

The COVID-19 pandemic

Coronavirus Disease (COVID-19) – Statistics and Research

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<https://ourworldindata.org/coronavirus>

The name of the disease and the virus

Diseases and the viruses or bacteria that cause them often have different names. For instance, the “human immunodeficiency virus”, HIV, causes “acquired immunodeficiency syndrome”, AIDS.

The virus causing the current outbreak is called *severe acute respiratory syndrome coronavirus 2*, shortened to SARS-CoV-2. The disease is called *coronavirus disease*, shortened to COVID-19.

These names have been assigned by the *World Health Organization* and the *International Committee on Taxonomy of Viruses*.²⁰

The WHO also refers to the virus as “the virus responsible for COVID-19” or “the COVID-19 virus” when communicating with the public. We follow the same conventions here.

How did the outbreak start?

The outbreak was first noticed in the city of Wuhan, China. Wuhan is the capital of the Hubei Province and has about 11 million inhabitants. On 29 December 2019, Chinese authorities identified a cluster of similar cases of pneumonia in the city.

These cases were soon determined to be caused by a novel coronavirus that was later named SARS-CoV-2.²¹

The first cases of COVID-19 outside of China were identified on January 13 in Thailand and on January 16 in Japan.

On January 23rd the city of Wuhan and other cities in the region were placed on lockdown by the Chinese Government.

Since then COVID-19 has spread to many more countries – cases have been reported in all world regions. By March it developed into a global pandemic and was declared as such by the WHO.

What is a coronavirus?

Although people often refer to the virus causing COVID-19 as “the coronavirus”, there are many different coronaviruses.

The term refers to a group of viruses that are common in humans: coronaviruses are the cause for around 30% of cases of the common cold.²² Corona is Latin for “crown” – this group of

viruses is given its name due to the fact that its surface looks like a crown under an electron microscope.

Two outbreaks of new diseases in recent history were also caused by coronaviruses – SARS in 2003 that resulted in around 1,000 deaths²³ and MERS in 2012 that resulted in 862 deaths.²⁴

The importance of testing

Testing is our window onto the pandemic and how it is spreading. Without testing we have no way of understanding the pandemic.

It is one of our most important tools in the fight to slow and reduce the spread and impact of the virus. Tests allow us to identify infected individuals, guiding the medical treatment that they receive. It enables the isolation of those infected and the tracing and quarantining of their contacts.⁸

Testing for COVID-19 also informs our understanding of the pandemic and the risks it poses in different populations.

This knowledge is important if we are to properly assess the interventions that should be implemented, including very costly interventions such as social distancing and the shutdown of entire regions and industries.

Different types of tests for COVID-19

There are two kinds of tests for COVID-19:

- those that test for the presence of the virus, aiming to establish whether an individual is currently infected;
- those that test for the presence of antibodies, aiming to establish whether an individual has been infected at some point in the past.

The testing data we present below relates to the former kind of test. The most common way of performing a test of this type is with a ‘PCR’ test.

Why data on testing is needed

Without data on COVID-19 we cannot possibly understand how the pandemic is progressing.

Without data we cannot respond appropriately to the threat; neither as individuals nor as a society. Nor can we learn where countermeasures against the pandemic are working.

The number of confirmed cases is what informs us about the development of the pandemic.

But the confirmation of a case is based on a test. The World Health Organization defines a confirmed case as “a person with laboratory confirmation of COVID-19 infection”.⁹

Reliable data on testing is therefore necessary to assess the reliability of the data that informs us about the spread of the pandemic: the data on cases and deaths.

The total number of tests performed or people tested so far

The two charts shown here show the *total* number of tests, or people tested, as indicated in the legend for each series.

The first chart shows the absolute number and the second shows it per thousand people of the country's population.

For comparisons across the series it is important to understand the definitions of the different measures. These are provided in the country by country notes below.

