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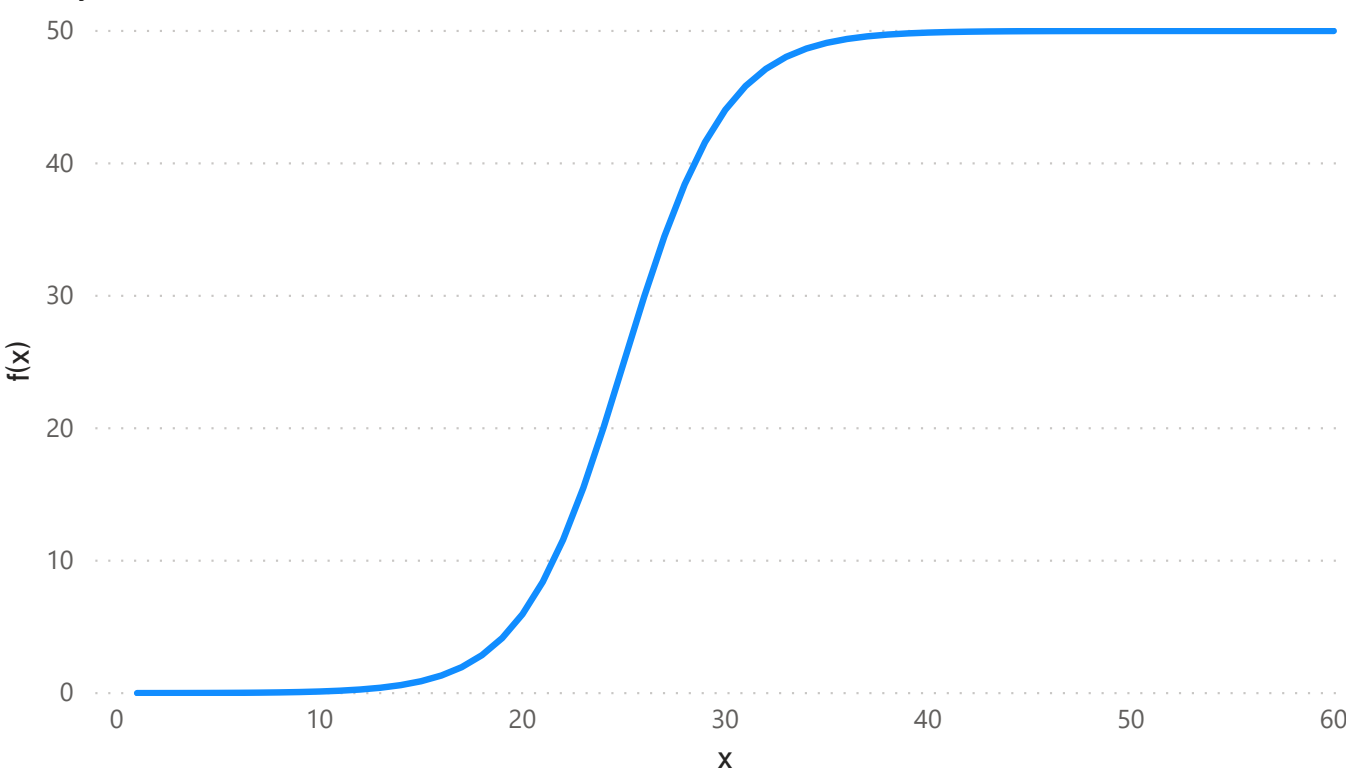
- e = the natural logarithm base (also known as Euler's number),
- x_0 = the x-value of the sigmoid's midpoint,
- L = the curve's maximum value, and
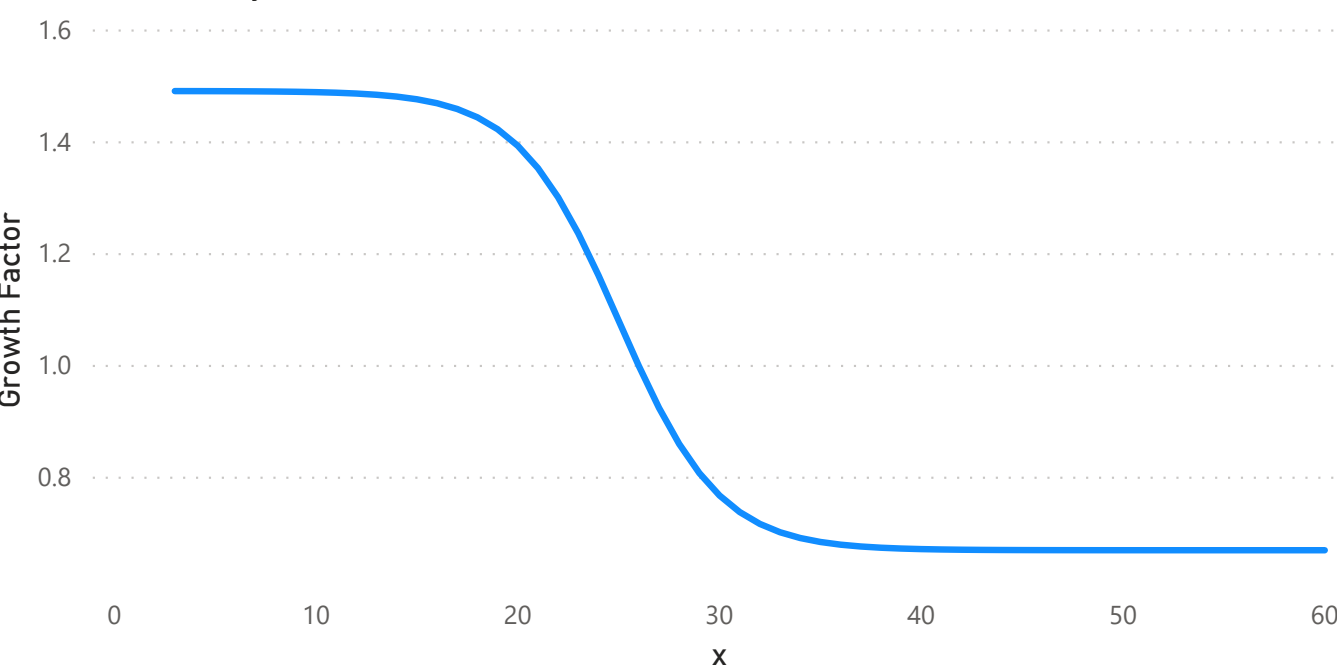- k = the logistic growth rate or steepness of the curve.[1]

