

A **logistic function** or **logistic curve** is a common "S" shape ([sigmoid curve](#)), with equation:

$$f(x) = \frac{L}{1 + e^{-k(x-x_0)}}$$

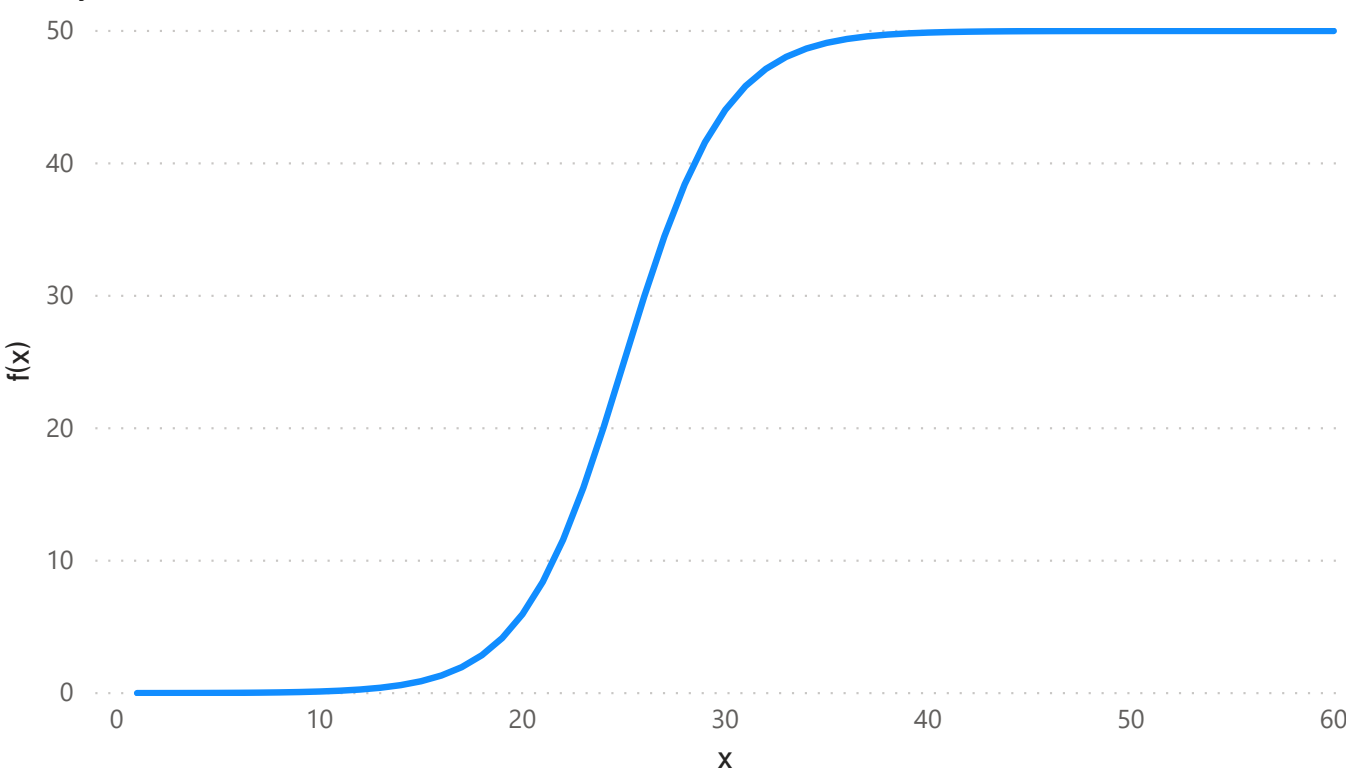
where

- $e$  = the [natural logarithm](#) base (also known as [Euler's number](#)),
- $x_0$  = the  $x$ -value of the sigmoid's midpoint,
- $L$  = the curve's maximum value, and
- $k$  = the logistic growth rate or steepness of the curve.<sup>[1]</sup>

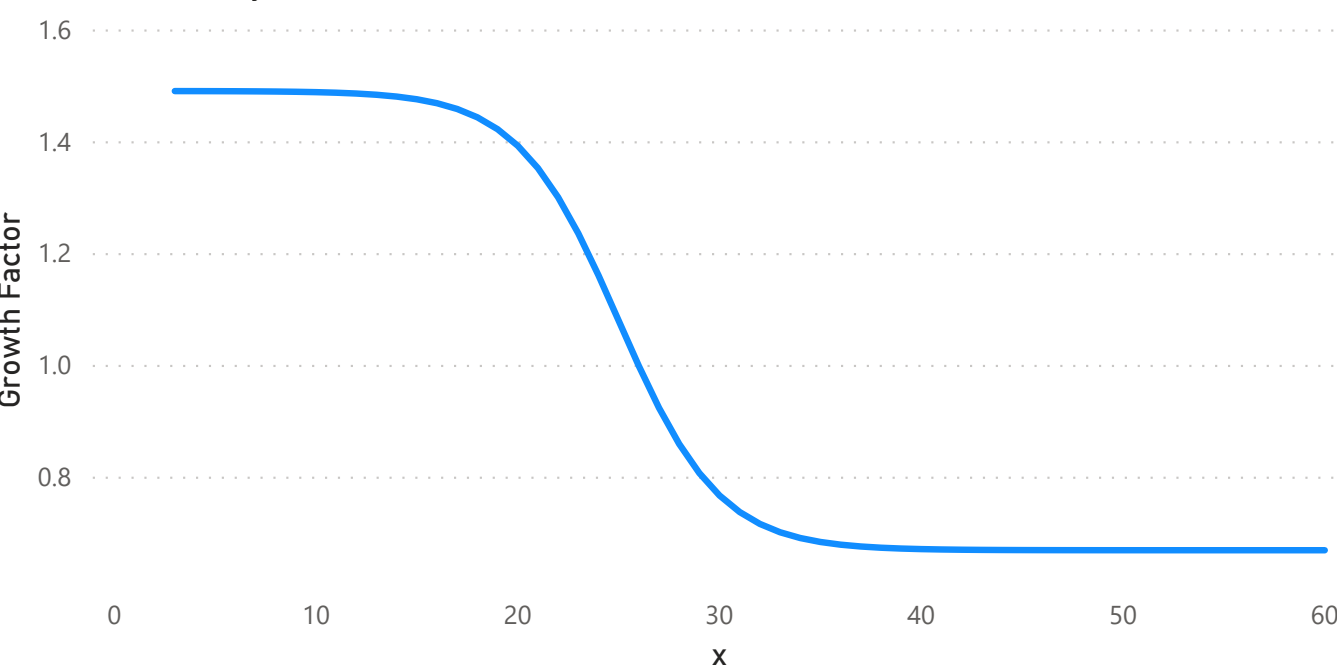
More information on [wikipedia](#)

