

"COVID-19. Where are we now and where will be in the future?"

Current epidemiological situation related to COVID-19 in selected countries

19th of March 2020

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1 Introduction

As there are numerous fake information about actual status of COVID-19 outbreak among the world, this brief communication is dedicated to show actual epidemic situation and possible progression of epidemic spread in selected countries. Selection of countries presented in this report is based on my current cooperates citizenship.

2 Materials and methods

Data on cases in Poland were taken from official Polish Ministry of Health [twitter](#), incidence data for other countries as well as fatalities number were taken from [Johns Hopkins University \(JHU\)](#) Global Cases by the Center for Systems Science and Engineering (CSSE). Data on current population size in each country were taken from [Worldometers](#) web site.

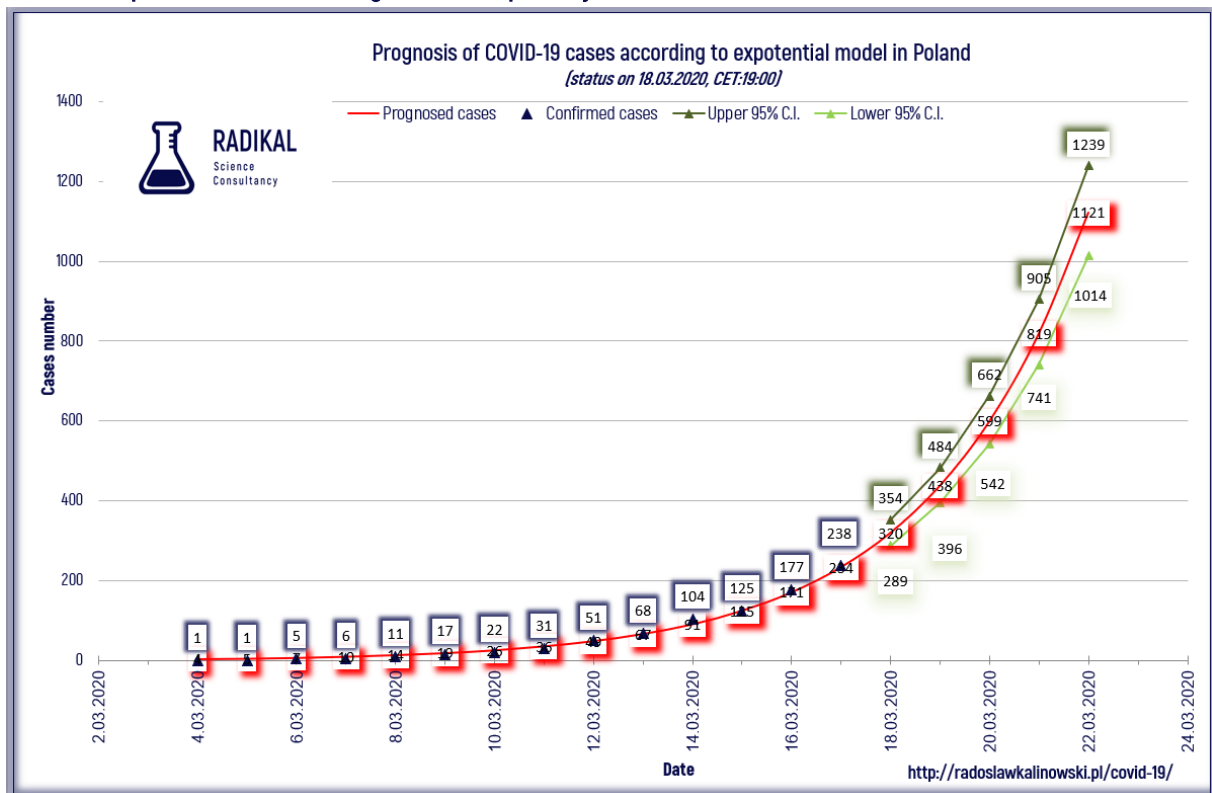
Two models were used: classic epidemiological exponential model for first stage of epidemy, as well as compartmental [SIR model](#) assuming acquisition of immunity in the population.

R-studio¹ as well as Microsoft Excel² were used for all calculations.