More information on wikipedia
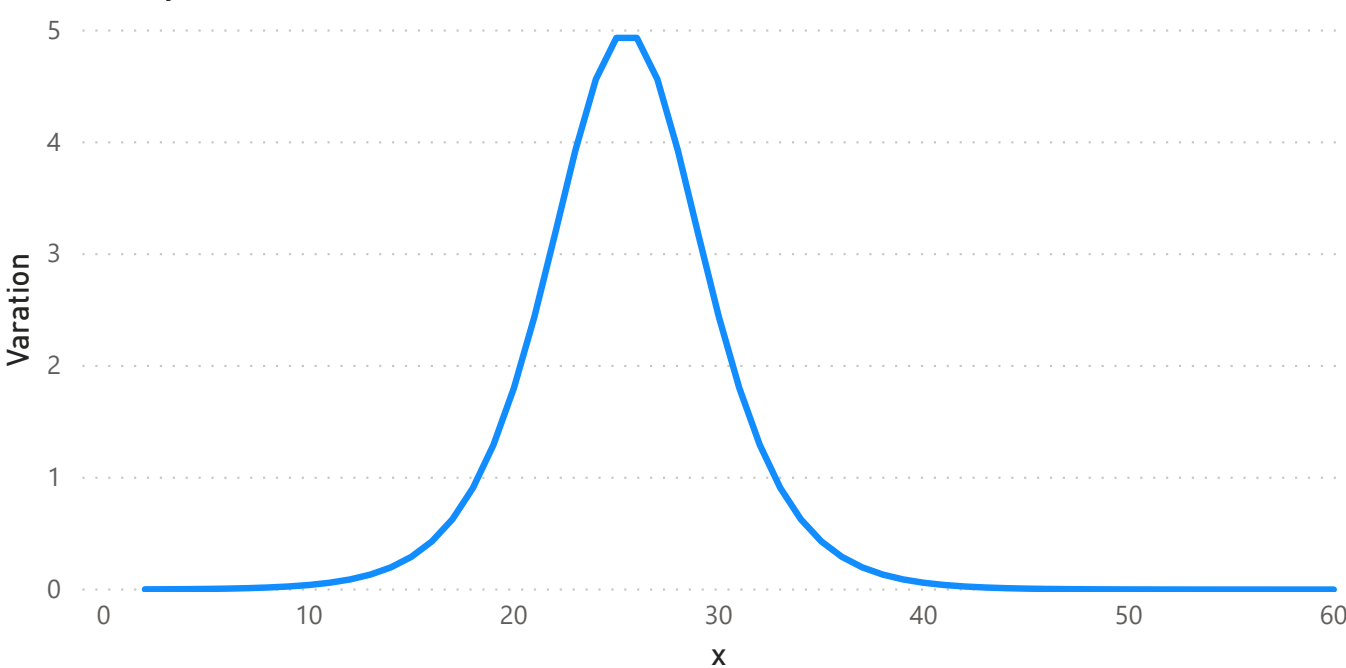
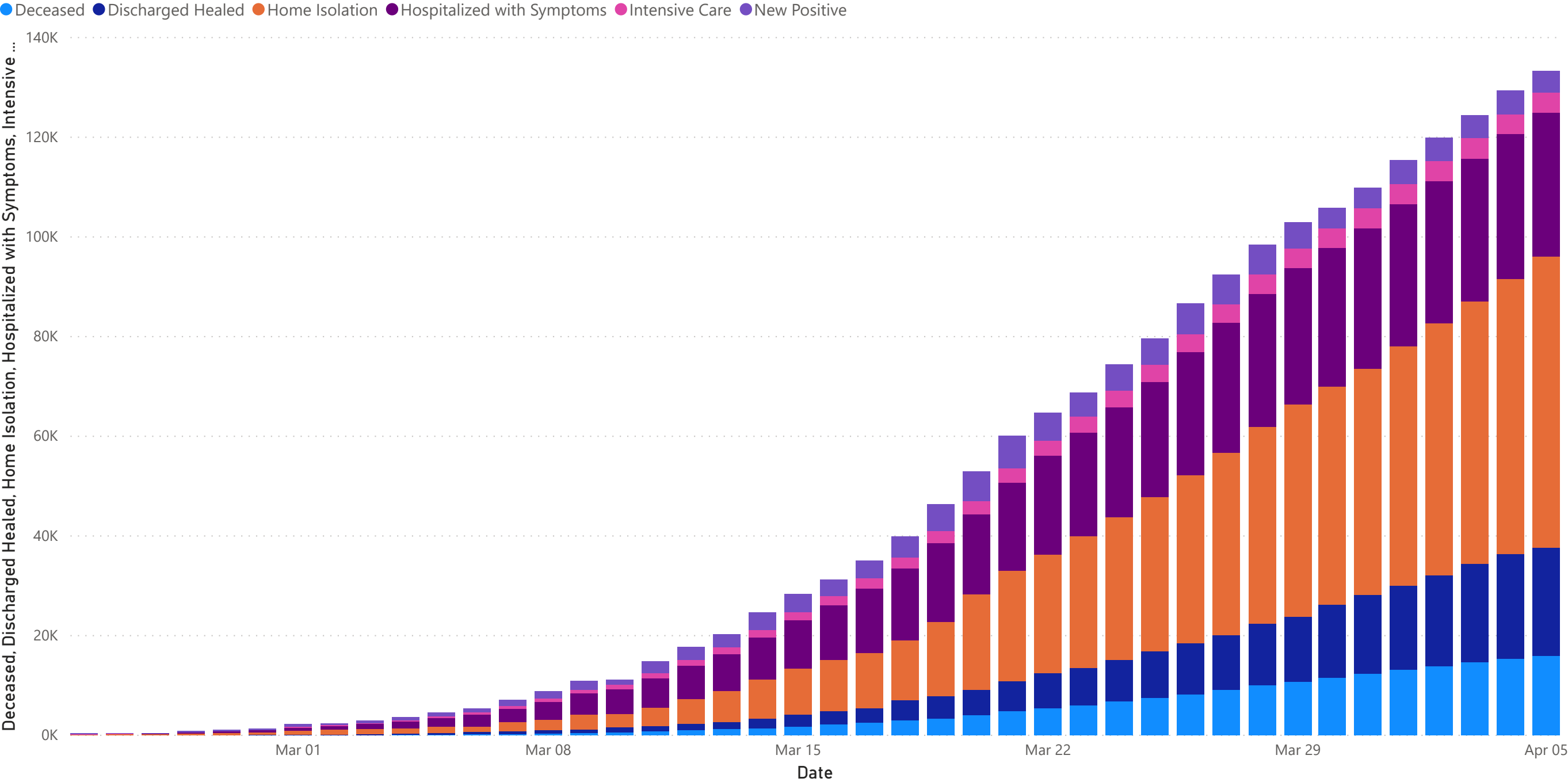In this example we are using: L=50, k=0.4, x0=25