In this example we are using: L=50, k=0.4, x0=25

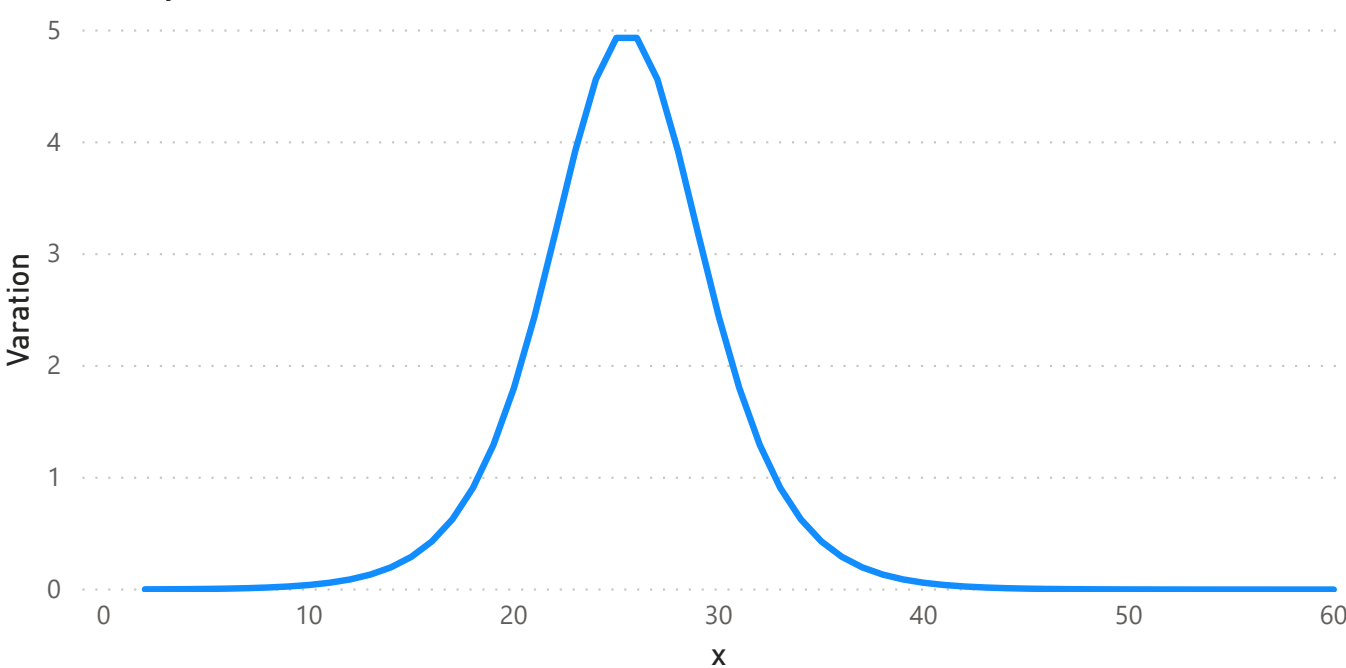
f(x) by x



Growth Factor by x

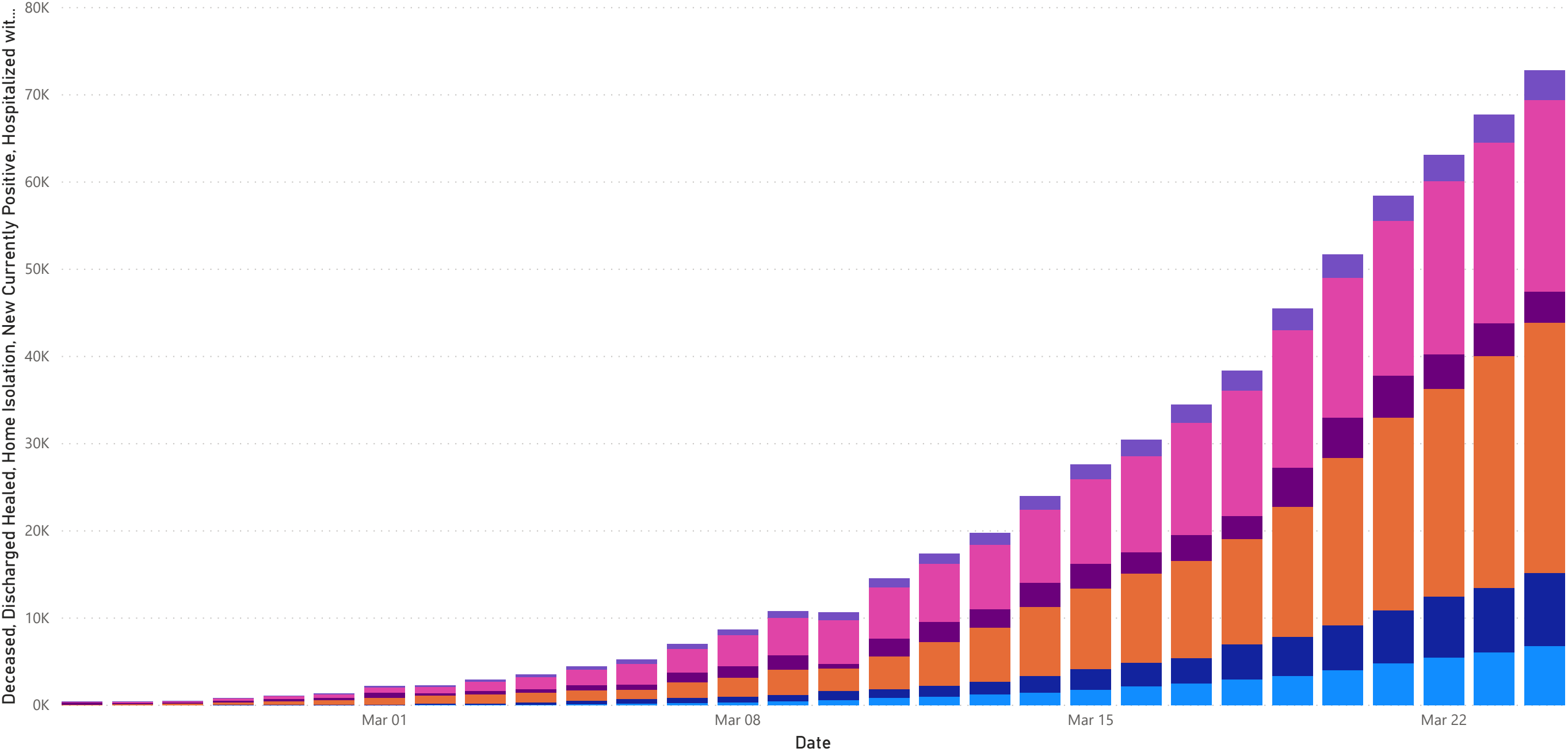


Variation by x



Deceased, Discharged Healed, Home Isolation, New Currently Positive, Hospitalized with Symptoms and Intensive Care by Date

