbers are more detailed explored in order to investigate this case.

In order to explore data on America, the table 1 was constructed presenting the following metrics:

- Region: which refers to the part of the world considered on a given row;
- Habitants: Absolute number of habitants on that region;
- COVID Cases: Absolute number of COVID-19 cases on that region;
- Deaths by COVID: Absolute number of deaths by COVID-19 on that region;
- Cases/Habitant (CH): Relative number of cases per habitant on that region. This value is shown in percentage;
- Deaths/Habitant (DH): Relative number of deaths per habitant on that region. This value is shown in number per 10000;
- Deaths/case (DC): Deaths per case of COVID-19. This value is shown in percentage.

The green background on Region stands for continents, while light green background is for countries within America. The text color is an indicative of how far from the World's score (WS), a country score actually is according to the following scale:

**Red text:** More than four times the WS for a given parameter.

**Orange text:** Between two and four times the WS.

**Black text:** Comparable with WS.

**Blue text:** Between two and four times below the WS.

**Light Blue text:** More than four times below the WS.

*Table 1: Habitants, COVID cases and deaths as relative numbers along with relative numbers of Cases per habitants, deaths per habitants and deaths per case worldwide, for all continents individually and for the countries with more cases, according to Fig. 2.*

Region	Habitants (abs)	COVID Cases (abs)	Deaths by COVID (abs)	Cases/Habitant (%)	Deaths/Habitant (per 10000 )	Deaths/Case(%)
World	7,794,798,739	31,377,031	965,681	0.40	1.24	3.08
Africa	1,340,598,147	1,414,596	34,088	0.11	0.25	2.41
America	1,022,831,978	15,810,903	534,546	1.55	5.23	3.38
Asia	4,641,054,775	9,526,954	177,665	0.21	0.38	1.86
Europe	747,636,026	4,591,374	218,449	0.61	2.92	4.75
Oceania	42,677,813	32,508	926	0.08	0.22	2.84
United States	331,452,301	6,857,967	199,881	2.07	6.03	2.91
India	1,383,164,876	5,562,663	88,935	0.40	0.64	1.60
Brazil	212,910,045	4,558,068	137,272	2.14	6.45	3.01
Russia	145,948,848	1,109,595	19,489	0.76	1.34	1.76
Peru	33,079,462	772,896	31,474	2.34	9.51	4.07
Colombia	51,009,371	770,435	24,397	1.51	4.78	3.17
Mexico	129,248,602	700,580	73,697	0.54	5.70	10.52
Spain	46,758,941	671,468	30,663	1.43	6.56	4.57
South Africa	59,483,557	661,936	15,992	1.11	2.69	2.42
Argentina	45,292,292	640,134	13,482	1.41	2.98	2.11

From the relative values, one can note extremely high CH and DH values for America's country, mainly but not only for United States, Brazil and Peru.

The first number, CH, is particularly interesting to us, since it is related to how much people of that given country has been infected by the sars-cov-2 and is an indirect mean to observe how effective was the social distancing on that given country. But this number alone cannot tell the whole history, since, in some countries (most in America) the social distancing was a recommendation, while in other (mainly Europe and Asia), it was an imposition. By any matter, observing a higher CH in America's country is an indicative that the social distancing has failed on such places.

The DH and deaths per cases are more related to how saturated the health system was on the given country, since a highly saturated health system would lead to a lower quality treatment for the sickness, increasing the risk of death. That was observed during the first stages of the pandemic (mainly in March-April) through Europe and is a clear explanation to the high DC percentage of 4.75 on this continent.

Another interesting result lies on Mexico, which has a fairly low CH, considering other examples, but the largest DC ratio of the World. This is probably related to a highly saturated health system, being unable to treat the presented number of contaminated.

Interestingly enough, America's most affected countries, United States, Brazil and Peru present a very higher DH, but lower DC. The most possible explanation for that lies on the high number of contaminated people percentage CH, more or less on the opposite hand of Mexican's case.

Despite of the differences through CH, DH and DC, an unquestionable conclusion of this chart is that Americans are contracting more COVID-19 than people on other countries. In the next section, we investigate how this can be related to the lockdown effectiveness.