f(x) by x

Growth Factor by x

Varation by x

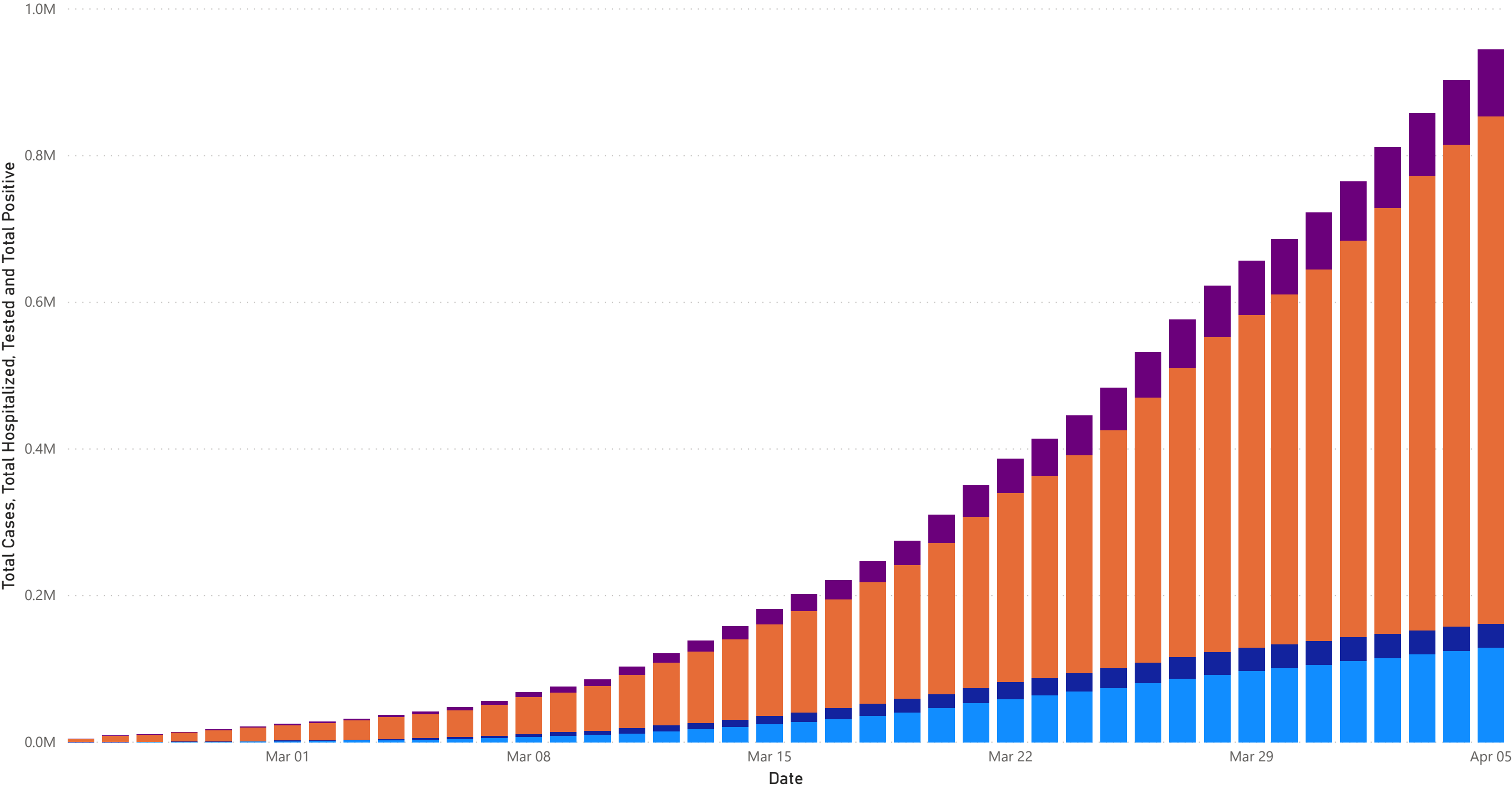# Deceased, Discharged Healed, Home Isolation, Hospitalized with Symptoms, Intensive Care and New Positive by Date

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

Data from Protezione Civile

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

● Total Cases ● Total Hospitalized ● Tested ● Total Positive

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

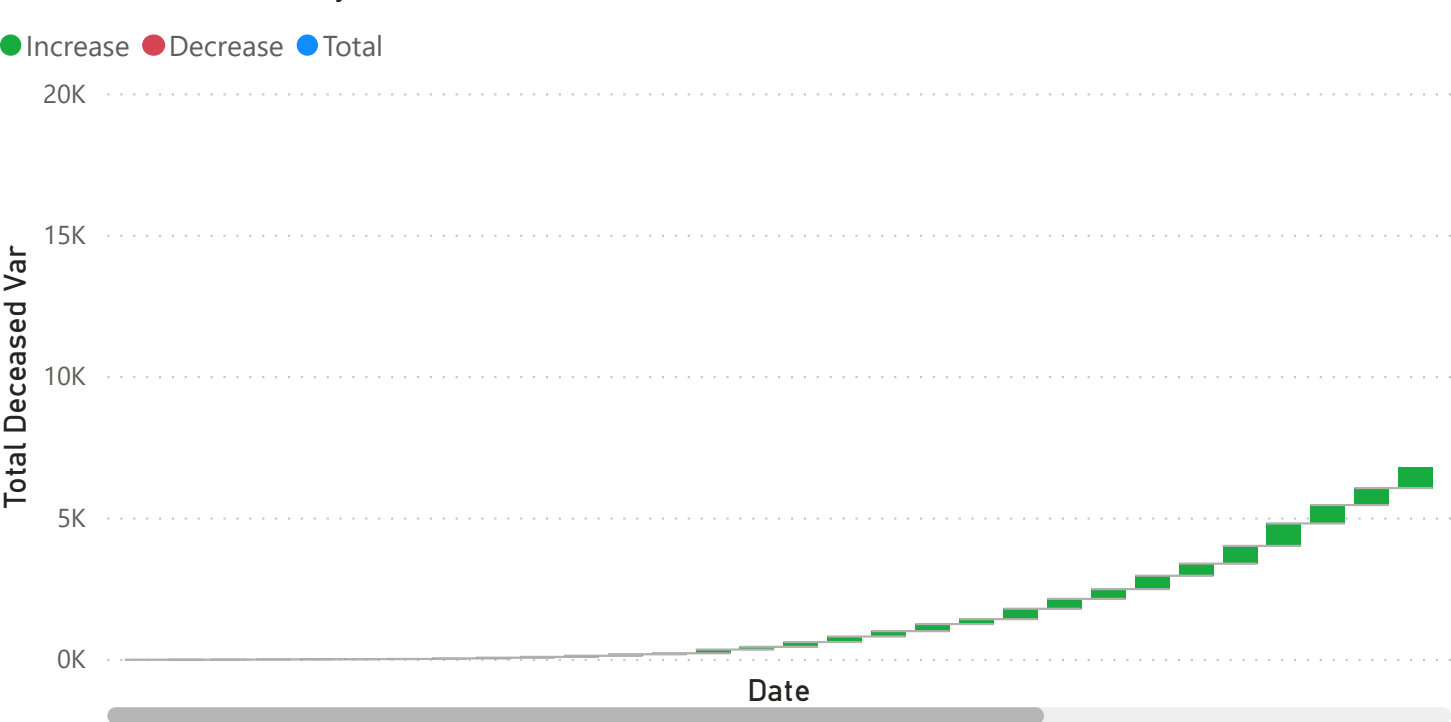● Deceased ● Hospitalized with Symptoms ● Home Isolation ● Discharged Healed ● Intensive Care ● New Positive
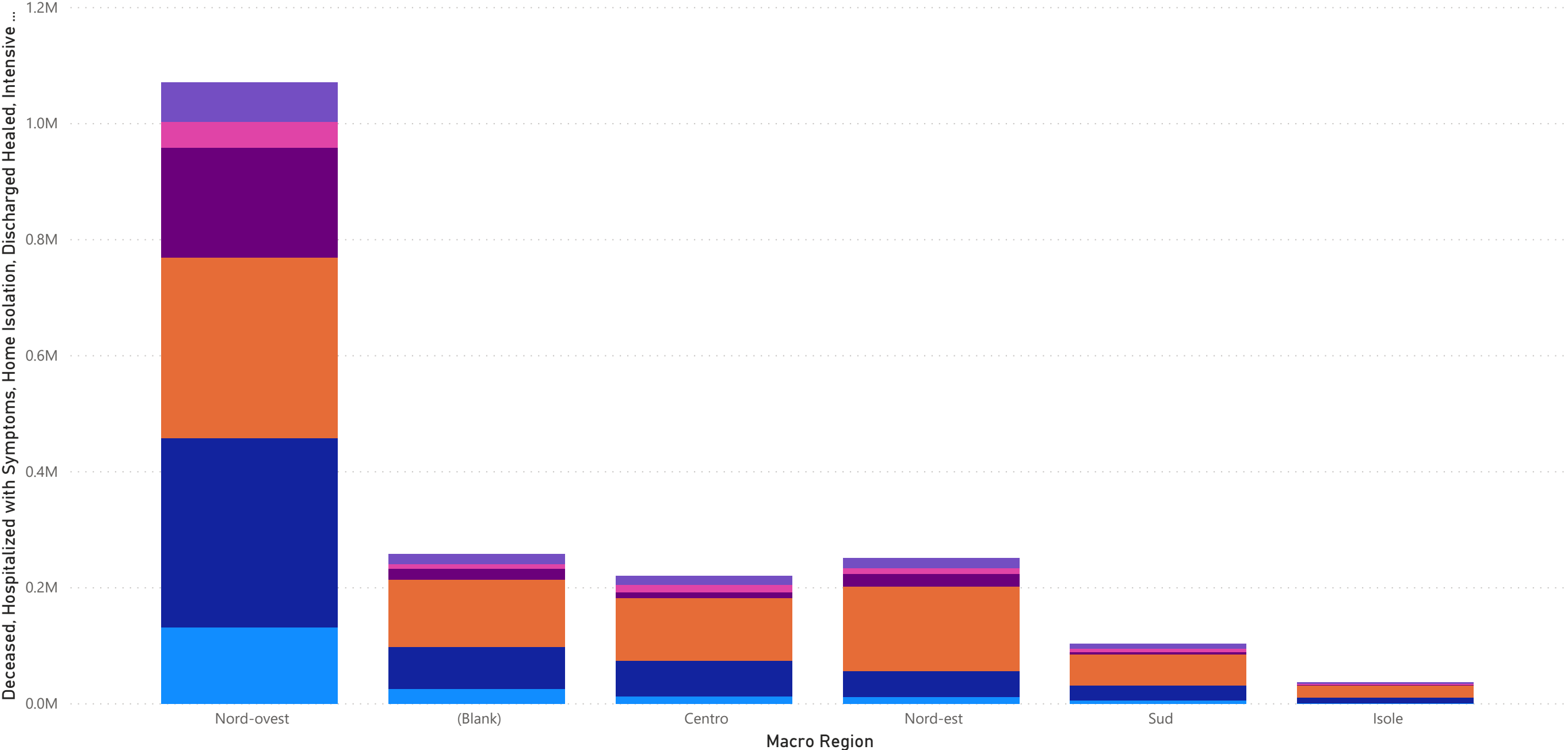
The virus started spreading in North Italia especially in Lombardia