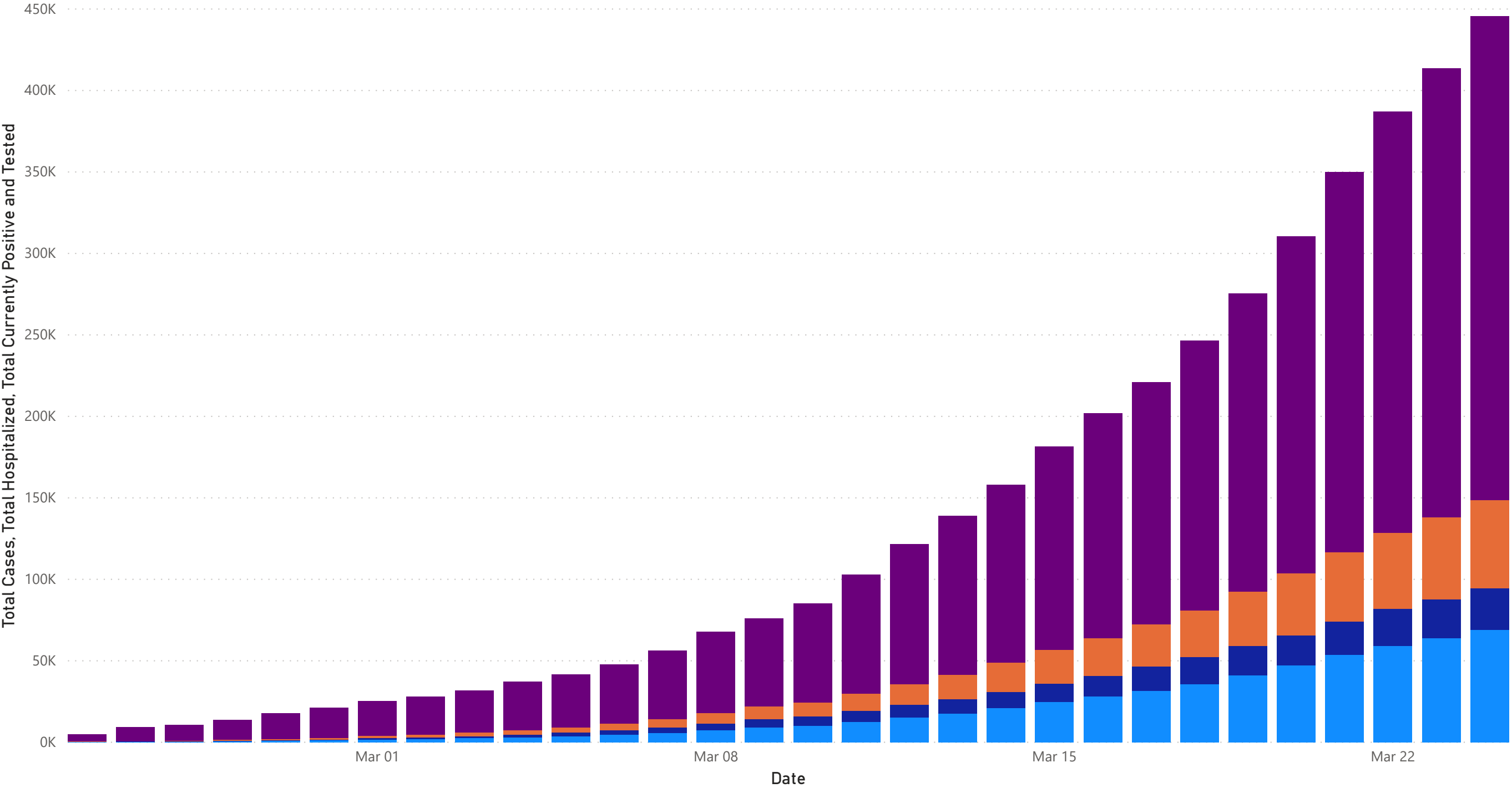
Deceased Discharged Healed Home Isolation New Currently Positive Hospitalized with Symptoms Intensive Care



Data from [Protezione Civile](#)

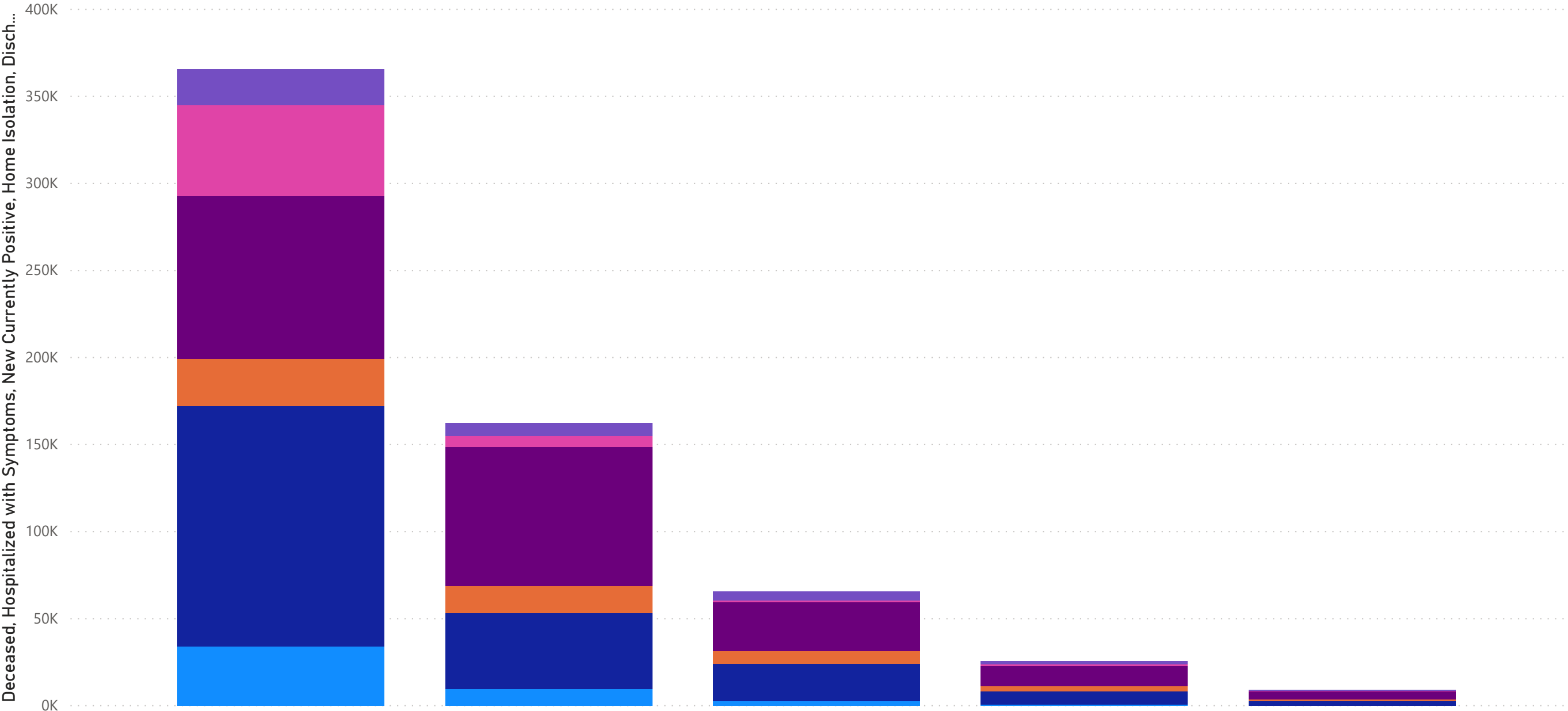
Total Cases, Total Hospitalized, Total Currently Positive and Tested by Date

