The post-lockdown society: challenges of social and mathematical predictions

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Do you know who this is?

- Prof. Neil Ferguson
  - Mathematical epidemiologist at Imperial College London
  - Scientific Advisor to UK Government
Prediction: based upon mathematical models

No action taken        500,000 deaths in UK!
MATHEMATICS

exponential growth
moving averages
flattening the curve

$R_0$
the R-number
Underlying basic principles

- Two modelling approaches
  - Agent based
  - Equation based

\[
\frac{dS}{dt} = -\beta SI \\
\frac{dI}{dt} = \beta SI - \gamma I \\
\frac{dR}{dt} = \gamma I
\]
Some cool simulators: agent based

Baseline simulation
2000 people
3% infection risk when near infected person
baseline mortality: 2%
at-risk age: 55+
critical risk age: 75+
healthcare capacity: 300 beds

Paul van Gent: post-doc at Faculty of CiTG
https://github.com/paulvangentcom/python_corona_simulation
Some cool simulators: equation based

https://ncase.me/covid-19/
Report 20: Using mobility to estimate the transmission intensity of COVID-19 in Italy: A subnational analysis with future scenarios

Occur, the number of deaths exerted is likely to be considerably lower in both scenarios. It should be noted that in our model we do not account for cross-region movement, which, given increased mobility, is likely to increase infections and subsequently deaths, in regions not experiencing major epidemics.
Equation based approach on networks

https://www.nas.ewi.tudelft.nl/index.php/coronavirus
Equation based approach on networks

- NIPA = Network Inference-based Prediction Algorithm

- Apply NIPA to evaluate Exit Strategies
Equation based approach on networks

- Total infected fraction in 12 provinces
- Recovery condition: \( \frac{dy(t)}{dt} \leq 0 \) & \( y(t) < 0.05 \)

**No measure**

**Lockdown process**

**Exit process**

**Total infected fraction \( y(t) \) in NL**

- Lockdown threshold = 0.02

**Time**

0 10 20 30 40 50 60 70 80 90 100
Exit Strategies

• Relaxation of measures post-lockdown
  • public gatherings
  • school closures
  • social distancing
  • mobility restrictions
  • case-based measures

• Exit Strategy is combination of
  • Which measures?
  • When?
  • Where?
  • For whom?
Analysis Exit Strategies: uncertainty

- Availability and quality of data
- Duration immunity
- Seasonal variation
- Undetected cases
- Human mobility
- Adherence to post-lockdown measures
Analysis Exit Strategies: uncertainty

4 May 2020

Piedmont

- Mobility held constant
- Increased mobility: 40% return to pre-lockdown level
Analysis Exit Strategies: uncertainty

Virus spreading in public transport networks: the alarming consequences of the business as usual scenario

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Panchamy Krishnakumari and Oded Cats, Ditlab | SmartPTLab, TU Delft

• Pre-corona demand:
  • 3 infectious travelers infect 55% of all travelers in 20 days
Analysis Exit strategies

ESCAPE: Exit Strategies - Combining Approaches from Population behavior, mobility and Epidemiology

NIPA

DiTT Lab
Data Analytics & Traffic Simulation

Lab
Smart Public Transport

dr. Tina Comes