Total tests for COVID-19

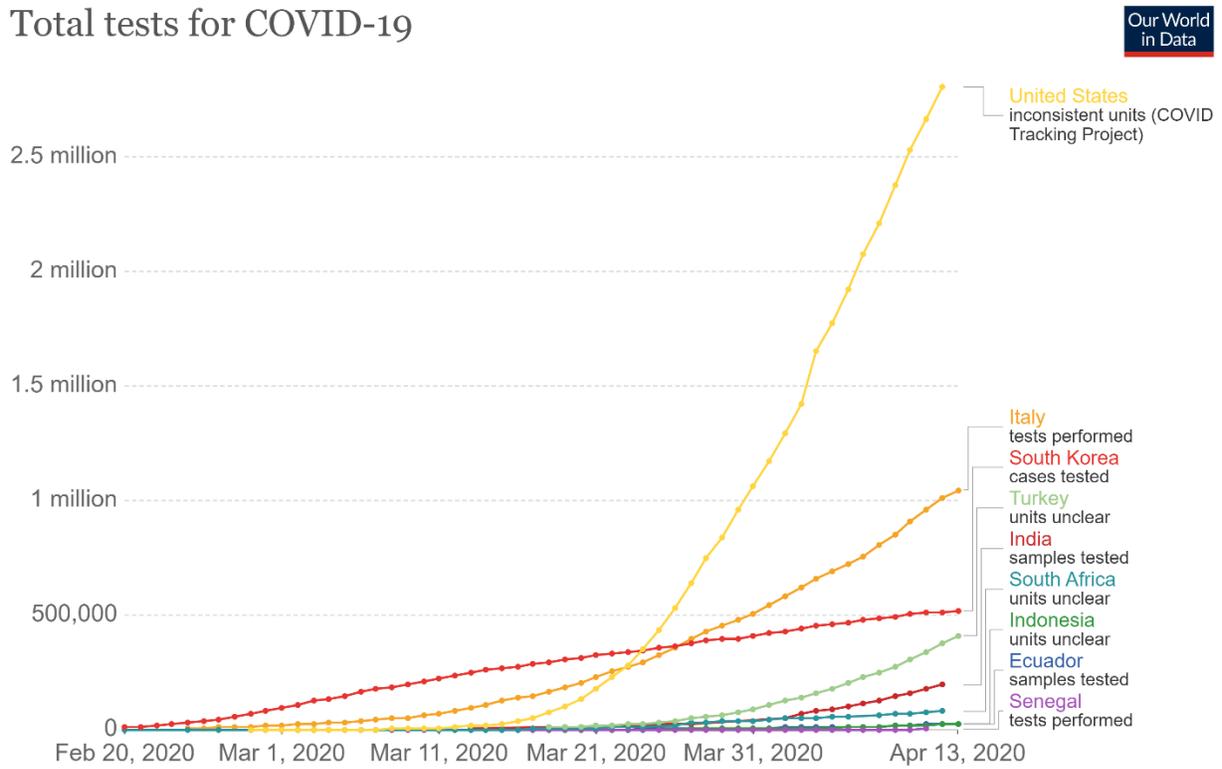


Fig. A

Source: Official sources collated by Our World in Data

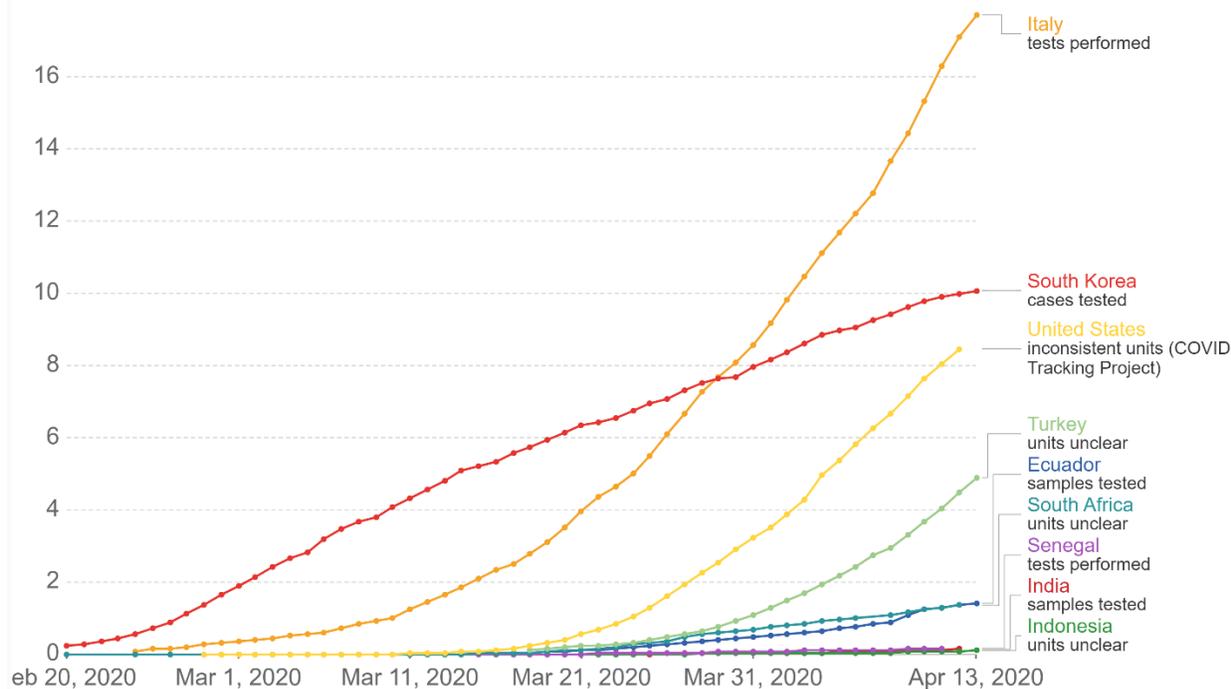
OurWorldInData.org/coronavirus • CC BY

Note: There are substantial differences across countries in terms of the units, whether or not all labs are included, the extent to which negative and pending tests are included and other aspects. Details for each country can be found at ourworldindata.org/covid-testing.

<https://ourworldindata.org/grapher/full-list-covid-19-tests-per-day>

Total tests for COVID-19 per 1,000 people

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Source: Official sources collated by Our World in Data

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Note: There are substantial differences across countries in terms of the units, whether or not all labs are included, the extent to which negative and pending tests are included and other aspects. Details for each country can be found at ourworldindata.org/covid-testing.

Fig. B

<https://ourworldindata.org/grapher/full-list-daily-covid-19-tests-per-thousand>

Testing data provides us with two indicators of the quality of data on COVID-19

No country knows the true number of people infected with COVID-19. All we know is the infection status of those who have been tested.

The total number of people that have tested positive – the number of *confirmed* cases – is not the total number of people who have been infected. The true number of people infected with COVID-19 is much higher.

Whilst there is no way to infer the true number of infections from testing data, it can help give us a strong indication of the quality of a country's data on the pandemic and an idea of how informative the number of confirmed cases in a country may be.

The number of tests per confirmed case

A further complication with using testing coverage as an indicator of reliability, is that the number of tests needed to have an accurate picture of the spread of the virus varies over the course of an outbreak.

At the beginning of an outbreak, where the number of people infected with the virus is low, a much smaller number of tests are needed to accurately assess the spread of the virus.

As the virus infects more people, testing coverage also needs to expand in order to provide a reliable picture of the true number of infected people.

For this reason it is helpful to look at the number of tests performed for each confirmed case. This gives us an indication of the scale of testing that accounts for the different stages each country may be in its outbreak.

The bar chart shows the number of tests, or people tested per confirmed case.

The key insight from this metric is that there are *very* large differences between countries.

In some countries the number of tests are many times higher than the number of confirmed cases. As of 11 April, in Vietnam more than 400 tests had been conducted for each confirmed case. In Taiwan and Russia there had been around a hundred tests for each confirmed case.

But in other countries testing is *very* low relative to the number of confirmed cases. The US, the UK and Ecuador had performed around 5 tests or fewer for every confirmed case.

Number of COVID-19 tests per confirmed case, Apr 13, 2020



Comparisons of testing data across countries is compromised for several reasons (see note below).