Total Cases Total Hospitalized Total Currently Positive Tested



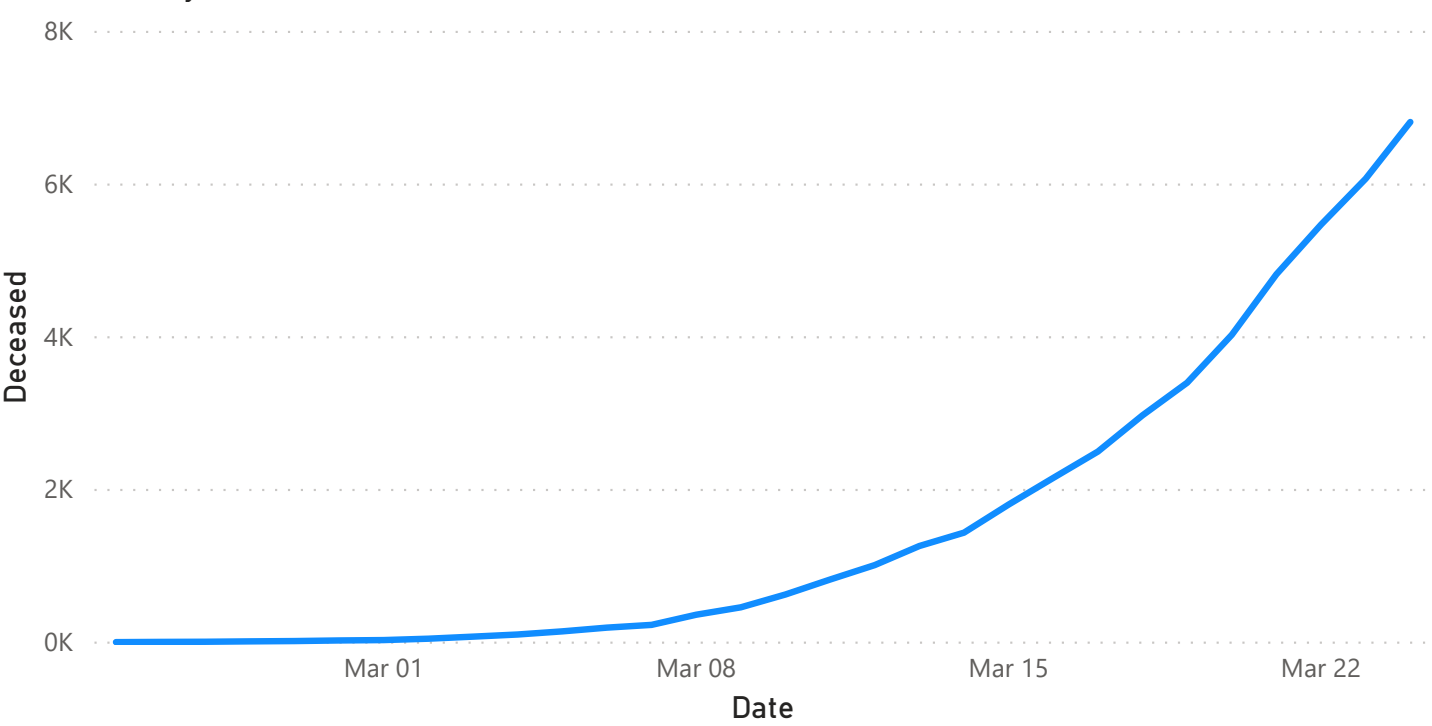
Deceased, Hospitalized with Symptoms, New Currently Positive, Home Isolation, Discharged Healed and Intensive Care by Macro Region

Deceased Hospitalized with Symptoms New Currently Positive Home Isolation Discharged Healed Intensive Care

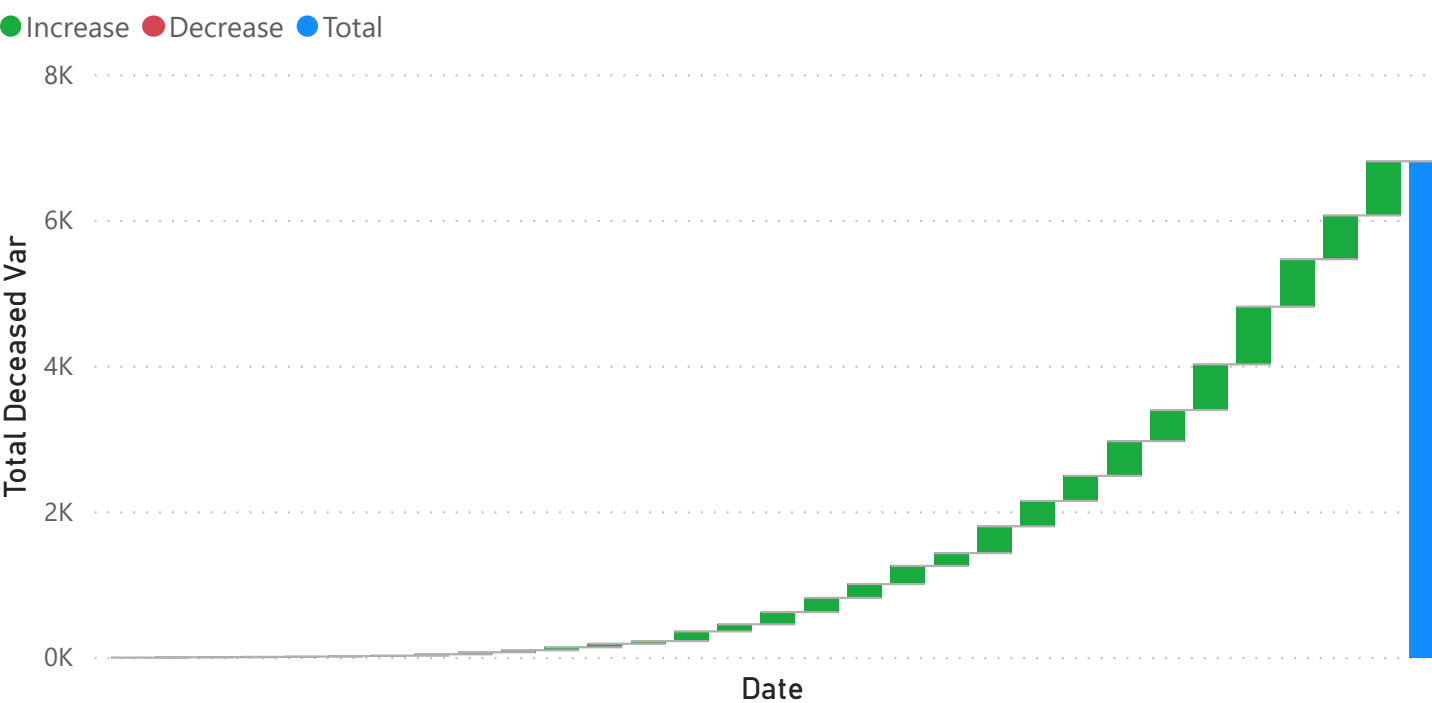


The virus started spreading in North Italia especially in Lombardia

Deceased by Date



Total Deceased Var by Date

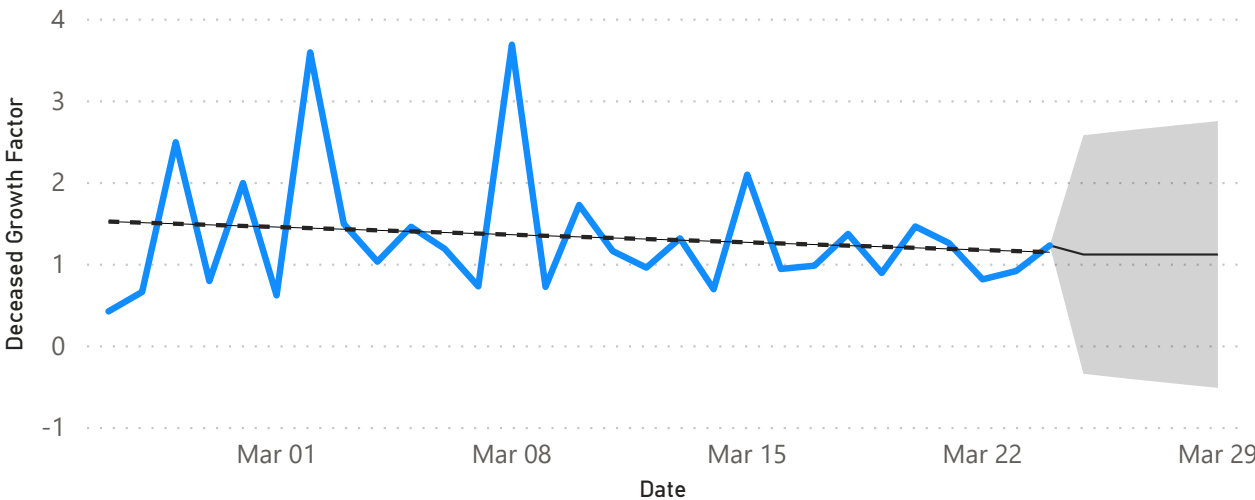


Because it is not possible to test all the population everyday to get the real number of infected people let's consider the number of deaths as starting point for our analysis