### **Section 3: Lockdown intensity and COVID evolution**

In this section the behavior of cases with time is analyzed for six distinct countries: China, Italy, Spain, United States, Brazil and Peru. The first three has faced a severe lockdown, even with policy restraint and state fee for those who were found on streets with no reasonable reason, while the last three had a softer lockdown, as a recommendation to people.

Results for the number of cases as a function of time are shown on Fig. 3 for the aforementioned countries. Lockdown start is represented as a vertical green line, while the end of this period is represented by a red line. Data regarding the period is open and can be found at [https://en.wikipedia.org/wiki/COVID-19\\_pandemic\\_lockdowns](https://en.wikipedia.org/wiki/COVID-19_pandemic_lockdowns). It's important to note that, for some larger countries as China, United States and Brazil, the lockdown was separated into different states/regions, but their beginning and end date is similar and such small differences would not affect the main results proposed here.

The first notable information is that all of this countries reacted fast for the pandemic. Meaning that the lockdown started at the very beginning of the curve's peak. The latest countries to start the lockdown were European's Spain and Italy, which has reached a critical state on their health systems.

It's notable however, that, while they had the latest start, the European countries also had the lockdown's finish more than a month after the peak in the number of cases. Another country that stopped the lockdown more than a month after the peak was China, which also had a very head beginning. This is reflected in the surprisingly low total number of cases (~90 thousands) and deaths (4,737) China presented. Despite of the fact that COVID-19 spread from Wuhan, China seems to handle the situation pretty well through a series of control restriction, including lockdown.

For the aforementioned countries it is notable however that the lockdown periods cover the whole or at least a large portion of the peak. The graphs for America's countries is quite different, not in the beginning of the lockdown period, but on the end of it. From data reported by United States, Brazil and Peru, one can clearly observe that the lockdown stopped near the curve's stabilization or even earlier. This fact leads to the conclusion that this decision was quite hasty and with a severe impact on the following months of the pandemic on these countries. United States and Peru faced a second peak about two months before the lockdown ending. For Peru, it has approximately twice the amplitude of the first one, while in United States, the second peak had almost three

times the amplitude of the first. Such enhancement observed for United States may be a reflection of the anti-racist presential manifestations that happens on June 2020<sup>1</sup>.

However, the most unique case in coping to COVID-19 is Brazil, in which the social distancing has been relaxed quite before the peak. This has leded Brazil to be the third country in number of cases and second one in the number of deaths, being below only India and United States.

As a conclusion, the presented data suggests a strong relation between an effective lockdown period with a less painful (which means with less cases and deaths) control of the COVID-19 pandemic.