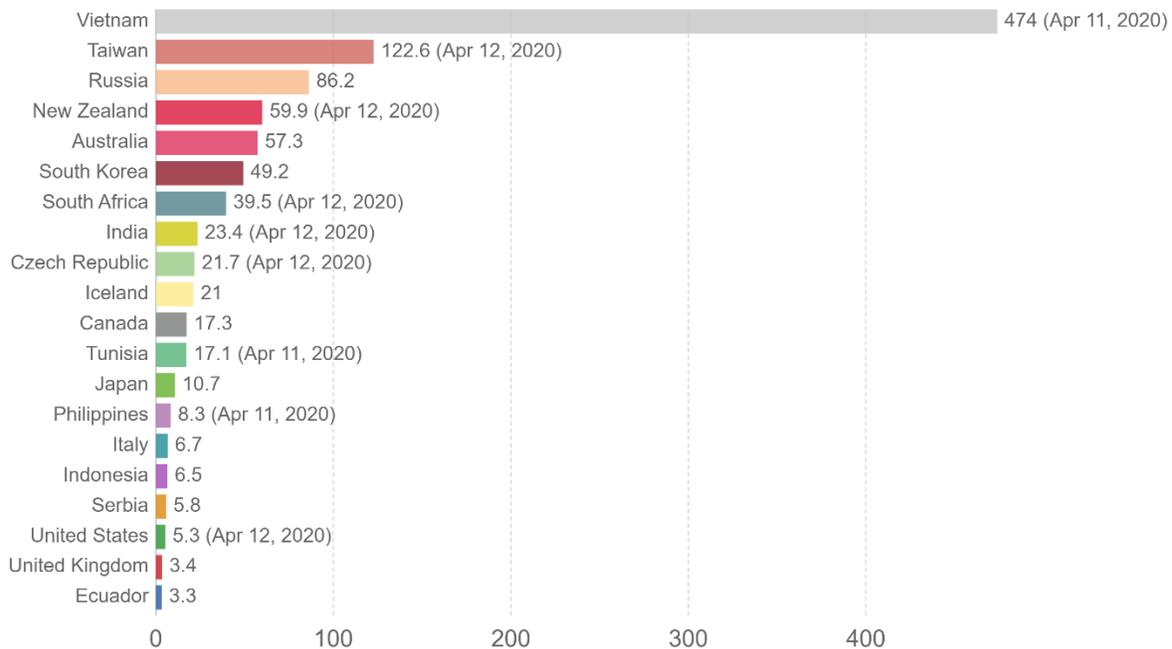


Fig. C

Source: Tests: official data collated by Our World in Data. Confirmed cases: European CDC – Situation Update Worldwide

Note: For testing figures, there are substantial differences across countries in terms of the units, whether or not all labs are included, the extent to which negative and pending tests are included and other aspects. Details for each country can be found at the linked page.

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<https://ourworldindata.org/grapher/number-of-covid-19-tests-per-confirmed-case?country=AUS+CAN+CZE+ECU+DEU+ISL+IND+IDN+ITA+JPN+NZL+PHL+RUS+SRB+ZAF+KOR+SWE+TWN+TUN+GBR+USA+VNM>

What can we learn from these measures about the pandemic?

Both testing coverage and the number of tests per confirmed case help us understand what we can know about the true spread of the virus from data on confirmed cases.

But it is the number of tests per confirmed case that is arguably the most helpful in this regard, because this accounts for the fact that a smaller outbreak requires less testing.

Consider for instance the difference between three countries: the UK, Australia and Taiwan.

These countries are highlighted in the chart here, which shows the number of tests per million against the number of confirmed cases per million. The dotted comparison lines show the points on the chart where the number of tests are a fixed number of times larger than the number of confirmed cases – 2, 5, 10, 20, 50, 100, 200 and 500 times larger.

In terms of testing coverage the UK appears to be ahead of Taiwan, with at least twice the number of people tested per thousand, as of 11 April.¹³

But on the same date, there were 60 times more confirmed cases per million in the UK than in Taiwan – 1,035 per million and 16 cases per million respectively.

So whilst testing relative to population size is higher in the UK, testing *relative to the size of the outbreak* is much, much higher in Taiwan.

As of 11 April, in Taiwan one case was confirmed for every 120 tests. In the UK, a case was confirmed in fewer than every four tests.¹⁴

In Australia, testing coverage is much higher than in Taiwan. But in terms of the number of tests per confirmed case, the countries are much closer – one case was confirmed for every 55 tests in Australia as of 11 April. A number of issues with the data on testing – discussed here – mean that small differences between countries should not be overinterpreted.

But the very large differences – such as those seen between Taiwan, Australia and the UK – do tell us something important about the quality of the data.

A country that performs very few tests for each case it confirms is not testing widely enough for the number of confirmed cases to paint a reliable picture of the true spread of the virus. Whilst those people with the most severe symptoms may have been tested in such countries, there are likely to be many times more people with mild or no symptoms that were never tested.

Testing in the UK has not kept pace with the advancing outbreak. The number of people tested per confirmed case fell rapidly throughout March and early April – from more than 400, to less than 4. The current low level of testing, relative to the size of the outbreak, suggests that the true number of infections in the UK is likely to be far higher than the number of confirmed cases.

The large number of tests for each confirmed case in Taiwan and Australia suggests that the number of confirmed cases paint a much more reliable picture of the true number of infections in these countries.

Researchers from the *London School of Hygiene and Tropical Medicine* – Timothy Russel, Joel Hellewell, Sam Abbott and others – reach similar conclusions about the UK and Australia via a different method.¹⁵ They estimate the degree to which countries' confirmed cases may underestimate total symptomatic cases by applying the case fatality rate (we explain this metric in detail here) observed in large studies in China and South Korea to data on the number of COVID-19 deaths in countries around the world.