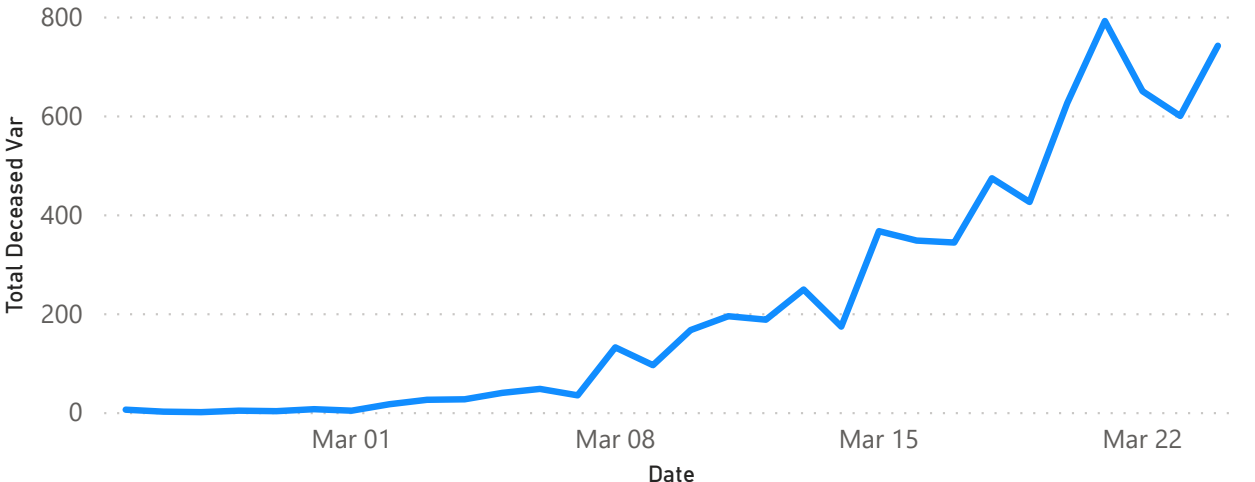
How many infected people are needed to get the the deaths we see? Of course to compute this we need to know the death\_rate of the disease

Let's take China as reference country because the disease started there and we can a have a look at the complete evolution of the spreading, in fact their data match pretty well a logistic curve which is the common math model for the spreading of a virus