3 Results

3.1 Poland

3.1.1 Exponential model for growth of epidemy in Poland

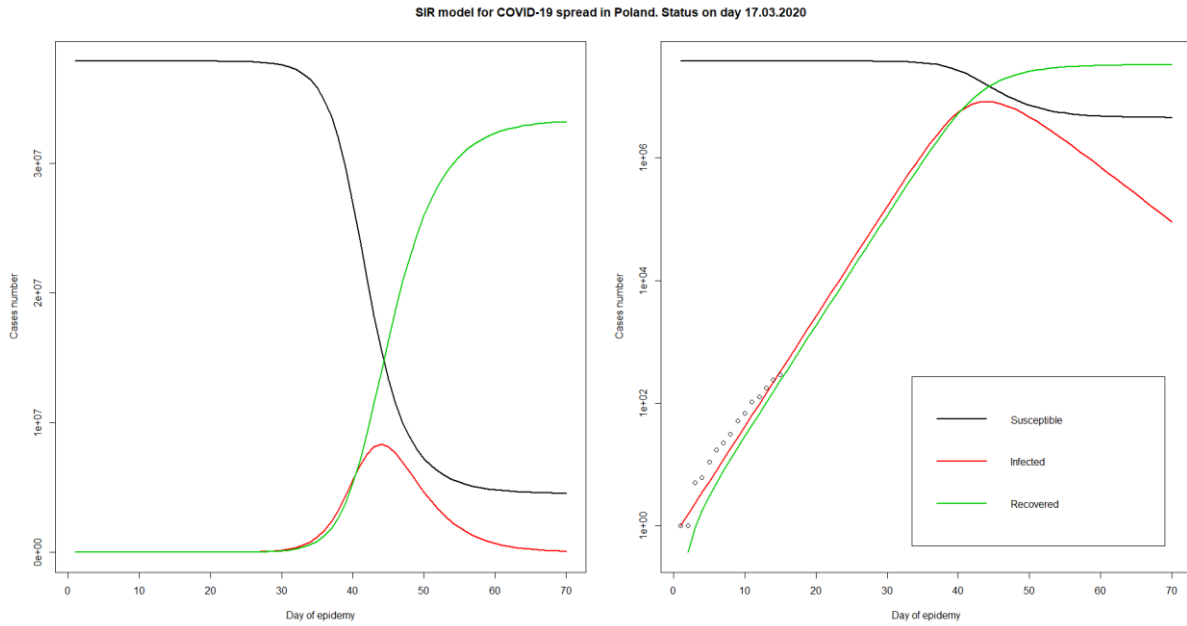


Based on exponential model number of cases in Poland on 24th of March will be 1121 [95% C.I. 1004-1139].

¹ RStudio Team (2019). RStudio: Integrated Development for R. RStudio, Inc., Boston, MA URL <http://www.rstudio.com/>

² Microsoft Excel Professional Plus (2019)

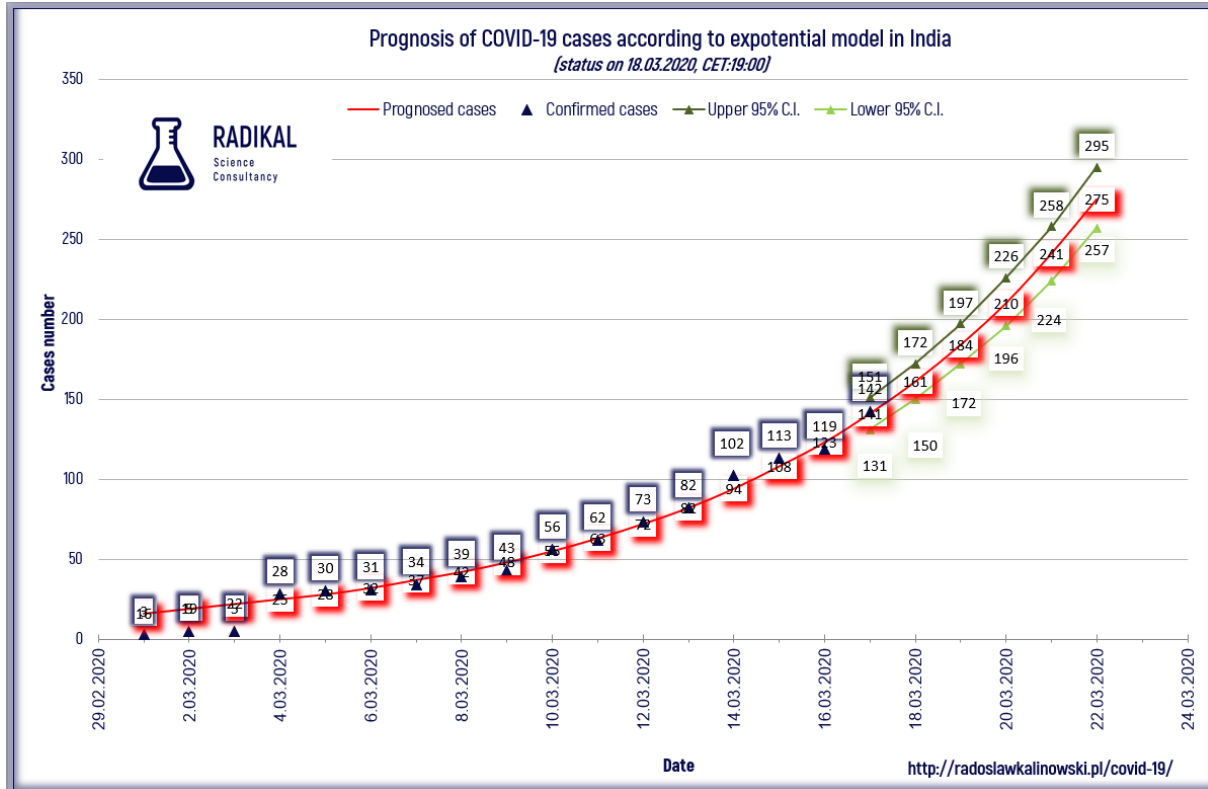
3.1.2 SIR model of epidemy in Poland



From SIR model maximal incidence will occur at 17th of April 2020, with 8 342 793 of infected and 145 344 of fatalities, based on actual fatality rate in Poland.