They estimate that in Australia the number of confirmed cases reflect more than three quarters of the total number of symptomatic cases in the country. For the UK, they estimate that confirmed cases represent less than one in twenty symptomatic cases.¹⁶

As such, the gap between the UK and Australia in terms of the true number of infections is likely to be far higher than that indicated by their confirmed cases.

The intuition behind these researchers' estimates is that where the number of confirmed cases looks low against the number of deaths, this is a clear indication that the true number of cases is likely to be much, much higher. But the fundamental reason for this is the limited extent of testing.

The rate of tests per case thus gives us another useful way of approaching the same question, by looking at the extent of testing relative to the number of cases directly.

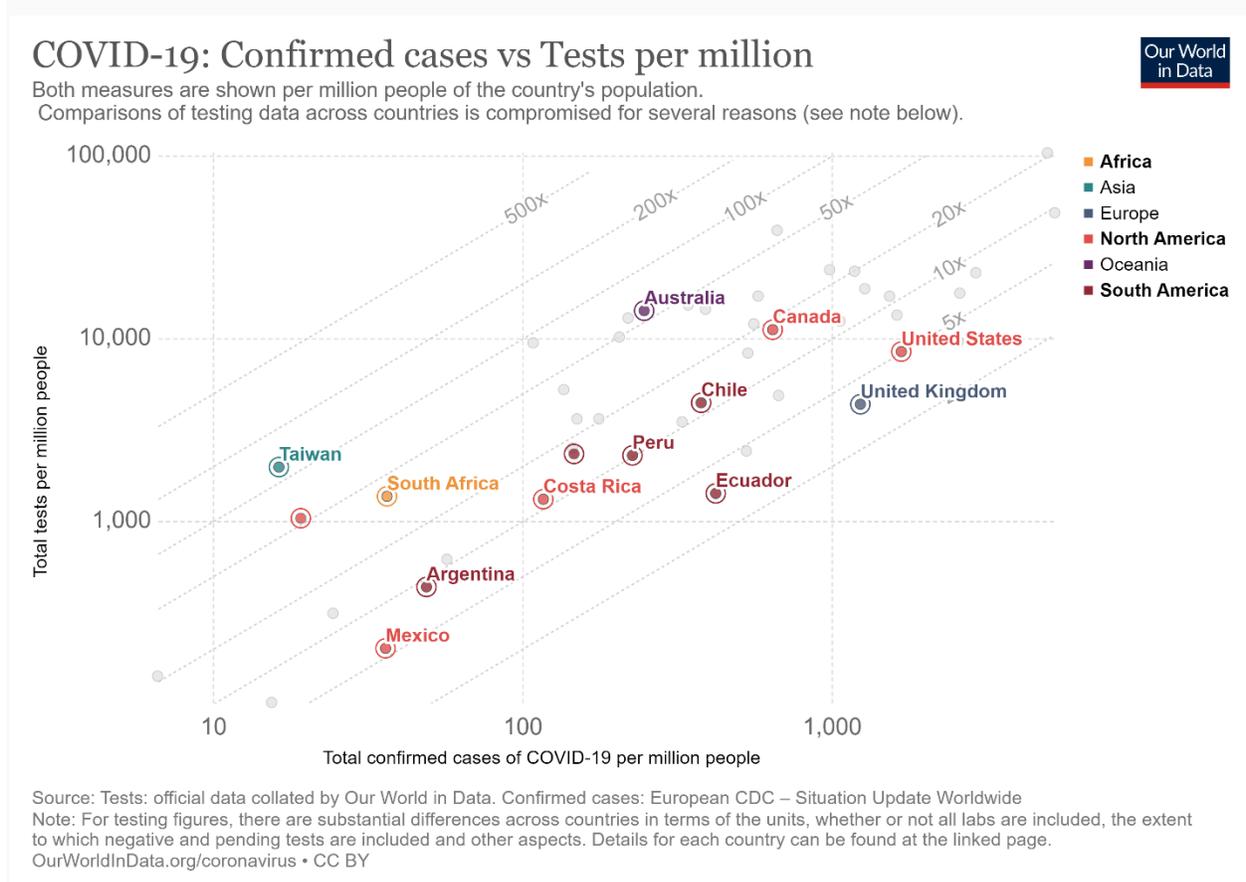


Fig. D

<https://ourworldindata.org/grapher/covid-19-tests-cases-scatter-with-comparisons?country=AUS+TWN+GBR+USA+MEX+CRI+CAN+SLV+PER+ECU+URY+CHL+ARG+ZAF>

Are cases growing at different rates in different countries?