Deceased by Date

Total Deceased Var by Date

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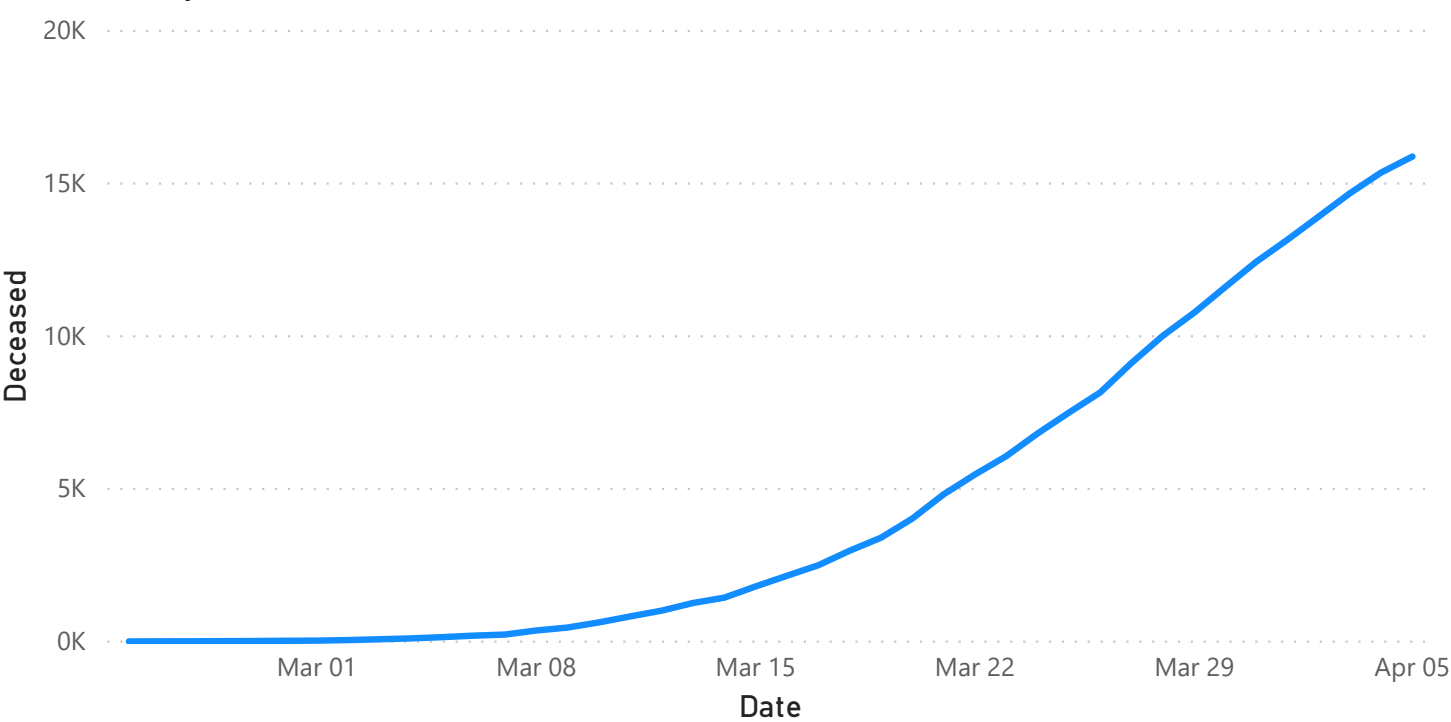
Because it is not possible to test all the population everyday to get the real number of infected people let's consider the number of deaths as starting point for our analysis

