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Assessment of non pharm

(10)(2e)

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Titel | 30-05-2018



Non-pharmaceutical interventions

- Distancing measures are currently the primary intervention against COVID-19 → Impact?
- For example:
 - Quarantine of (suspected) cases
 - Social distancing
 - Travel restrictions
- Start (March) → Papers focuses on measures in China
- Now (June) → Papers focuses on measures in Europe/US & strategies to relax measures



Workflow

- Screening of (10)(2e) :
 - Impact of measures
 - Setting of article
 - Outbreak phase
 - Model assumptions
- Screening of expert from Epi-department:
 - Preprint
 - Authors / Institutions
 - Familiarity
- Try to compare the differences in included/excluded papers
 - > Still an ongoing process!



Individual interventions

Effect of individual interventions in real life difficult to assess because of simultaneous introduction.

However: in models often 'stand alone'.

Initial models had limited data to estimate model parameters, which could differ from national, recent parameters.

Country and regional estimates further vary due to different healthcare systems, criteria for ICU admission and discharge, age distribution, contact patterns, adherence, etc., but also from pandemic phase.



Quarantine of people exposed to confirmed/ suspected cases

- Based on a Cochrane review of 29 studies (Nussbaumer):
Quarantine of people exposed to confirmed or suspected cases averted between 44% to 81% of cases and between 31% to 63% of deaths, compared to no measures.
- Home isolation can reduce deaths by at least 50% (Sweden, Gardner)

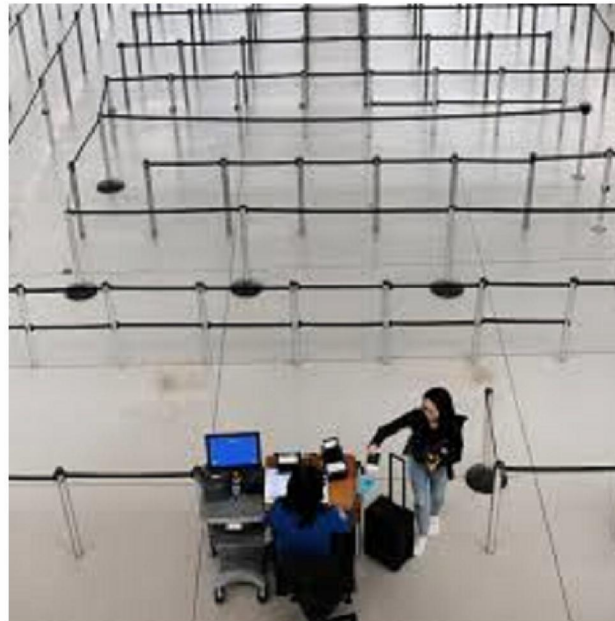




Travel ban

Travel ban slows spread but has limited effect on the total number of cases.

- The Wuhan travel ban resulted in a delayed arrival time of COVID-19 in other cities by approx. 2.9 days (Moghadas).
- In Spain a reduction as large as 90% in traffic flow has a limited effect on the spreading of the disease. The peak however was delayed by over 20 days (Aleto).