The COVID-19 outbreak started in different countries at different times, and now those countries are at different stages. For instance, on 25 March, Italy had reported 74,386 confirmed cases, while the UK had only reported 8,077.

But it would be useful to know whether cases in the UK now are growing faster, slower, at the same speed as cases did in Italy when it had a similar number.

This chart is designed to allow these comparisons, by showing how quickly the number of cases in each country has grown since the 100th confirmed case. That gives a standard starting place for each line on the graph.

China had a particular fast rise. Just 10 days after the 100th confirmed case the country already confirmed the 10,000th case.

Other countries saw a much slower increase. The speed at which the number of confirmed cases increased in Singapore and Japan was much slower than in other countries.

The straight grey lines show the trajectory for a doubling time of 2 days, 3 days, 5 days and 10 days. If a country's line on the chart is higher than those lines, then its number of cases is doubling faster than that.

The pathway of China and South Korea shows that the speed at which cases rise is not necessarily constant over time. Both countries saw a rapid initial rise but then implemented severe countermeasures (see [here](#)), and the pathway became flatter, meaning that the spread of the disease has slowed down.

Confirmed COVID-19 cases

The number of confirmed cases is lower than the number of total cases. The main reason for this is limited testing.

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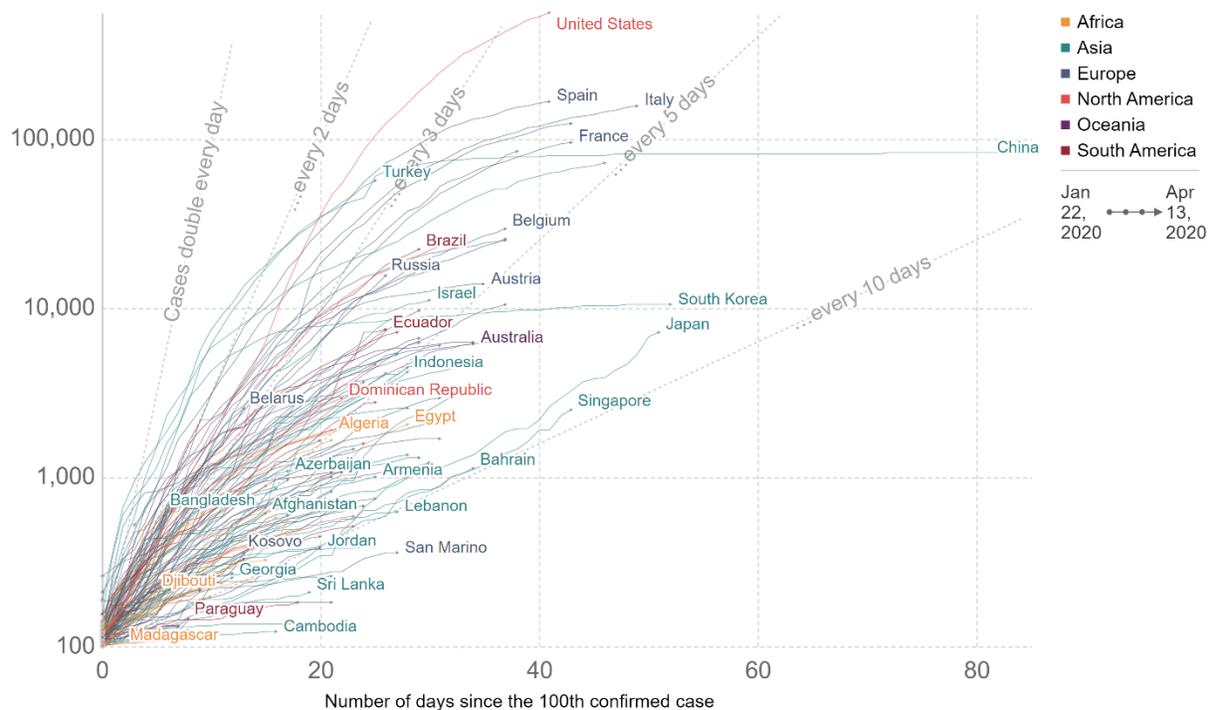


Fig. E

Source: European CDC – Situation Update Worldwide – Last updated 13th April, 11:30 (London time) OurWorldInData.org/coronavirus • CC BY