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

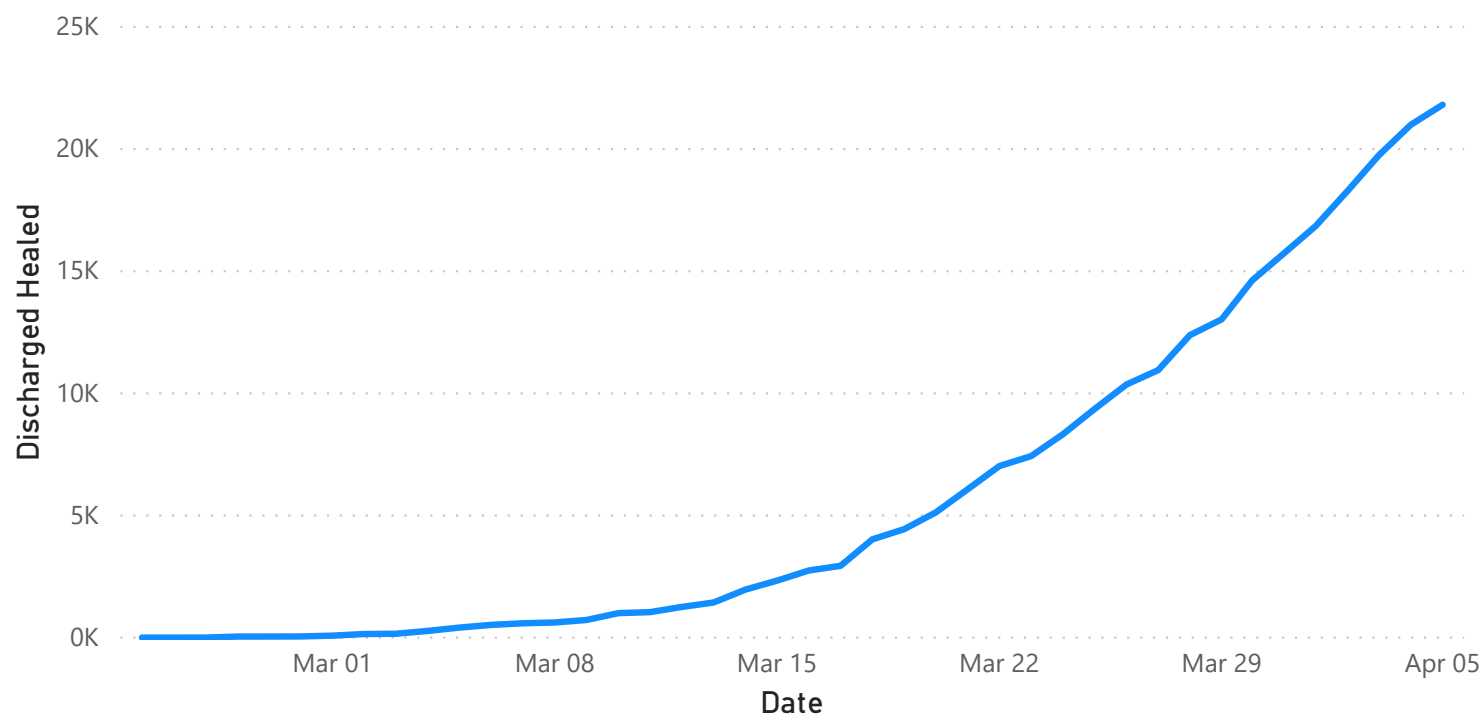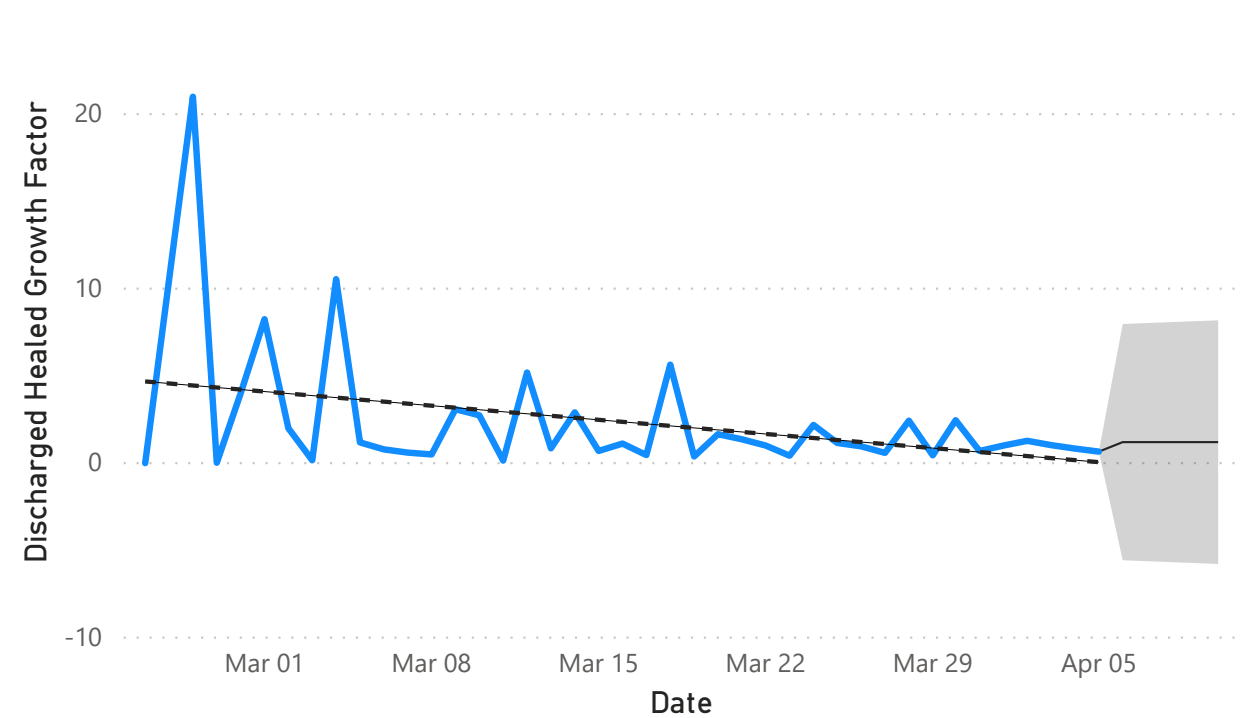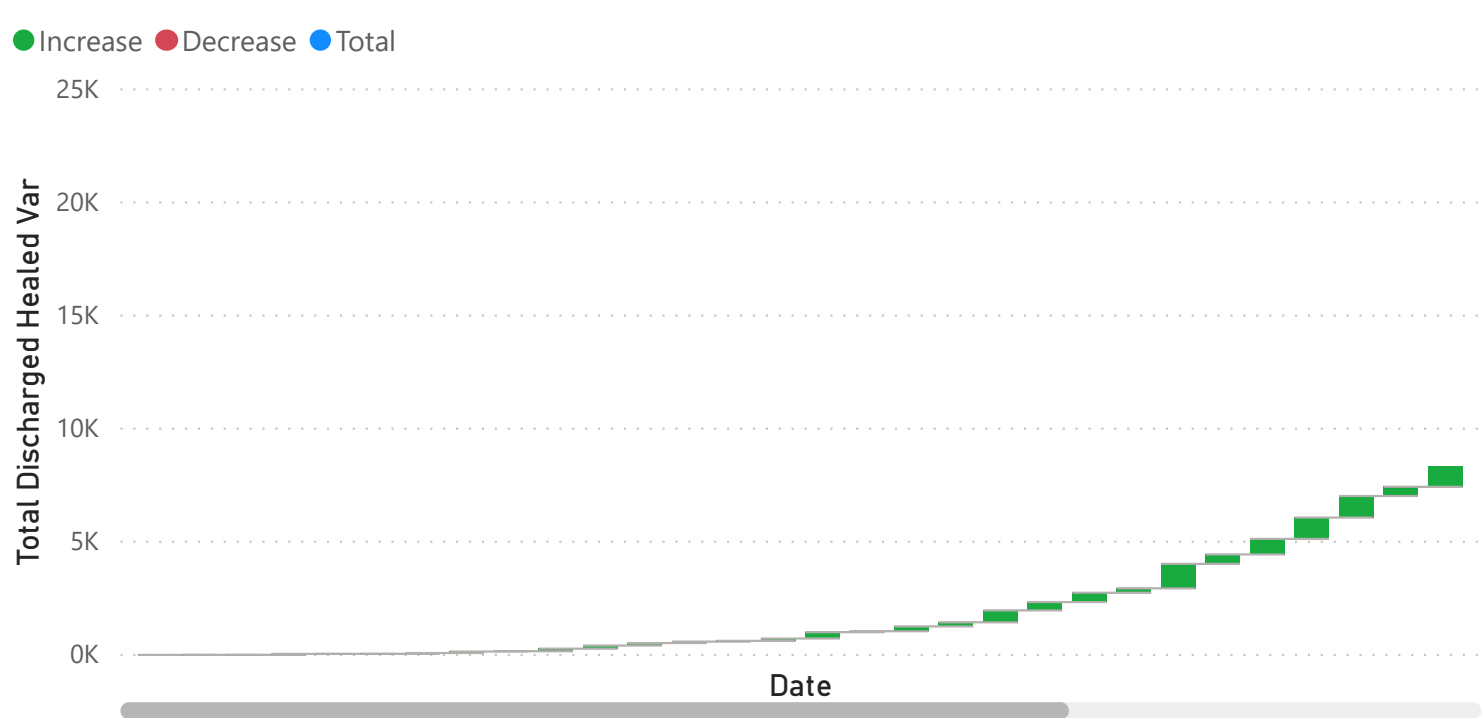## Deceased Growth Factor by Date
