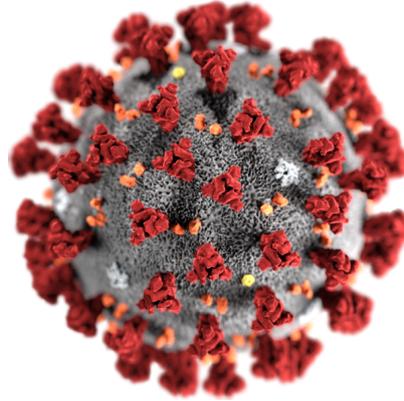


Modelling the spread of COVID-19 in the Netherlands (MEP)

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1 Introduction

In December 2019 a new infectious disease was identified in Wuhan, China caused by a coronavirus and named coronavirus disease 2019 (COVID-19). The disease quickly spread across the entire globe, causing a serious pandemic. Governments were forced to take measures in order to limit the spread of the virus in order to prevent a possible collapse of their healthcare systems. However they had to take "100% of the measures with 50% of the knowledge", according to PM Rutte of the Netherlands in March 2020. This is unfortunate, because all of the measures taken to contain the virus come with a price (economical, societal and also medical). This means that it is beneficial to estimate beforehand the medical gain and the costs of a number of possible measures in order to be able to take the most cost-efficient ones. In order to do so we will first need to develop a good model of the spread of COVID-19. Consecutively we can include a certain measure into our model, estimate the benefits and (roughly) the costs and compare certain measures. In this project, however, we will mostly focus on the first step: a reliable mathematical model of the spread of COVID-19.

2 Mathematical model

A basic model for the spread of an epidemic is a SIR-model [3]. Such a model typically neglect (among others)

1. spatial heterogeneity
2. temporal variation of R_0

In [1] we propose an improved model that takes both of these effects into account, which leads to a (large) set of coupled ODEs. We will solve these ODEs numerically and we will fit the solutions of the model equations to the data available from the RIVM [2] to determine our model parameters. There are numerous interesting ways to extend the model, e.g.,

- Inclusion of the effect of different agegroups
- Using stochastic spreading coefficients (in order to allow for "super spreading events")
- Inclusion of different type of (governmental) measures
- ... (we encourage students to come up with their own ideas)

References

- [1] B.J. Meulenbroek. Modelling the spread of covid-19 through the netherlands, unpublished.
- [2] RIVM. <https://data.rivm.nl/geonetwork/srv/dut/catalog.search#/home>.
- [3] Wikipedia. https://en.wikipedia.org/wiki/compartmental_models_in_epidemiology.