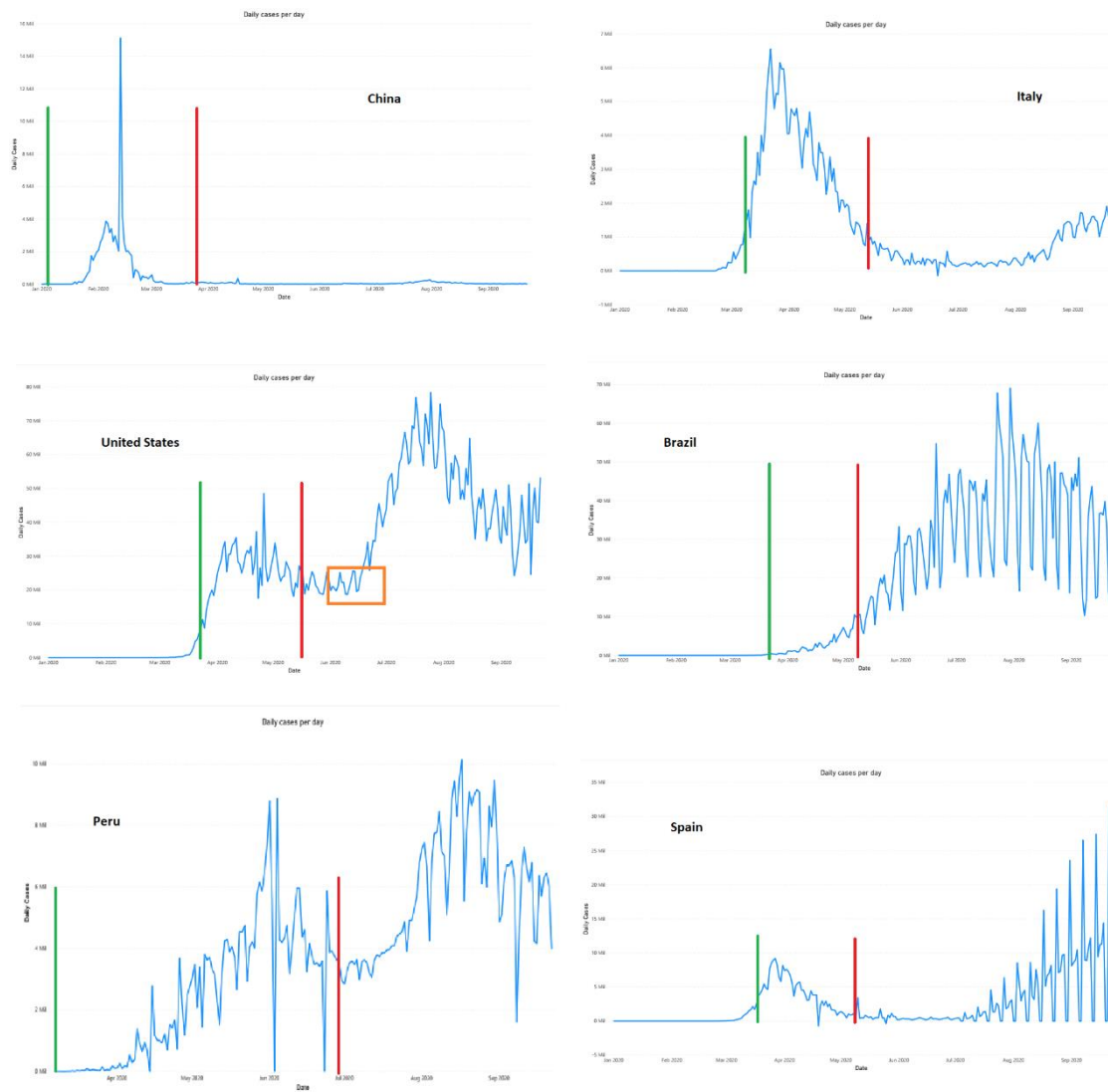


Fig. 3: Number of new daily cases as a function of time for China, Italy, United States, Brazil, Peru and Spain. Green line marks the lockdown beginning and red line its end. Orange box for United States graph stands for the period of anti-racist manifestations on the country.

<sup>1</sup> It's not the author's intention to belittle or criticize the manifestations which, in his opinion, are crucially import for democracy and social equality. The only point relevant for the work is to observe the manifestations as a focus of popular agglomeration.

#### Section 4: Evidence of a second wave

Pandemic crises are well known from literature to come in waves, which means that there may be several peaks of the disease over time. From the social point of view, people tends to “forget” or “minimize” the issue when the disease no longer has a huge median focus, relaxing sanitary safety and increasing the cases again. The period between this so called ‘waves’ depends on the biology of the pandemic entity, the sanitary conditions, above other parameters. However, in this section, we will point out what the data can say about the possibility of a second wave so far.

Graphs on Fig.4 are similar to those on Fig.3, showing the number of new diary infections for each of the countries: China, Italy, Spain, France, United Kingdom and Germany, where China is the “control group” and the other are the countries on Europe with the largest numbers of infected people<sup>2</sup>.