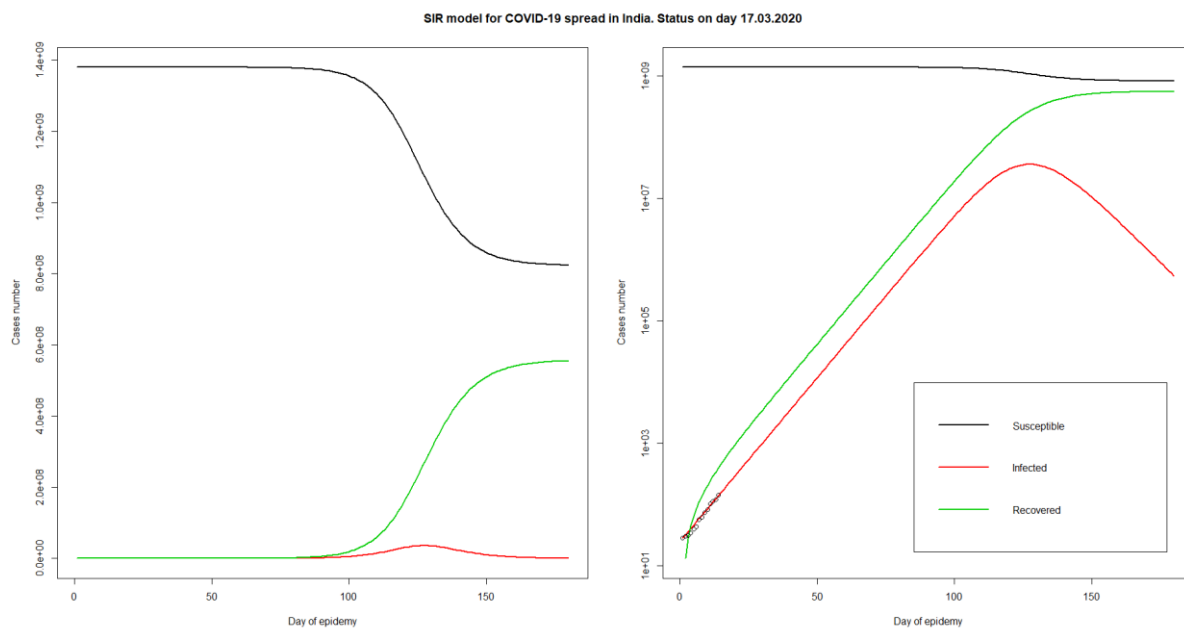
3.1 India

3.1.1 Exponential model for growth of epidemy in India



Based on exponential model number of cases in India on 24th of March will be 275 [95% C.I. 257-295].

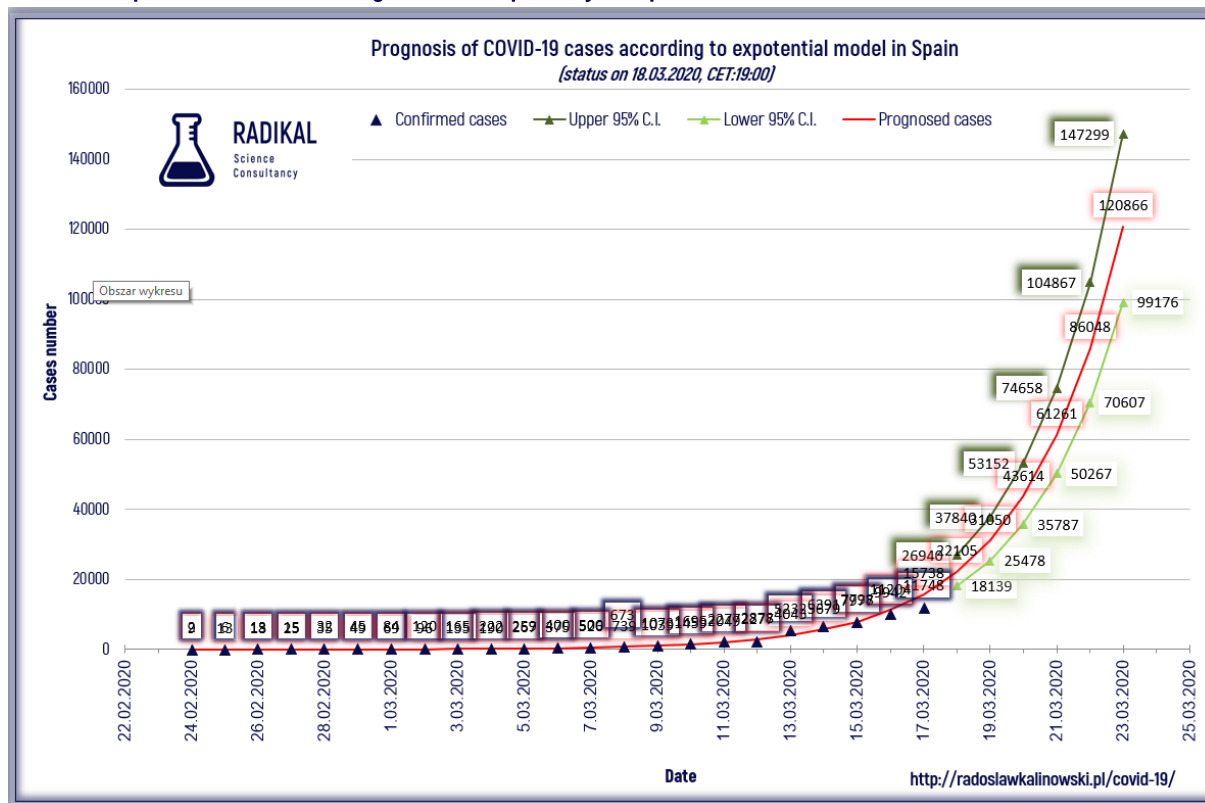
3.1.2 SIR model of epidemy in India



From SIR model maximal incidence will occur at 9th of July 2020, with 35 919 380 of infected and 690 757 of fatalities, based on actual fatality rate in India.