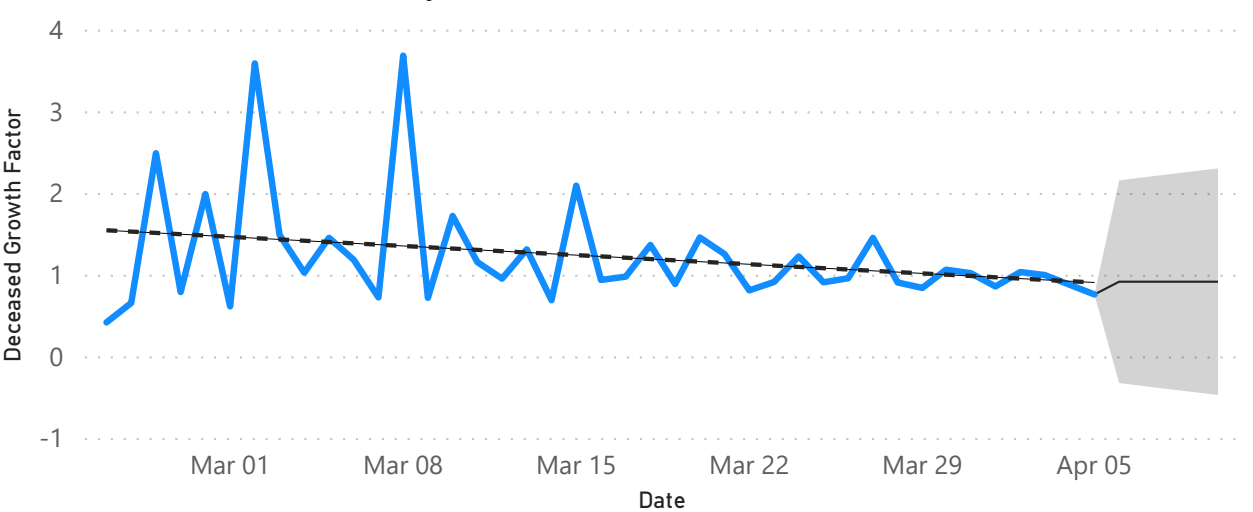
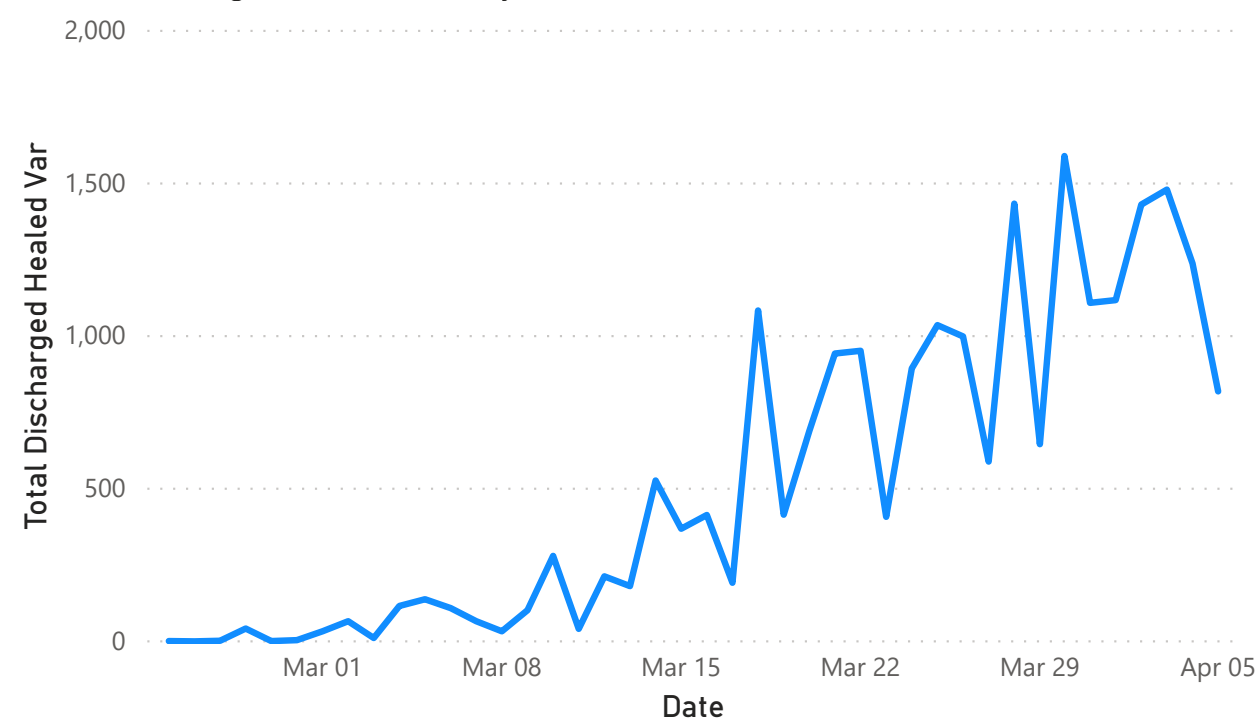## Total Deceased Var by Date
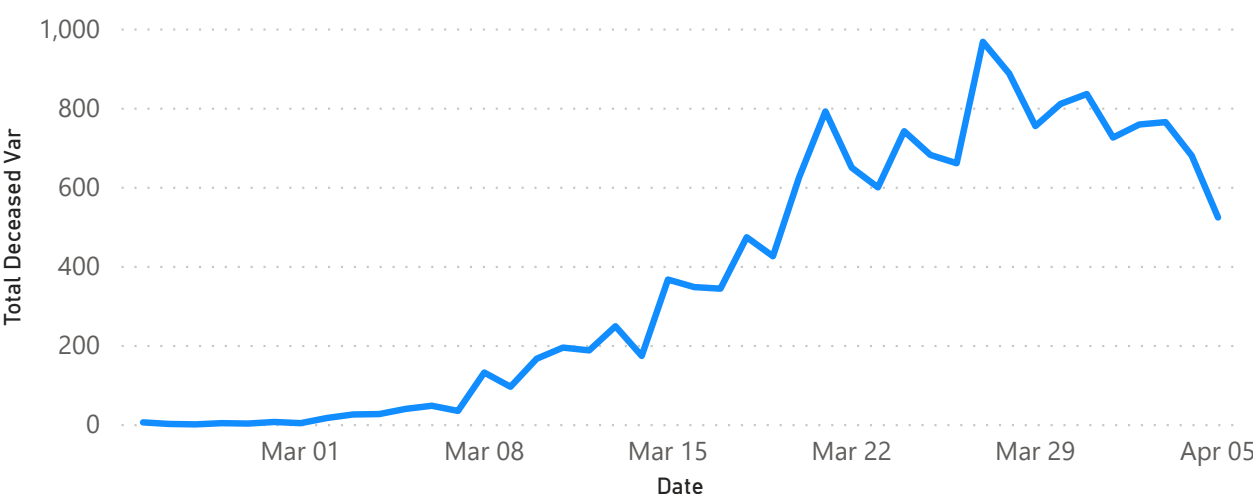
Discharged Healed by Date