<https://ourworldindata.org/grapher/covid-confirmed-cases-since-100th-case>

Total confirmed cases

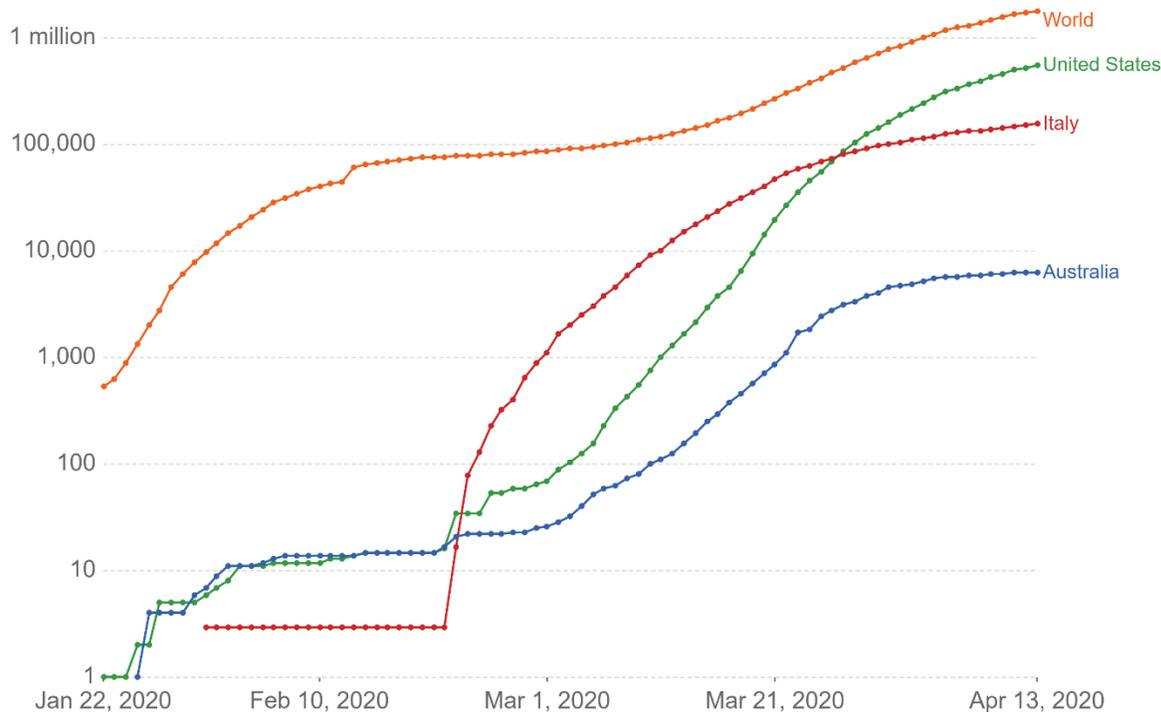
This chart shows the total number of confirmed COVID-19 cases.

By switching from the linear to a logarithmic y-axis it is possible to compare the growth rate between countries – on a logarithmic scale the steepness of the line corresponds to the growth rate.

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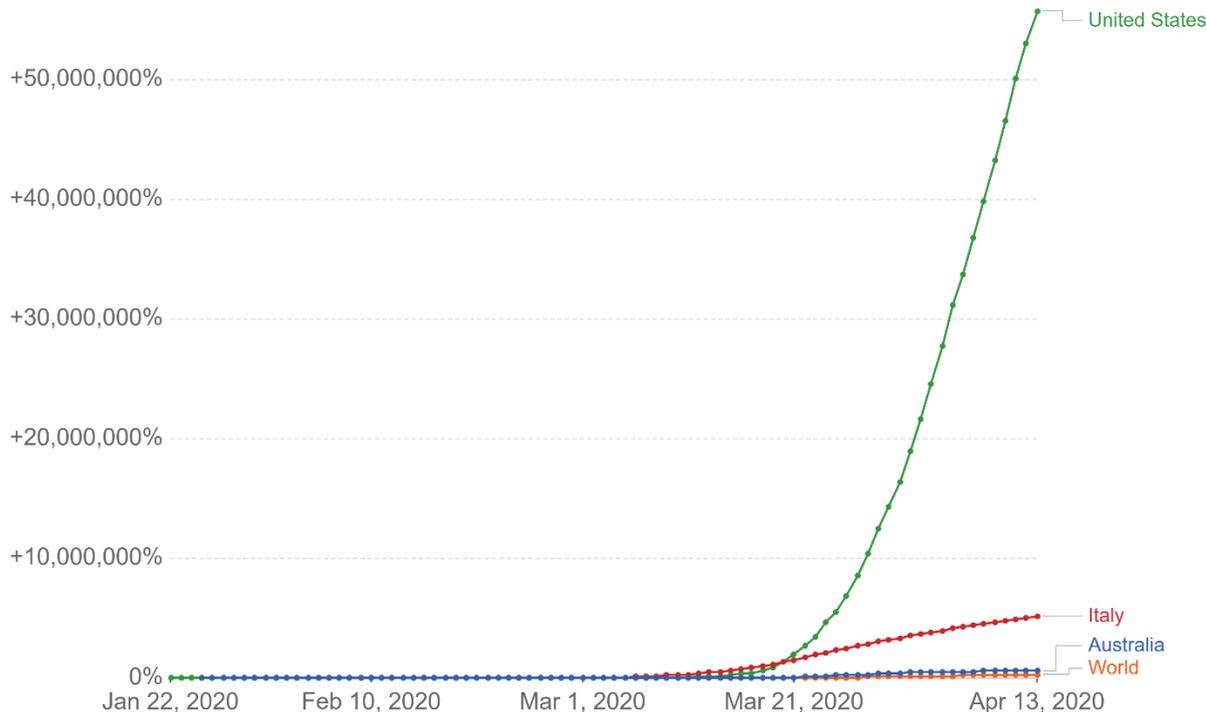
Source: European CDC – Situation Update Worldwide – Last updated 13th April, 11:30 (London time) OurWorldInData.org/coronavirus • CC BY