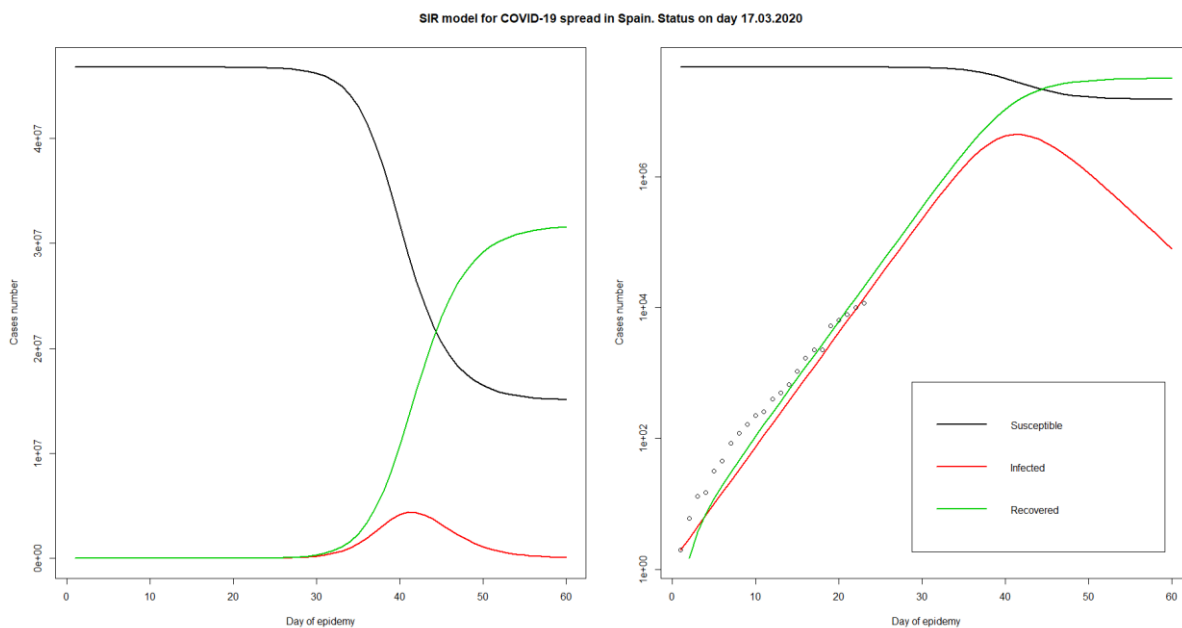
3.2 Spain

3.2.1 Exponential model for growth of epidemy in Spain



Based on exponential model number of cases in Spain on 24th of March will be 169 771 [95% C.I. 139306-206900].

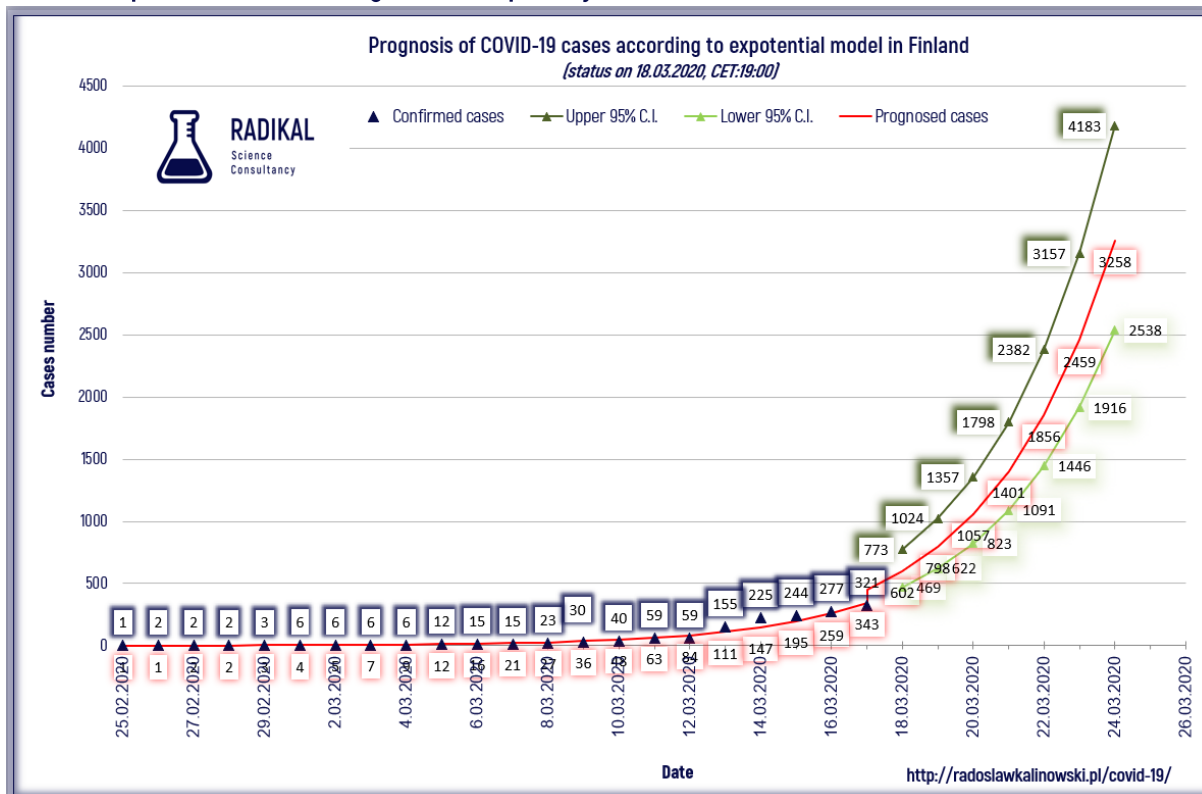
3.2.2 SIR model of epidemy in Spain



From SIR model maximal incidence will occur at 5th of April 2020, with 4 406 225 of infected and 197 345 of fatalities, based on actual fatality rate in Spain.