Discharged Healed Growth Factor by Date

Total Discharged Healed Var by Date

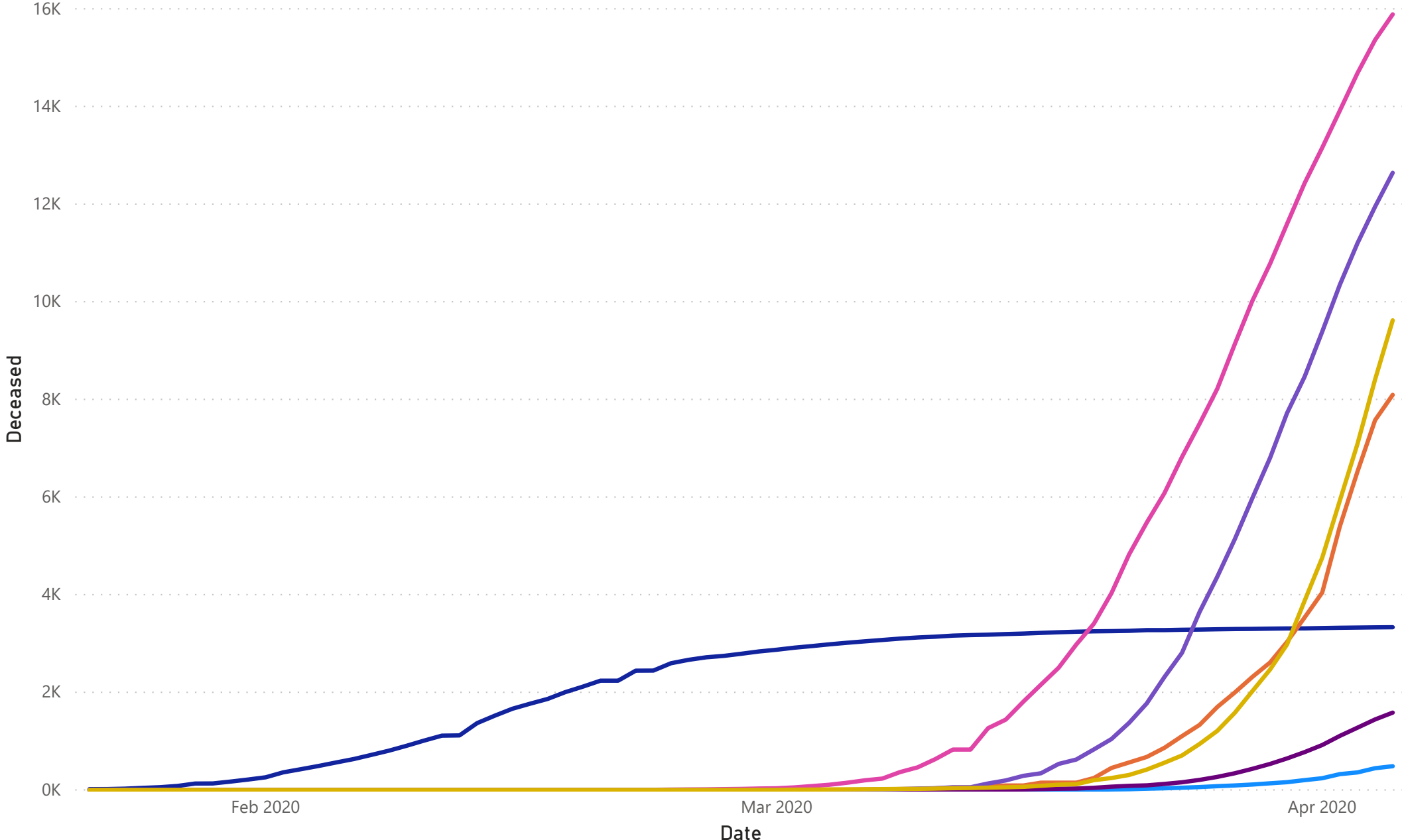● Increase ● Decrease ● Total

Total Discharged Healed Var by Date

Deceased by Date and State

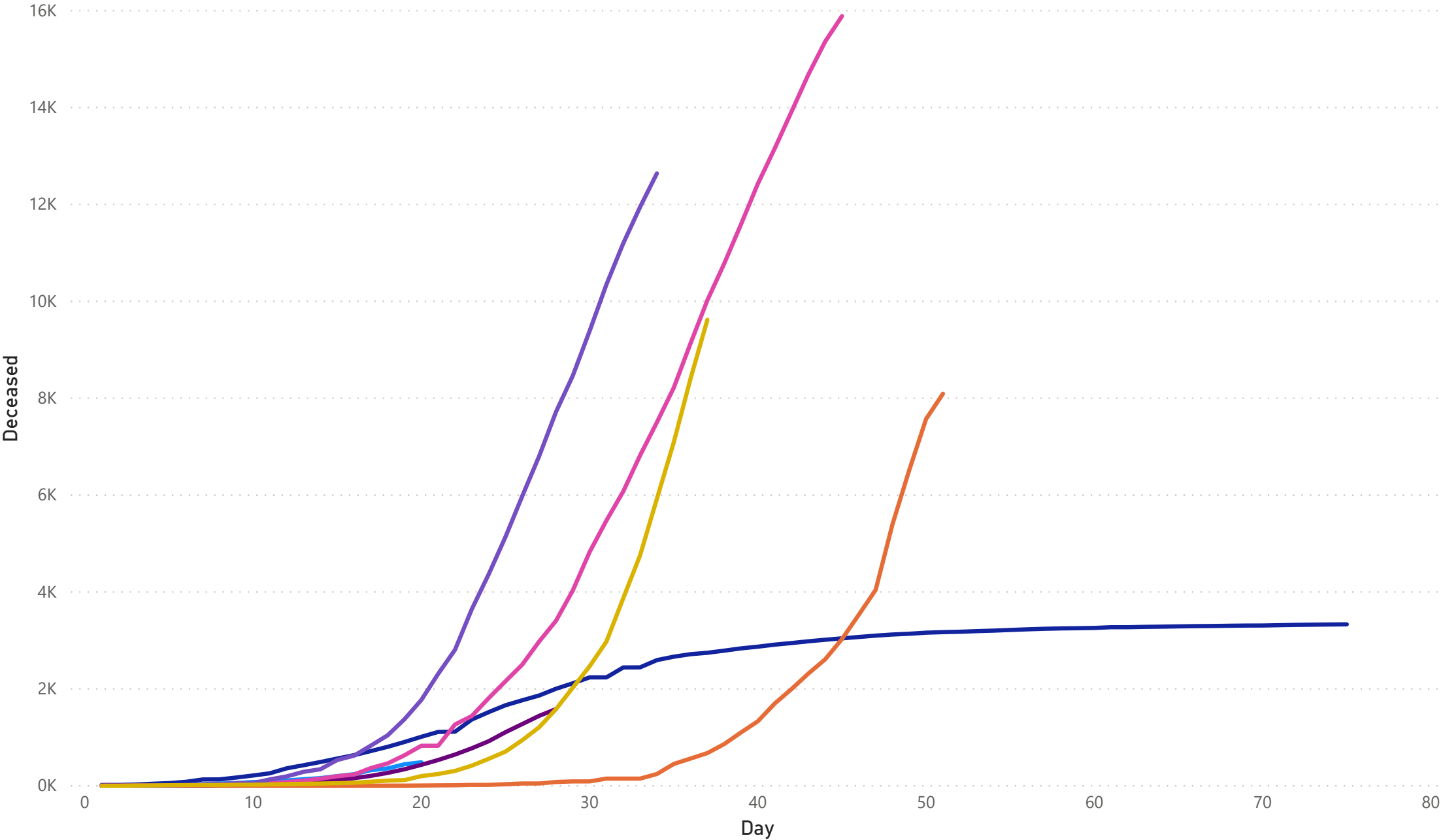**State** ● Brazil ● China ● France ● Germany ● Italia ● Spain ● US

