Modelling COVID-19

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Total confirmed COVID-19 deaths

Shown is the rolling 7-day average. Limited testing and challenges in the attribution of the cause of death means that the number of confirmed deaths may not be an accurate count of the true number of deaths from COVID-19.

Source: European CDC – Situation Update Worldwide - Data last updated 30th May, 10:38 (GMT+01:00), European CDC – Situation Update Worldwide
Latest Mortality Monitor estimates 64,000 excess deaths to date in the UK.
Early on, modelling COVID-19 infections was easy!

- This forecast was made with a modified S/I/R model
- $S =$ Susceptible
- $I =$ Infectious
- $R =$ Removed
- $R_t = 2.6;$ Infectious Period 6 days.
- Daily infection rate = $\frac{2.6}{6} = 43.3\%$
- Daily recovery rate = $\frac{1}{6} = 16.7\%$
- Growth in infections = $26.7\%$
How to solve the issue of such heterogeneity within the Wilkie “I” state?

Novel solution – introduce time dependency.

### Table: Description of State

<table>
<thead>
<tr>
<th>Epidemiologist Models</th>
<th>Description of state</th>
<th>Wilkie Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susceptible (S)</td>
<td>No exposure to the virus</td>
<td>Healthy (H)</td>
</tr>
<tr>
<td>Exposed (E) or Infectious (I)</td>
<td>Exposed but not yet infectious</td>
<td>Infected (I)</td>
</tr>
<tr>
<td>Infectious (I)</td>
<td>Infectious but unaware</td>
<td>Infected (I)</td>
</tr>
<tr>
<td>Infectious (I) or Removed (R)</td>
<td>Infectious and isolated</td>
<td>Infected (I)</td>
</tr>
<tr>
<td>Removed (R)</td>
<td>No longer infectious</td>
<td>Infected (I)</td>
</tr>
<tr>
<td>Removed (R)</td>
<td>Deceased</td>
<td>Dead (D)</td>
</tr>
</tbody>
</table>
Other Models

Example: ICL – Imperial College London
Comparing Data Sources

Example: England

DHSC figures announced daily by UK Gov. Now include deaths in all settings where there has been a positive COVID-19 test. Date of notification basis.

NHS hospital deaths released daily, showing actual date of death. Now includes those with no positive test, but where COVID-19 documented on the death certificate.

ONS figures released weekly and reflect all registered deaths (hospital, care homes and community) with COVID-19 indicated on the death certificate.
Risk varies geographically
Heterogeneity of Exposure and Mortality Risks

#OpenSafely
What next?

Living with Uncertainty

COVID-19 Infectious Population - UK

- R=1.2; Seasonal
- R=1.2; Non-seasonal
- R=1.1; Non-seasonal
- R=1.1; Seasonal
Thank you! Questions?

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