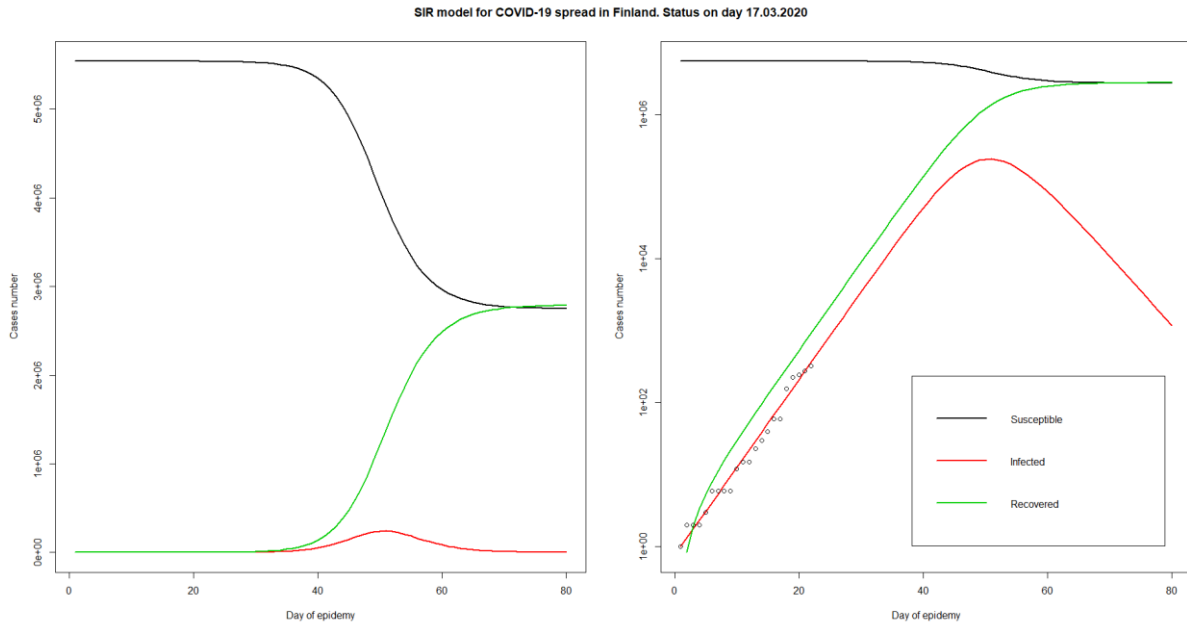
3.3 Finland

3.3.1 Exponential model for growth of epidemy in Finland



Based on exponential model number of cases in Finland on 24th of March will be 3258 [95% C.I. 2538-4183].

3.3.2 SIR model of epidemy in Finland



From SIR model maximal incidence will occur at 16th of April 2020, with 242 251 of infected and 9753 of fatalities, based on actual fatality rate in World (no fatal cases in Finland).

4 Summary

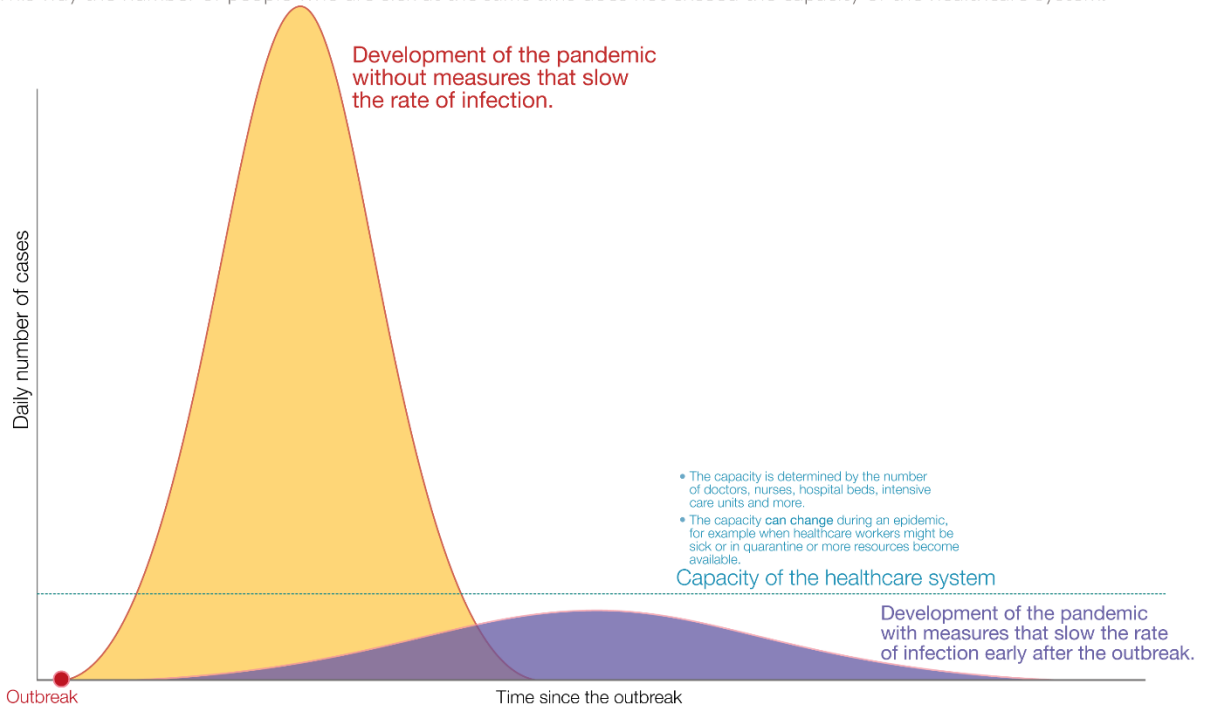
Analysis indicate that different epidemiological situation related to COVID-19 outbreak occurs among countries. Currently worst situation is in Spain (highest mortality and lowest doubling time) and best is in India (highest doubling time – causing flattening of pandemic curve).