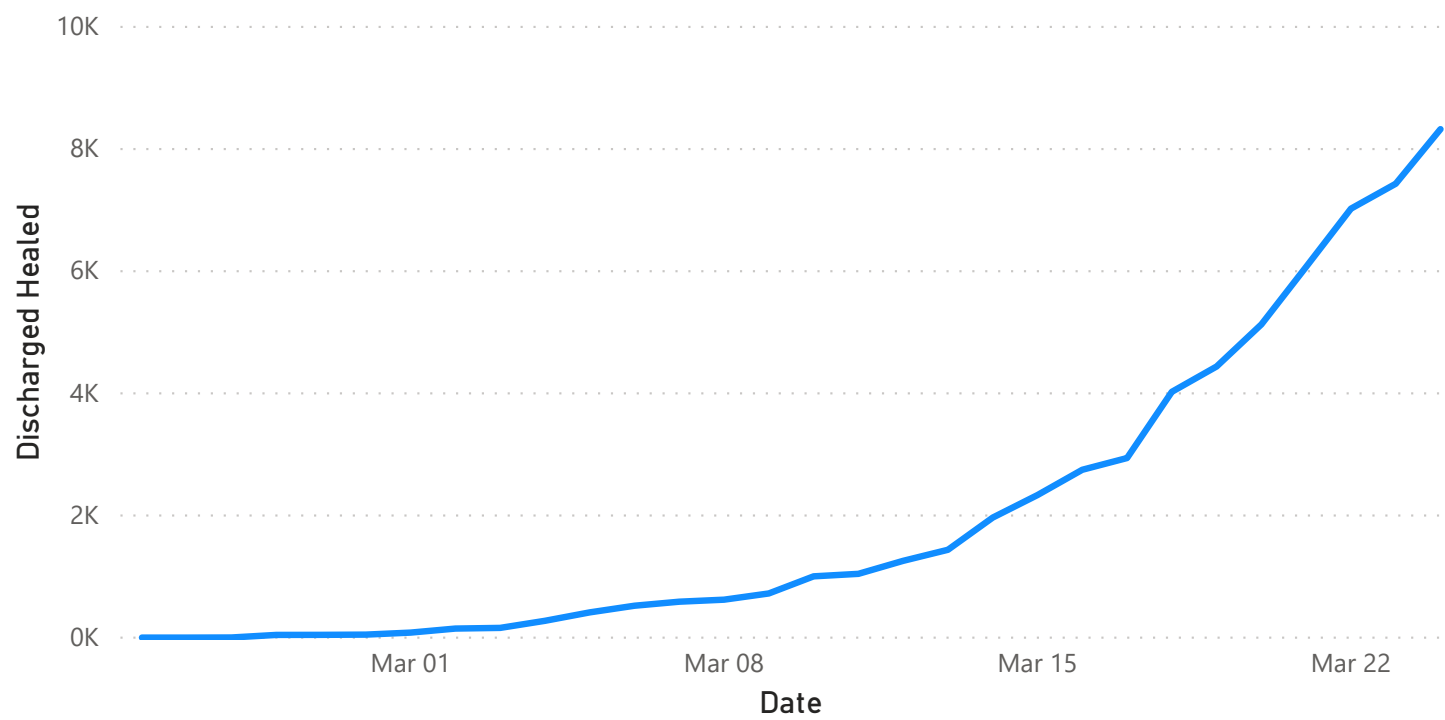
Deceased Growth Factor by Date



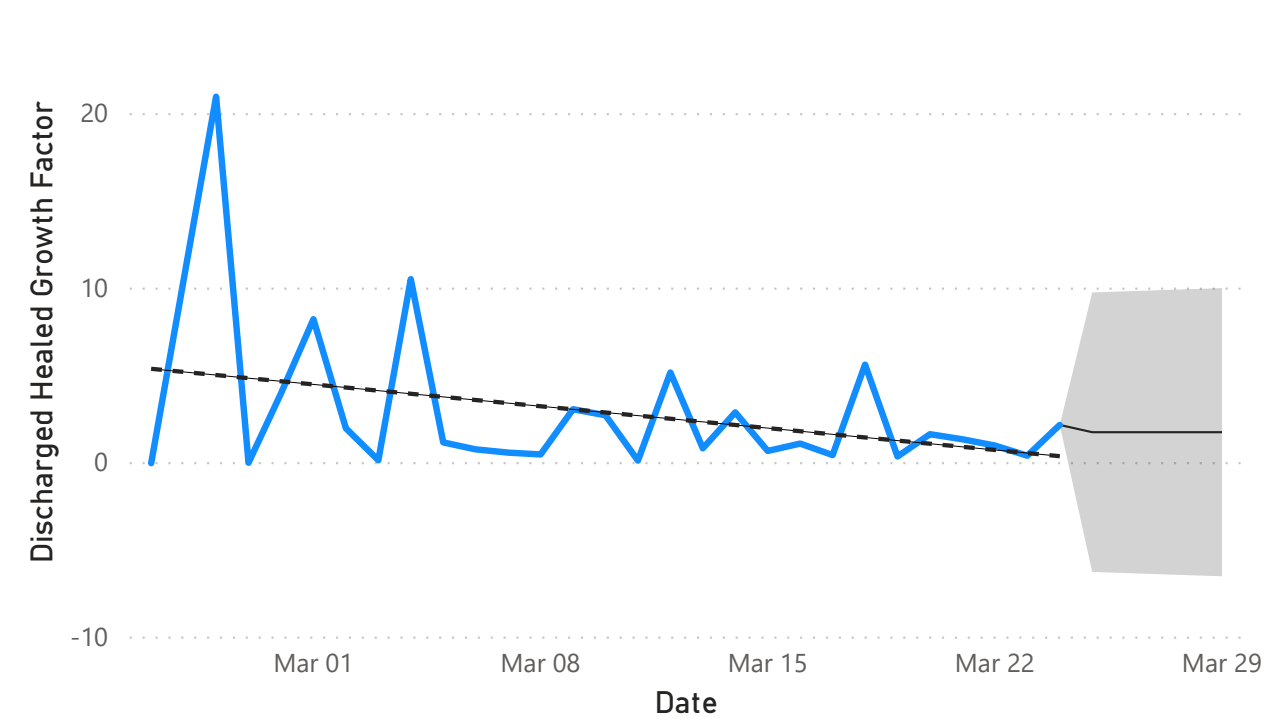
Total Deceased Var by Date



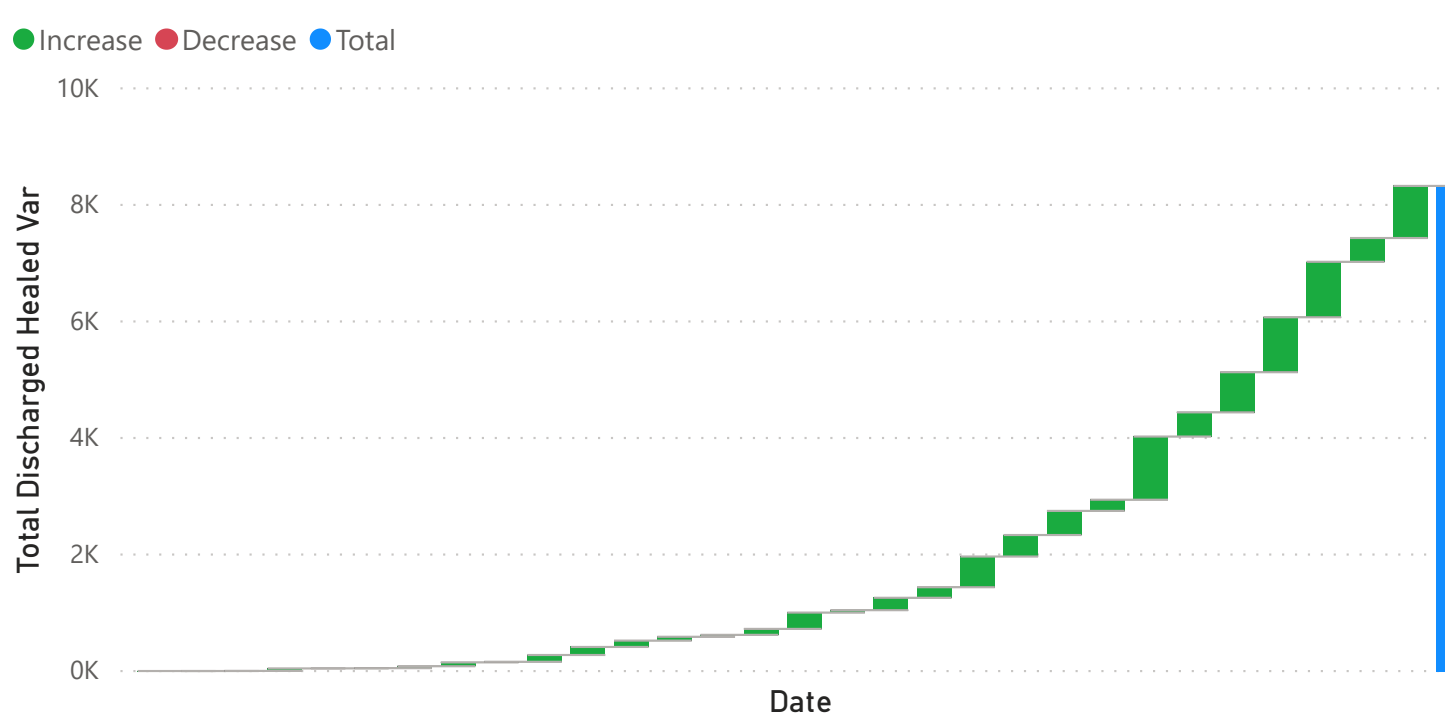
### Discharged Healed by Date



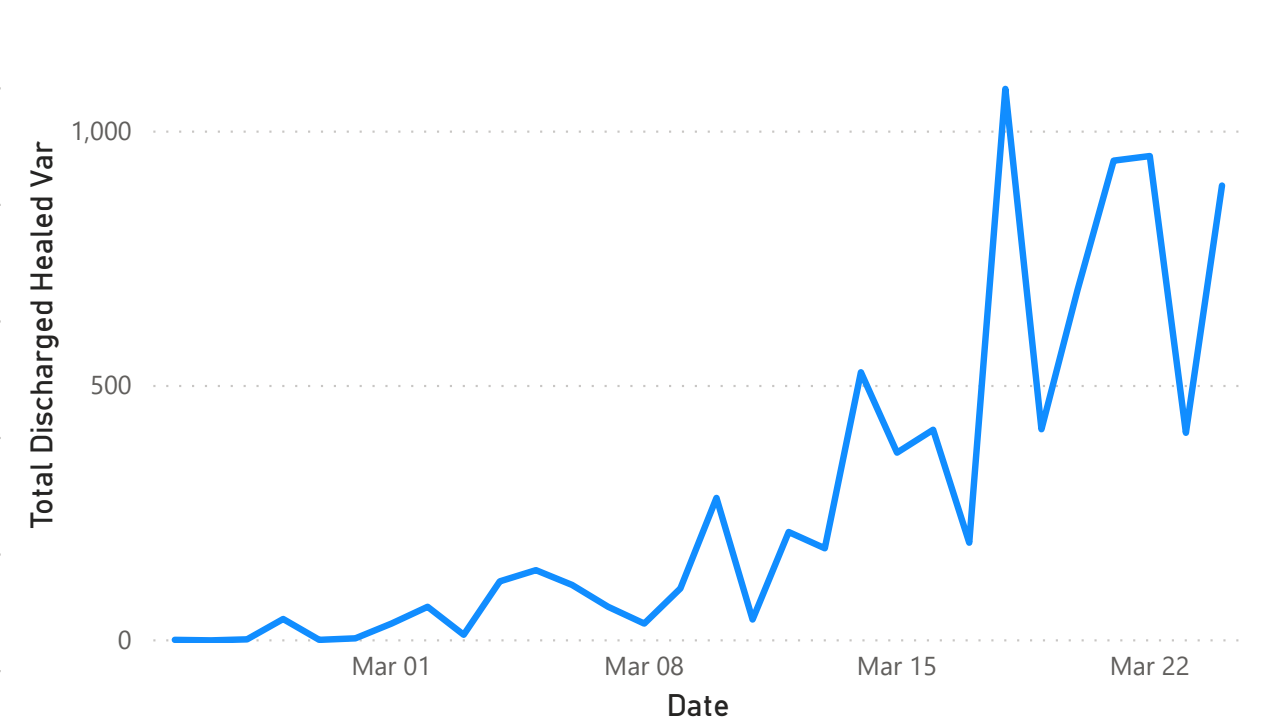
### Discharged Healed Growth Factor by Date