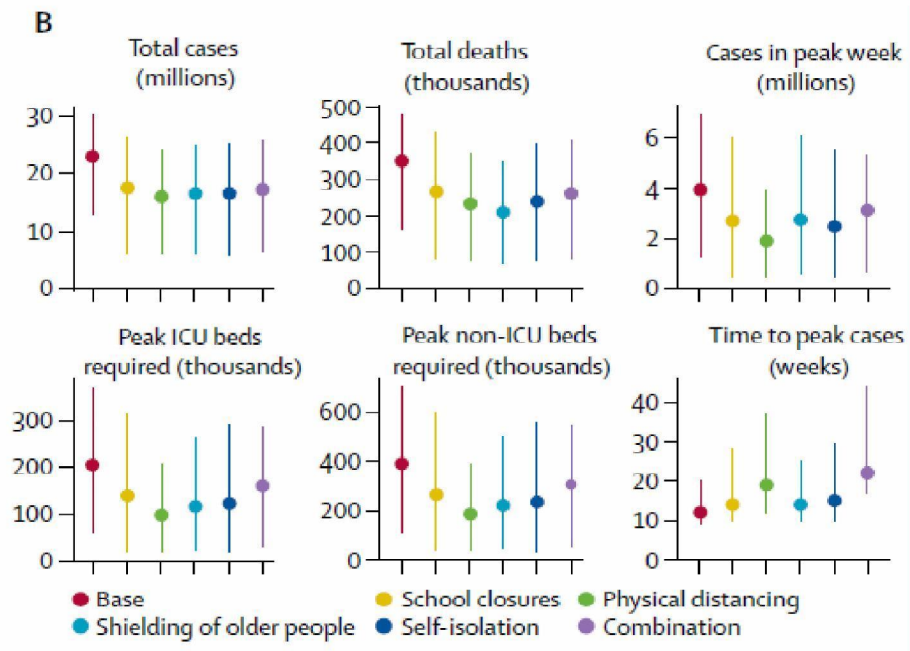


Physical distancing measures

- Physical distancing measures resulted in a contact reduction of 78% in British Columbia (Anderson)
- Mandated social distancing, including closures of schools and non-essential business, can reduce deaths by at least 50% in Sweden (Gardner).
- School closures, physical distancing, shielding of older people, self-isolation of symptomatic individuals, and the combination intervention each decreased the total number of cases by 20–30% in UK (Davies).
- Recent modelling of school closures alone, in China, predicted a prevention of only 2-4% of the deaths (Viner).

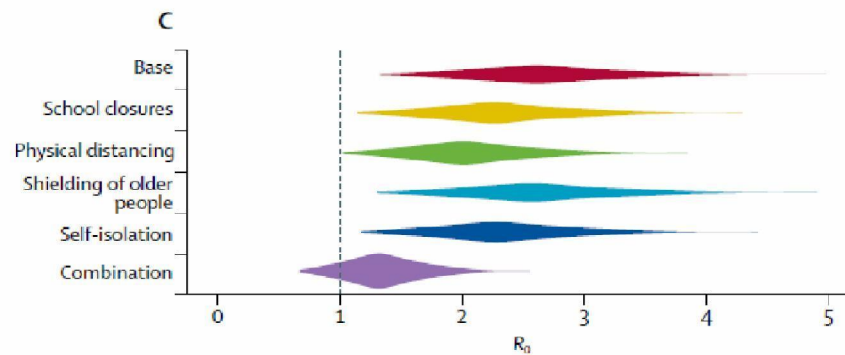


Recent results for UK:





Combined interventions



Combinations are more effective than single measures:

- Home isolation of suspect cases, home quarantine of household members *and* social distancing limited to risk groups might reduce deaths by 50% (US and UK) (Ferguson).
- But the combination in the former slide is not sufficient to prevent healthcare demand exceeding availability -> lock down



Lock down

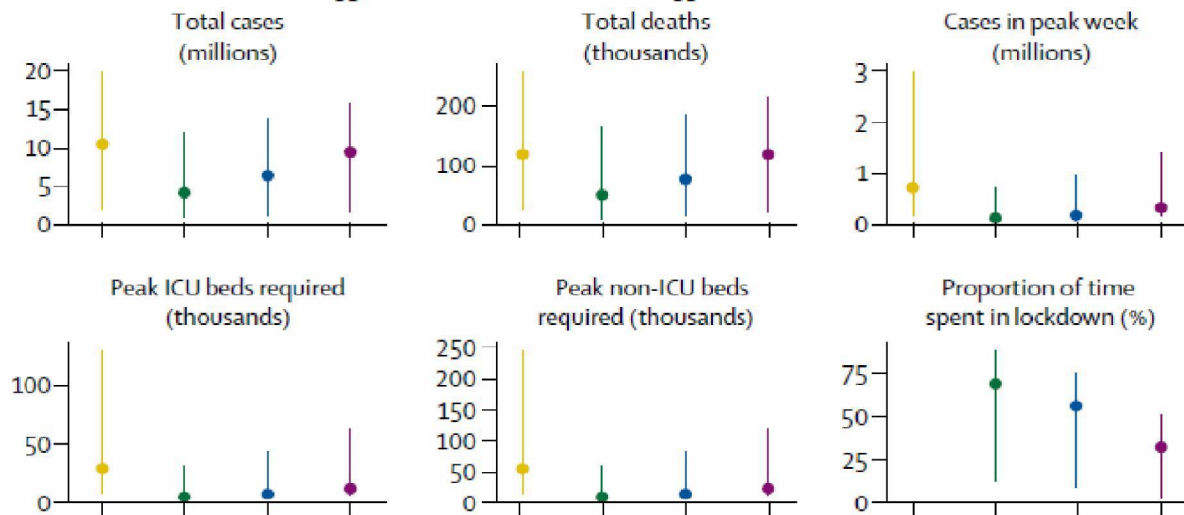
- The lockdown in China reduced the doubling time of the outbreak from 2 days to 4 days (Lau) and decreased R to <1 (Zhao).
- In the UK only lockdown periods were estimated to be sufficient to bring R_0 near or below 1 (Davies).
- Lock down resulted at 92% less peak cases in the US (Matrajt)
- Lock down leads to a substantial reduction of the reproductive number ($* = 0.68$ [0.62-0.73]) in Île-de-France (Di Domenico).