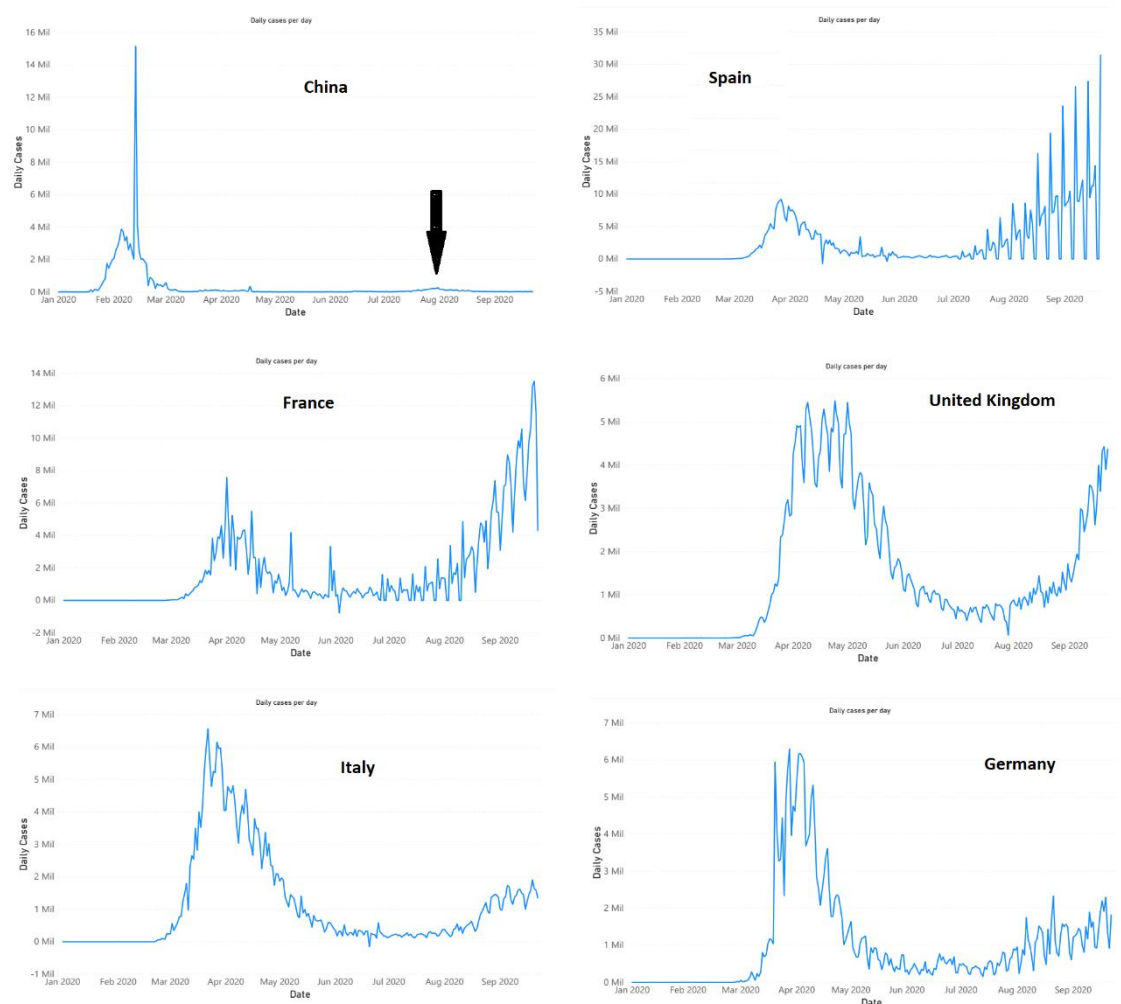


Fig. 4: Number of new daily cases in China and European countries. The arrow on China indicates the second wave.

<sup>2</sup> Russia and Turkey were excluded since they have a part on Europe and other part on Asia.

Based on the oldest reliable data, from China, a tiny second wave has happened on the beginning/mid August, six months after the first wave. The very same phenomena are being observed on the most affected European countries. On Europe, the second wave will have a major contamination spread on early October, again six months after the peak of the first wave. From Chinese data, one would expect a second wave about fifteen times smaller, however, the case on Europe seems to contradict this expectation, especially for Spain and France, which the second wave seems to be stronger than the first one.

It's important to note that the second peak on the American's countries, observed for US and Peru on Fig.3 is not associated with this second wave, but with a less restrictive lockdown process. The model propose that the second wave is expected to reach Americas by end-November, however, it's impact is still unpredictable with the model used in this calculations, since it seems that first and second waves are going to overlap on America's country, especially for Brazil, which has a very spread first wave period.

## **Section 5: Conclusions**

We analyzed the worldwide up-to-date data regarding COVID-19 pandemic, revealing that America continent has more than 50% of the total cases of the disease, regarding of having about 13% of World's population, revealing a very ineffective handling of the pandemic on America's countries. It was also stated that such inefficiency might be related to a weak and uncontrolled lockdown. Also, the data indicates that Europe is shortly coming through a second wave of the disease, which has already taken China and will overtake America by the end of November, with a not yet known strength.