### Total Discharged Healed Var by Date

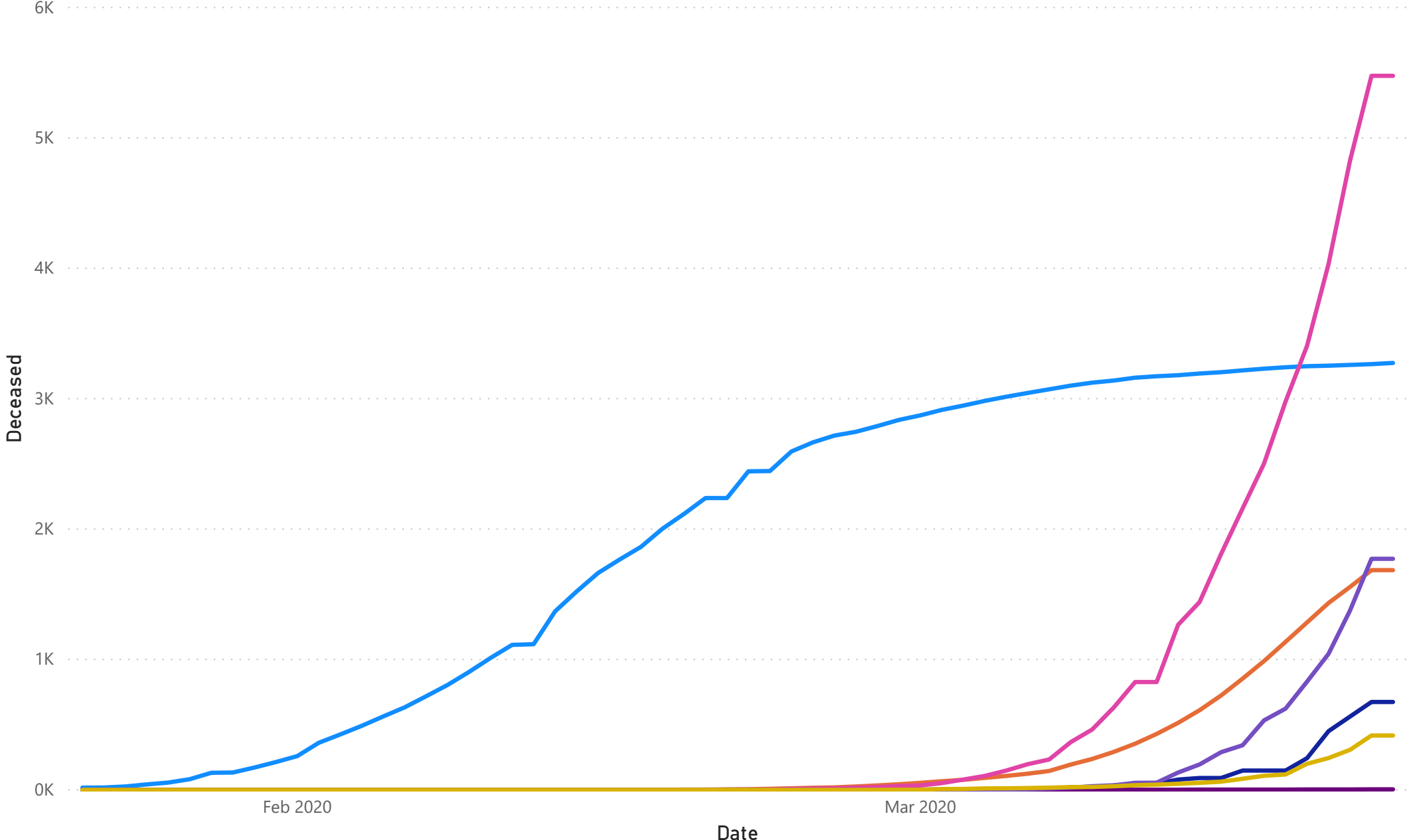


### Total Discharged Healed Var by Date



## Deceased by Date and State

**State** ● China ● France ● Iran ● Ireland ● Italia ● Spain ● US



Data from [data.humdata.org](http://data.humdata.org)

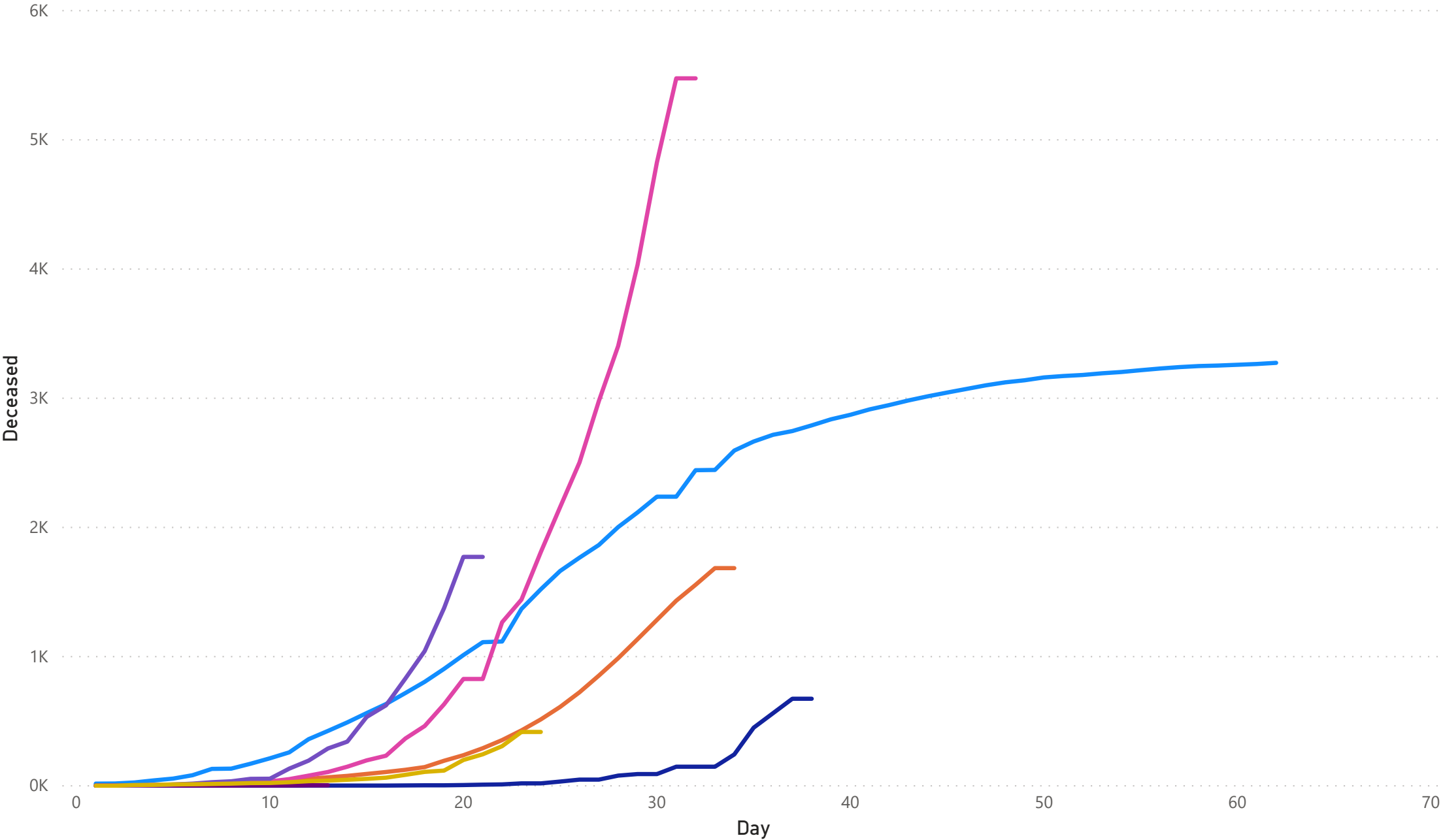
We can see the delay in time needed to covid-19 to reach the others countries from China and the spreading phase