Fig. F

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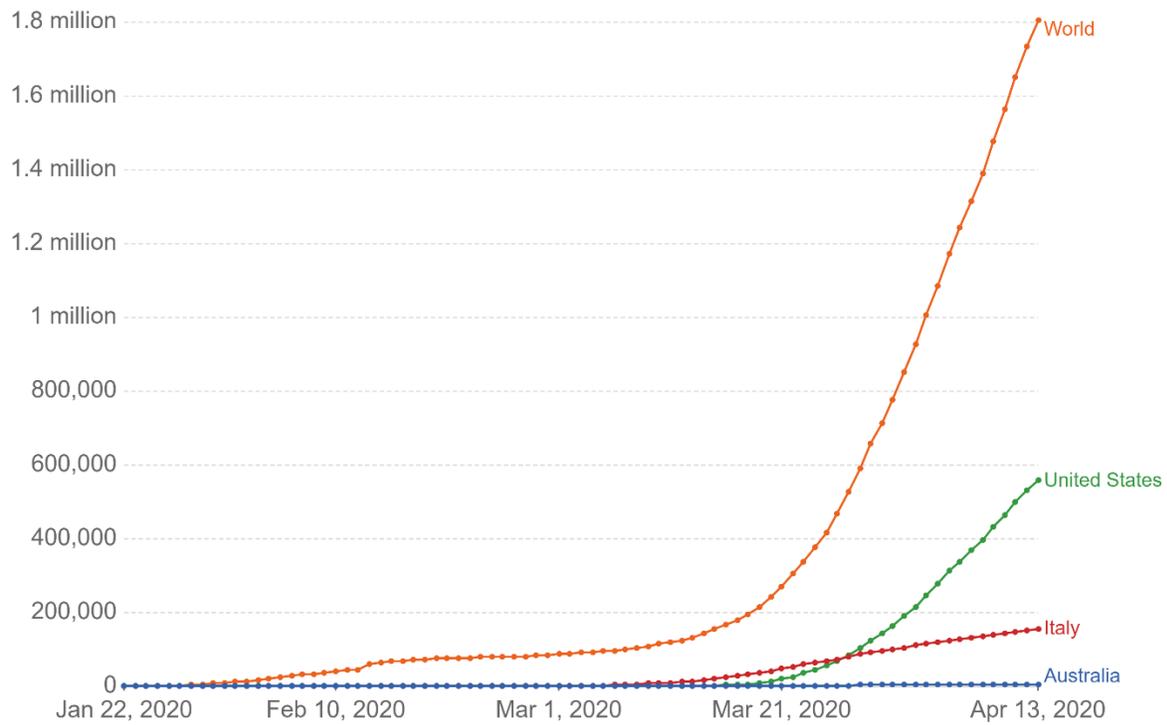


Source: European CDC – Situation Update Worldwide – Last updated 13th April, 11:30 (London time) OurWorldInData.org/coronavirus • CC BY

Fig. G

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Source: European CDC – Situation Update Worldwide – Last updated 13th April, 11:30 (London time) OurWorldInData.org/coronavirus • CC BY

Fig. H

https://ourworldindata.org/grapher/total-cases-covid-19?yScale=log&country=OWID_WRL+USA+ITA+AUS