Recent results for UK:

B

- Intensive interventions
- Lockdown: 1000-bed trigger
- Lockdown: 2000-bed trigger
- Lockdown: 5000-bed trigger





Facemask use by the public

Even very weak masks (20% effective) can still be useful. With 80% adoption:

- In New York, masks could reduce mortality by 2-9% mortality (peak death reduction 9-18%)
- in Washington, where baseline transmission is much less intense, masks could reduce mortality by 24-65% (and peak deaths 15-69%)
- In the USA hospitalizations could be reduced by 63%. (Eikenberry; Ngonghala)





Conclusions on containment measures so far

- Effects vary with outcome studied (cases, deaths, peak or total numbers) and timing of the intervention.
 - Not so effective reg. total cases: travel restrictions
 - Not so effective reg. total deaths: school closures
 - Other interventions not so obvious better/worse
- Overall: multiple measures are more effective

- Many models' assumptions reg. restricting contacts are difficult to relate to real life.



Exit strategies

- Massive testing & contact tracing
- Relaxation of measures
 - Alternate between different strategies for a certain period



Massive testing & contact tracing

- Implementing aggressive case-finding and isolation together with social distancing would allow to release the lockdown in May, engaging the ICU services below their maximum capacity throughout the epidemic ((Île-de-France, Paris region, di-domenico))
- A policy of population-wide testing and contact tracing would help to rapidly end the epidemic: the peak would be reached sooner and, after 350 days, 0.43% of the population would contract the virus (0.33% diagnosed), with an estimated 0.05% dying (Italy, giordano).



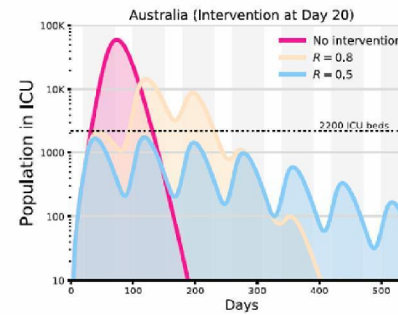
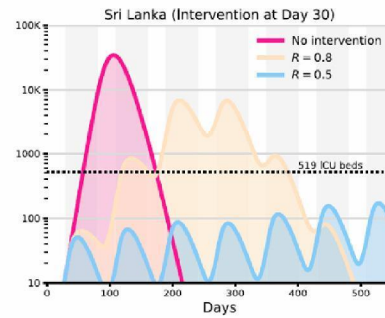
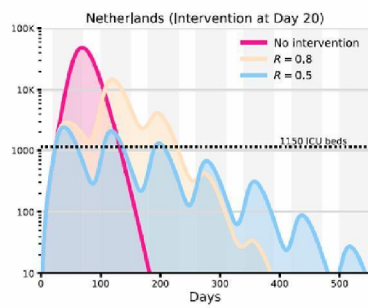
NPIs with intervals of relaxed social distancing

- Chowdhury et al.
- 16 countries (ranging from high income, upper-middle income, lower-middle income to low income)

- Strategy
 - 18 month period
 - Cycles of 50-day mitigation / suppression followed by a 30-day relaxation
 - › Mitigation = combination of social distancing, hygiene rules, case-based isolation, shielding of vulnerable groups, school closure, restriction of large public events.
 - › Suppression = additional measures of strict physical distancing, including lockdown
 - › Relaxation = comprising of case-based home isolation and shielding vulnerable groups



NPIs with intervals of relaxed social distancing





Phased lift of control measures

- De Vlas et al.
- Setting = The Netherlands
- 14 months
- Strategy
 - Netherlands divided into 10 parts
 - Every 90 days, one part had a measure lift (return to normal situation)
 - In this manner, the number of cases would remain within the limits of the health care capacity
- Results
 - On average: individuals will experience 432 days (14 months) of intensive control
 - 56% of population has become immune.

(already not feasible anymore as the travel restrictions are lifted...)