Data from 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

- [ ] (Blank)
- [ ] Afghanistan
- [ ] Albania
- [ ] Algeria
- [ ] Andorra
- [ ] Angola
- [ ] Antigua and Barbuda
- [ ] Argentina
- [ ] Armenia
- [ ] Australia
- [ ] Austria
- [ ] Azerbaijan
- [ ] Bahamas
- [ ] Bahrain
- [ ] Bangladesh
- [ ] Barbados
- [ ] Belarus
- [ ] Belgium
- [ ] Belize
- [ ] Benin
- [ ] Bhutan
- [ ] Bolivia
- [ ] Bosnia and Herzegovina
- [ ] Botswana
- [x] Brazil
- [ ] Brunei
- [ ] Bulgaria
- [ ] Burkina Faso
- [ ] Burma
- [ ] Burundi
- [ ] Cabo Verde
- [ ] Cambodia
- [ ] Cameroon
- [ ] Canada
- [ ] Central African Republic
- [ ] Chad

State

- [ ] (Blank)
- [ ] Afghanistan
- [ ] Albania
- [ ] Algeria
- [ ] Andorra
- [ ] Angola
- [ ] Antigua and Barbuda
- [ ] Argentina
- [ ] Armenia
- [ ] Australia
- [ ] Austria
- [ ] Azerbaijan
- [ ] Bahamas
- [ ] Bahrain
- [ ] Bangladesh
- [ ] Barbados
- [ ] Belarus
- [ ] Belgium
- [ ] Belize
- [ ] Benin
- [ ] Bhutan
- [ ] Bolivia
- [ ] Bosnia and Herzegovina
- [ ] Botswana
- [x] Brazil
- [ ] Brunei
- [ ] Bulgaria
- [ ] Burkina Faso
- [ ] Burma
- [ ] Burundi
- [ ] Cabo Verde
- [ ] Cambodia
- [ ] Cameroon
- [ ] Canada
- [ ] Central African Republic
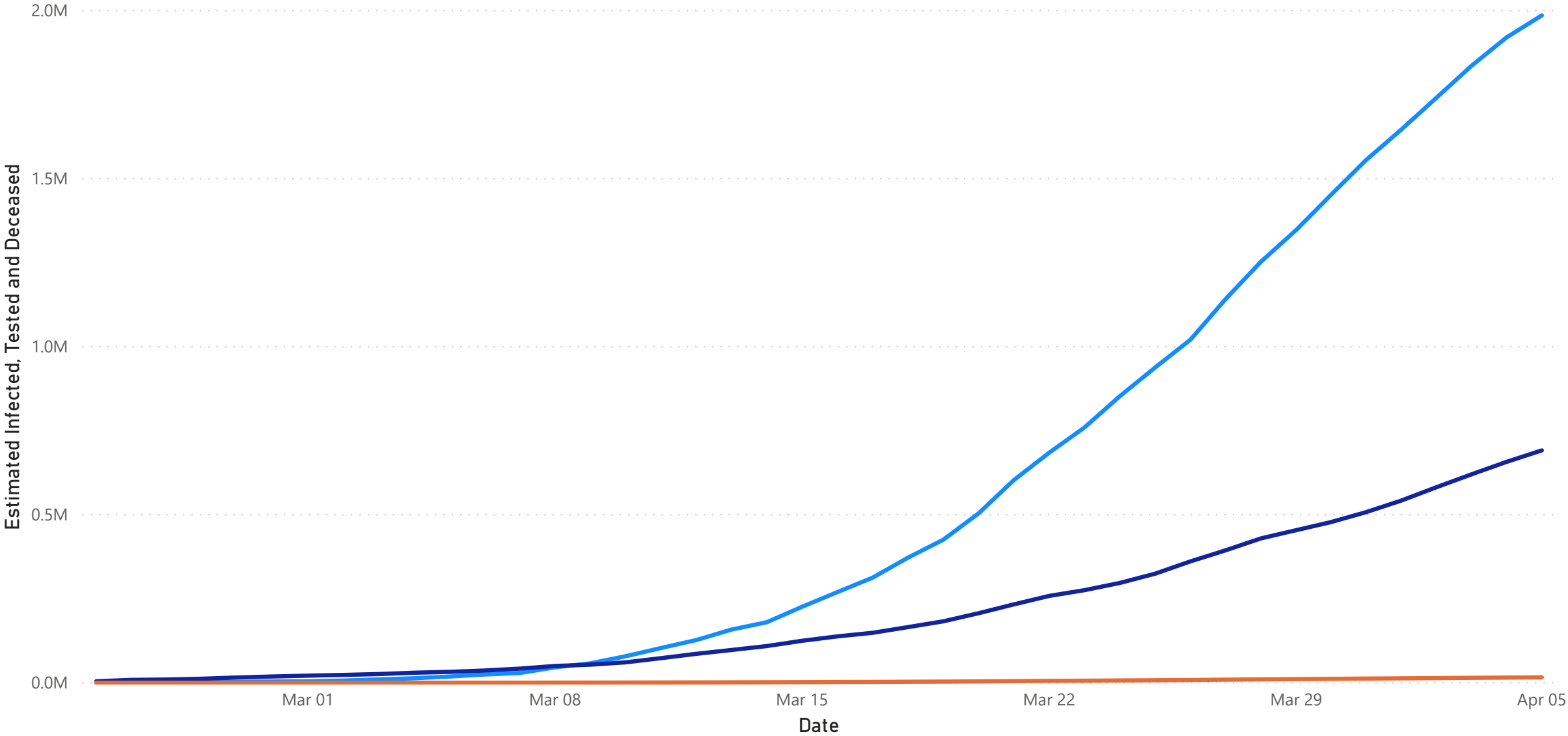- [ ] Chad

Deceased by Day and State

State ● Brazil ● China ● France ● Germany ● 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

By changing the death_rate we can have an estimation of how many infected people are needed to get the the number of deaths we see

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

Estimated Infected, Tested and Deceased (y-axis: 0.0M, 0.5M, 1.0M, 1.5M, 2.0M) — Date (x-axis: Mar 01, Mar 08, Mar 15, Mar 22, Mar 29, Apr 05)

Death rate in Italia 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 Italia 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"