On the effectiveness of interventions in Italy

PHE Modelling Cell

23 March, 2020

Goal: Use a simple model to identify changes in growth rate from week to week, using confirmed, hospital, ICU and death counts. These changes can then be linked back to different interventions.

Highlights

- We identify three different growth rates, first change two weeks ago, followed by another reduction one week ago.
- The model allows for delays between confirmed, hospital, ICU and death compartments. As a result the growth rate in the later compartments will be delayed as well.
- The most complete data available is currently from Italy, so that data set is used.

Caveats

- Model works on date of report. As a result there is likely to be a delay between when interventions were applied and when the growth rate in the model changes.
- This is a simple model specifically designed to model changes in growth rate. Parameter values will not map perfectly onto actual disease parameters.
- Growth rate currently only changes on a weekly basis.
- Poisson distributions are presumably to narrow to capture the full uncertainty. As such these results will not capture the full posterior distribution of the parameters.

Data

Data used was downloaded from: https://raw.githubusercontent.com/pcm-dpc/COVID-19/master/dati-andamento-nazionale/dpc-covid19-ita-andamento-nazionale.csv

Model

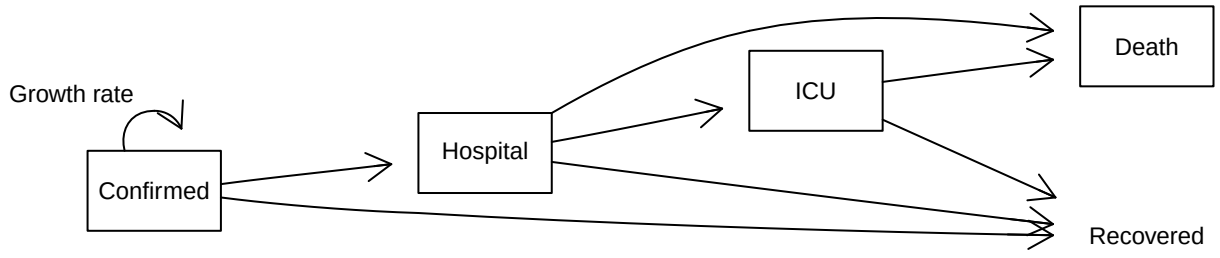

Figure 1: Model compartments and rates of flow. All compartments, except for Death are internally divided into two sub compartments, such that waiting times between compartments are gamma distributed. The recovered compartment is currently not explicitly modelled

Figure 1 illustrates the basic model. All data is assumed to be Poisson distributed. The rate of growth is able to change from week to week using a stochastic process. The prior probability of that change point

happening from week to week is 10 percent. The model is fitted using PMCMC. Parameter priors are uniformly distributed, with minimum waiting time between compartments of 1 day.

Results

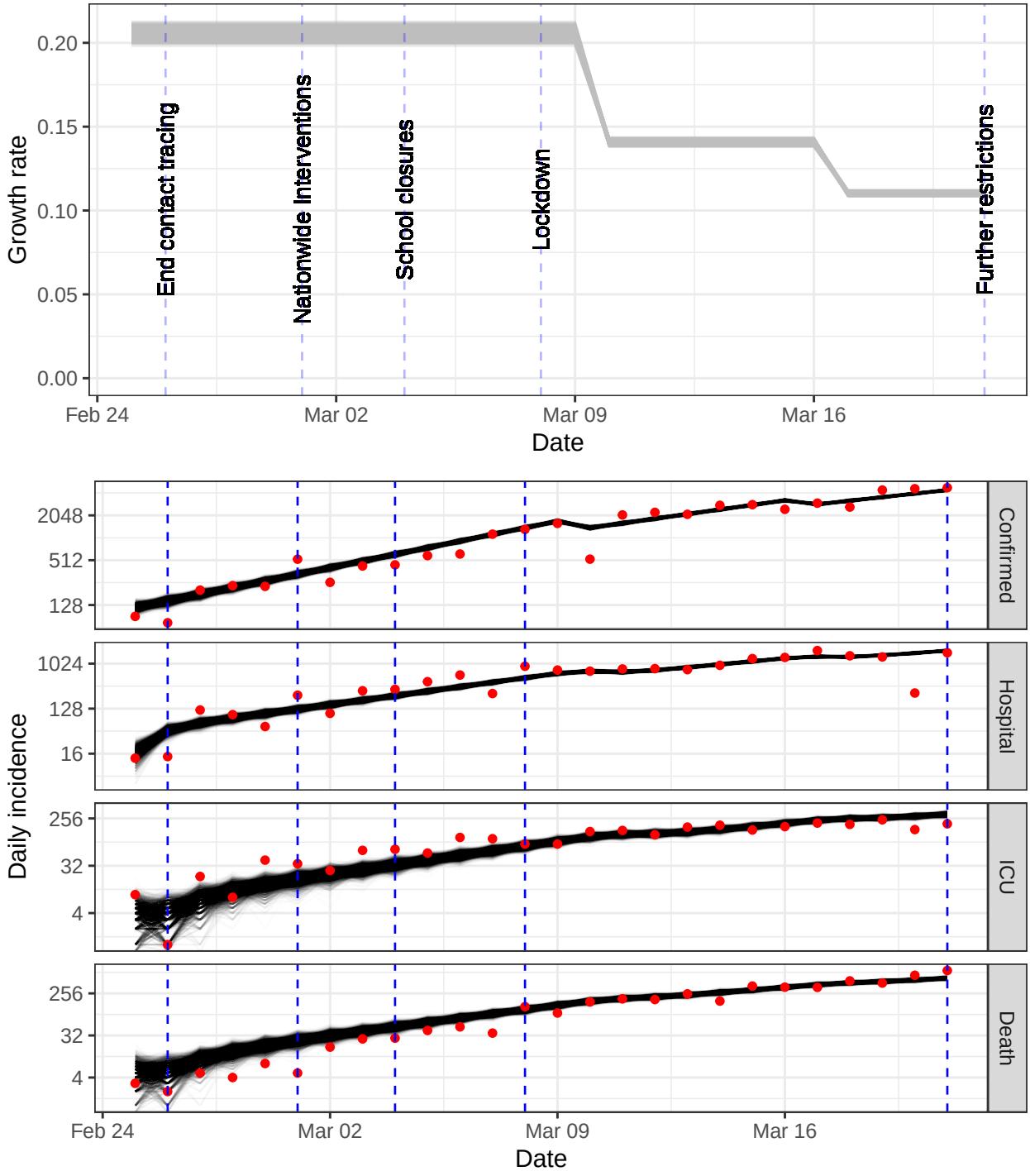

Figure 2: Growth rate and daily incidence There were two distinct changes in the growth rates. The first one is 2 weeks ago and the second 1 week. First two weeks the rate was been stable.