Alternate between 2 scenario's of contact reduction

- Anderson et al.
- Setting = Canada
- 5 months

- Strategy
 - Alternate between 2 scenario's of contact reduction
 - A contact reduction of 20% versus a contact reduction of 78% every three or four weeks

- Results
 - Allows an overall continued decline

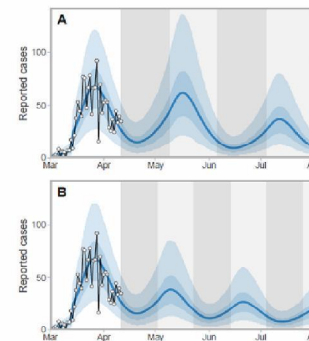


Figure 7: Two scenarios of cycling between physical distancing levels. Here, the percentage of contact reduction alternates between 20% and 78% at (A) four-week and (B) three-week intervals. Reducing contacts by 78% is approximately the estimated level by our model (Figure 4). Dark- and light-grey shaded regions represent the 20% and 78% time periods, respectively. Note the lag between changes in physical distancing and reported case counts. Blue lines represent the posterior mean and shaded ribbons represent 50% and 90% credible intervals on new observations. Dots and black lines represent the reported data.



Conclusion exit strategies

- How to execute this in practice?
 - E.g. 20% contact reduction
- What are the implications for changing the policy every so period?
- More literature on exit strategies

Literature



- **Impact of measures**

- Nussbaumer-Streit B, Mayr V, Dobrescu A, Chapman A, Persad E, Klerings I, et al. Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review. *Cochrane Database of Systematic Reviews*. 2020(4).
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- Davies NG, Kucharski AJ, Eggo RM, Gimma A, Edmunds WJ, Jombart T, et al. Effects of non-pharmaceutical interventions on COVID-19 cases, deaths, and demand for hospital services in the UK: a modelling study. *The Lancet Public Health*. 2020.
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- Matrajt L, Leung T. Evaluating the effectiveness of social distancing interventions against COVID-19. *medRxiv*. 2020:2020.03.27.20044891.
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Literature



- Exit strategies:
 - Giordano G, Blanchini F, Bruno R, Colaneri P, Di Filippo A, Di Matteo A, et al. Modelling the COVID-19 epidemic and implementation of population-wide interventions in Italy. *Nature Medicine*. 2020.
 - Di Domenico L, Pullano G, Sabbatini CE, Boëlle P-Y, Colizza V. Expected impact of lockdown in Île-de-France and possible exit strategies. *medRxiv*. 2020:2020.04.13.20063933.
 - Chowdhury R, Heng K, Shawon MSR, Goh G, Okonofua D, Ochoa-Rosales C, et al. Dynamic interventions to control COVID-19 pandemic: a multivariate prediction modelling study comparing 16 worldwide countries. *European Journal of Epidemiology*. 2020;35(5):389-99.
 - de Vlas SJ, Coffeng LE. A phased lift of control: a practical strategy to achieve herd immunity against Covid-19 at the country level. *medRxiv*. 2020:2020.03.29.20046011.
 - Anderson SC, Edwards AM, Yerlanov M, Mulberry N, Stockdale J, Iyaniwura SA, et al. Estimating the impact of COVID-19 control measures using a Bayesian model of physical distancing. *medRxiv*. 2020:2020.04.17.20070086.



- Example of SEIR model:

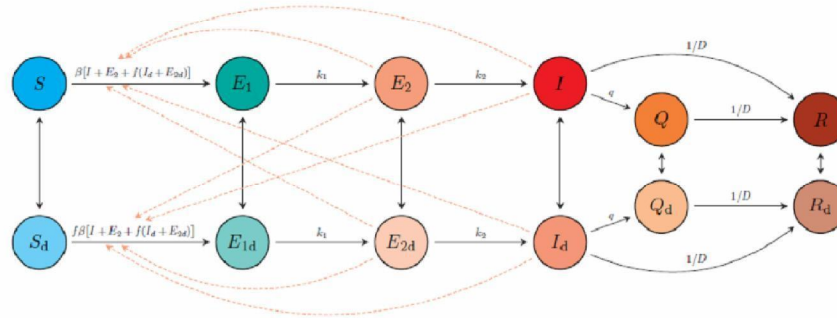


Figure 3: Schematic of model described by Equations (1) and (2). An individual in some compartment X can begin distancing and move to the corresponding compartment X_d at rate u_d . The reverse transition occurs at rate u_r . The model quickly settles on a fraction $e = u_d/(u_d + u_r)$ participating in distancing, and dynamics depend on this fraction, rather than on the rates u_d and u_r .