Country	Epidemy doubling time [days]	Fatality rate [%]
Poland	2.21	1.64
India	5.17	1.92
Spain	1.97	4.48
Finland	2.52	N/A
World	N/A	4.03

In the outbreak of an epidemic *early* counter measures are important



Their intention is to 'flatten the curve': to lower the rate of infection to spread out the epidemic. This way the number of people who are sick at the *same time* does not exceed the capacity of the healthcare system.



Based on the Centers for Disease Control and Prevention
OurWorldinData.org - Research and data to make progress against the world's largest problems.

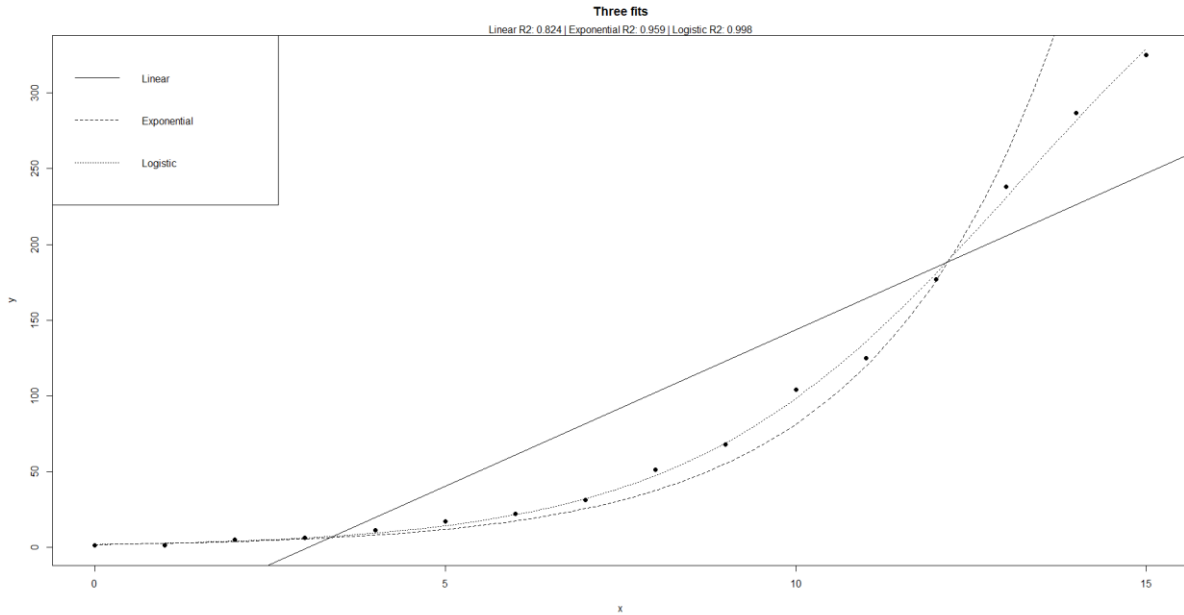
Licensed under CC-BY by the author Max Roser

Source: [Our World in Data](https://ourworldindata.org)

Presented models are well approximations for first, beginning periods of epidemy. They indicate that we all may face higher increase of cases, and fatalities with mean World's fatality rate approx. 4%. It was not my intention to scare anyone, just to point out that uncontrolled COVID-19 spread can be serious danger. But as new data will be available everything may change... in both directions.

5 Future of COVID-19

It must be noted that on such early stage of epidemy most models (even linear) give quite good approximation of daily data i.e. for Polish data:

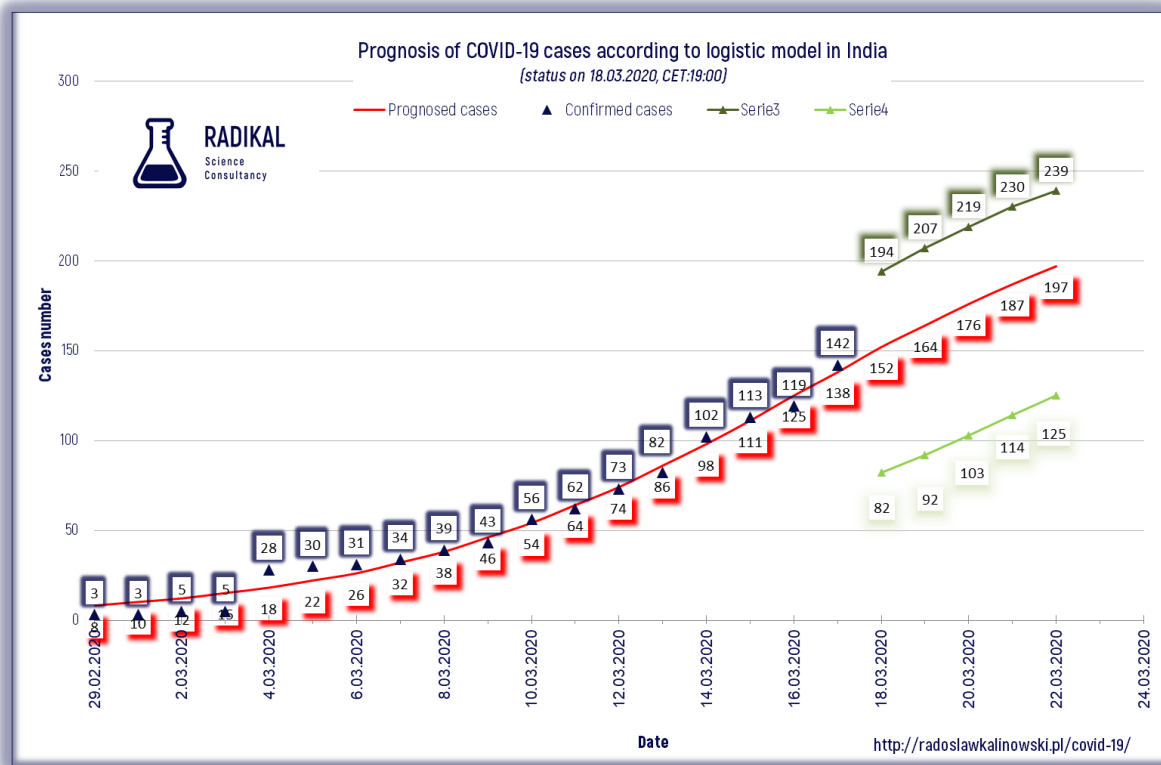
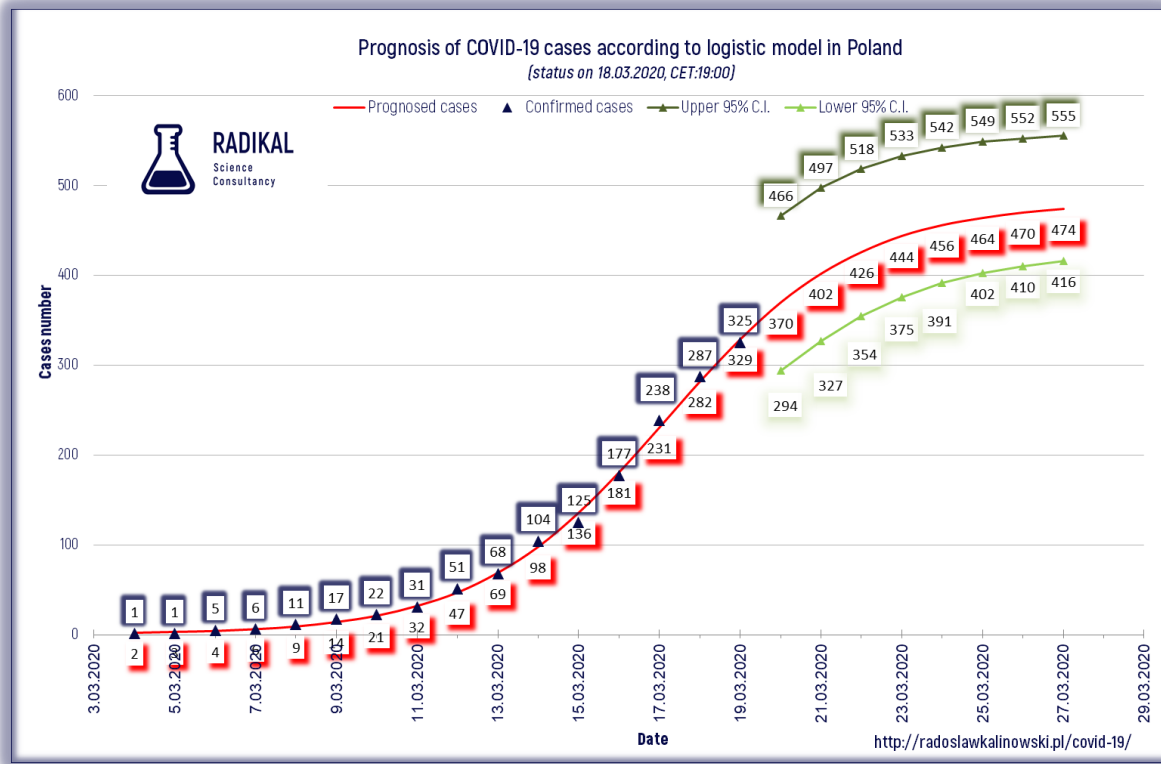