- State
- ☐ Afghanistan
  - ☐ Albania
  - ☐ Algeria
  - ☐ Andorra
  - ☐ Angola
  - ☐ Antigua and Barbuda
  - ☐ Argentina
  - ☐ Armenia
  - ☐ Australia
  - ☐ Austria
  - ☐ Azerbaijan
  - ☐ Bahamas, The
  - ☐ Bahrain
  - ☐ Bangladesh
  - ☐ Barbados
  - ☐ Belarus
  - ☐ Belgium
  - ☐ Benin
  - ☐ Bhutan
  - ☐ Bolivia
  - ☐ Bosnia and Herzegovina
  - ☐ Brazil
  - ☐ Brunei
  - ☐ Bulgaria
  - ☐ Burkina Faso
  - ☐ Cabo Verde
  - ☐ Cambodia
  - ☐ Cameroon
  - ☐ Canada
  - ☐ Cape Verde
  - ☐ Central African Republic
  - ☐ Chad
  - ☐ Chile
  - ☒ China
  - ☐ Colombia
  - ☐ Congo (Brazzaville)
  - ☐ Congo (Kinshasa)



Deceased by Day and State

State ● China ● France ● Iran ● Ireland ● Italia ● Spain ● US

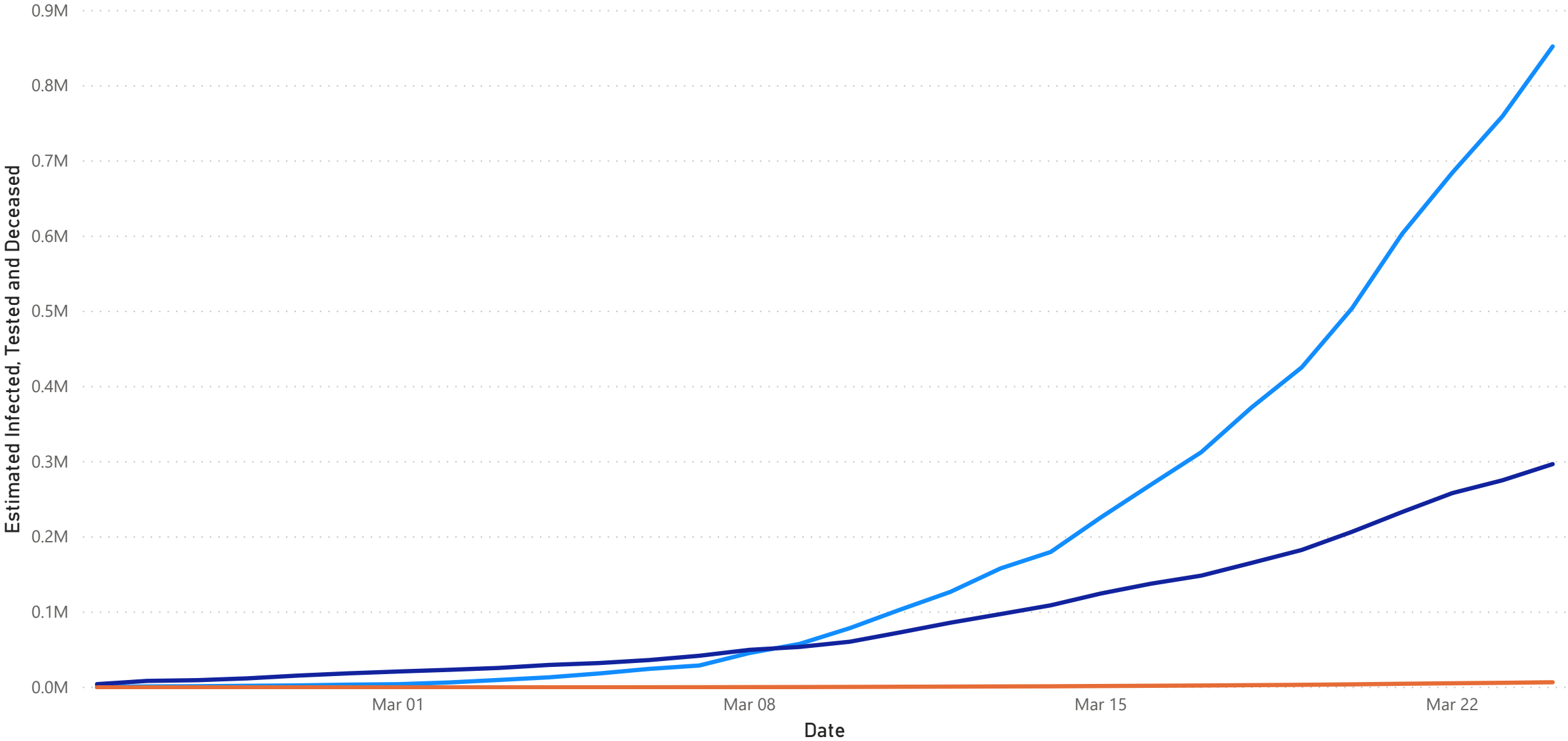


By shifting in time the data we can see the infections spreading in days so we can better compare the trajectories of the deaths for each country  
We can see how in Italia the number of deaths is climbing way faster than in others countries



Estimated Infected, Tested and Deceased by Date

● Estimated Infected ● Tested ● Deceased



Death Rate

0.001  
0.002  
0.003  
0.004  
0.005  
0.006  
0.007  
0.008  
0.009  
0.010  
0.011  
0.012  
0.013  
0.014  
0.015

Death rate in Italy is way higher than in China. This can be caused by a lot of [factors](#): overall age of people, Italy counts every deaths in which covid19 is involved as a death by covid19 even if previous disease were present in the patient (99% of death in Italy happen to people having others diseases. More info about this [here](#))  
More information on [wikipedia](#): "As of 20 March 2020, the [rate of deaths per number of diagnosed cases](#) is 4.1%; however, it ranges from 0.2% to 15% according to age group and other health problems"