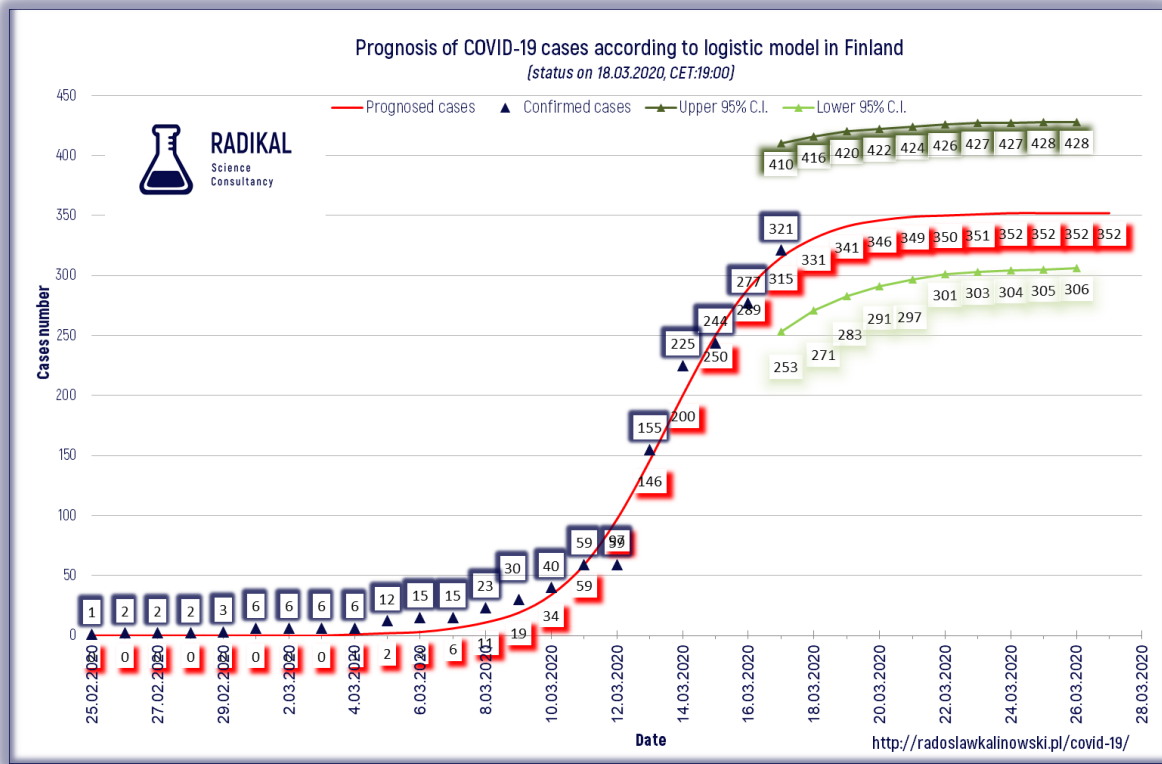
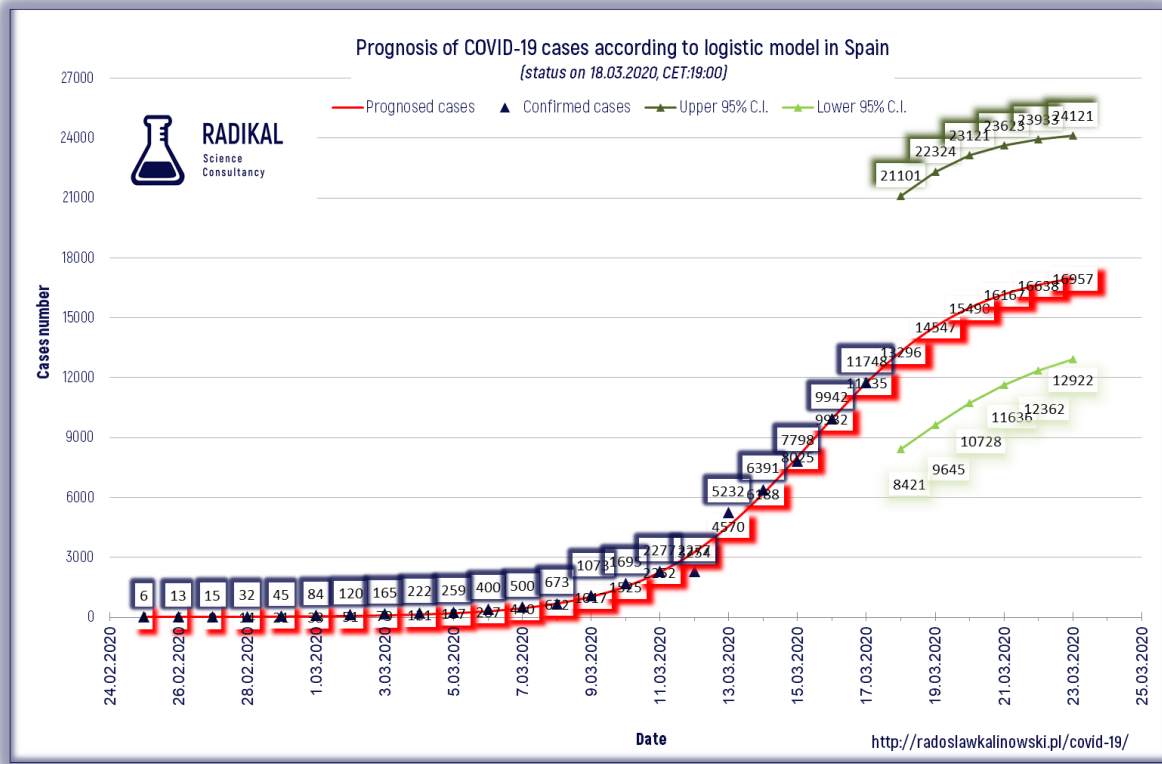
As mentioned earlier exponential and SIR models provide estimation in case of undisturbed growth of disease (without or with society immunity). Hopefully numerous anti-epidemic actions are taken both by authorities and responsible society.

Due to that fact it seems that in case of some countries we are (or soon will be) able to switch from J-shaped exponential curves into S-shaped logistic functions. The point of such decision is reaching of so called disease inflection point. Based on actual incidence data inflection points were calculated for all countries.

Country	Epidemy inflection point [days]
Poland	12-14
India	14-22
Spain	18-21
Finland	16-19
World	N/A

So let's have a hope that soon for each of you such curves will better show what is going on in virus's world.





6 Messages to be taken

- As there are no vaccine for COVID-19 disease (YET!) the only thing we may do right now is to brake epidemic chain by cutting transmission routes via proper hand washing and keeping 1-1.5 m distance one to another.
- As there were information about mass euthanasia of pets it must be clearly stated that there are **no scientific evidence that** our **cats** or **dogs** may **transmit** the virus.
- Use only confirmed information provided by your domestic authorities or from [WHO](#) and [EMA](#).
- Do not panic! 1000 toilet paper rolls is definitely not what you need right know.
- Additional information (mostly in Polish language) are available on my [website](#).

#StayHome

#TakeCareOfYourself

7 About the author

As far as you probably know, I am an experimental Ecotoxicologist since 2003, currently plant protection products regulatory affairs specialist, formerly GLP certified Test Facility Manager at [Institute of Environmental Protection – National Research Institute \(Poland\)](#), but what you rather do not know I am also (due to my previous employment at [Military Institute of Hygiene and Epidemiology](#)) graduated at 2014 Specialist in Epidemiology. And finally yes, statistical analysis and modelling of research data are also one of my scientific interests.