COVID-19 Mortality by Age Distribution

Hannah Phillips, Dr. Henry Matzinger
Georgia Institute of Technology
Thanks to other collaborators

Rapahel Hauswer: Oxford University
Rishi Pathak, Ali Kazmi, Youpeng Zhao: Georgia Institute of Technology
Topics

- Tools
- Deaths vs Confirmed Cases
- Case Study: Germany vs Italy
- Does age matter?
Tools of the Trade

- Statistics
- Latex
- Python + Jupyter Notebook
  - Numpy
  - Scipy
  - Pandas
  - Matplotlib
Case Fatality Ratio

- First method
- Case Study
  - Germany: 1%
  - Italy: 15%
- Is the probability to die 15 times less in Germany?

\[ CFR = \frac{\text{deaths}}{\text{diagnosed}} \times 100\% \]
CFR: The Flawed Statistic

- CFR requires diagnosed cases
  - As much as 90% of cases are not tested
- Antibody random test sampling showed true scope of infection in people

\[
CFR = \frac{\text{deaths}}{\text{diagnosed}} \times 100\%
\]
Infection Fatality Ratio

- Random sampling is important
- Better statistic

\[ IFR = \left( \frac{\text{deaths}}{\text{diagnosed}} \right)_{\text{random sample}} \times 100\% \]
Seroprevalence Studies

- Similar to IFR
- Usually population is not random
### Seroprevalence Studies (Cont’d)

<table>
<thead>
<tr>
<th>location</th>
<th>country</th>
<th>mortality estimate</th>
<th>relative precision</th>
<th>date size</th>
<th>sample random</th>
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<tbody>
<tr>
<td>DiamondP. Vo</td>
<td>cruiseship</td>
<td>0.0043</td>
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<td></td>
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<tr>
<td>Gangelt</td>
<td>Germany</td>
<td>0.0037</td>
<td>0.12</td>
<td>aprile2</td>
<td>500</td>
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<tr>
<td>NY – pregnant</td>
<td>USA</td>
<td>0.00402</td>
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<td>Tokyo</td>
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</table>
Case Study

- Age distribution matters in determining lethality
- 80% above 80 bracket

## Deaths by Age Distribution

<table>
<thead>
<tr>
<th></th>
<th>&lt; 20</th>
<th>&lt; 30</th>
<th>&lt; 40</th>
<th>&lt; 50</th>
<th>&lt; 60</th>
<th>&lt; 70</th>
<th>&lt; 80</th>
<th>&lt; 90</th>
<th>90+</th>
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<td>ger.</td>
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<td>0.002</td>
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<td>0.034</td>
<td>0.092</td>
<td>0.224</td>
<td>0.450</td>
<td>0.189</td>
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<tr>
<td>ita</td>
<td>0.0</td>
<td>0.000</td>
<td>0.002</td>
<td>0.009</td>
<td>0.036</td>
<td>0.108</td>
<td>0.289</td>
<td>0.406</td>
<td>0.149</td>
</tr>
</tbody>
</table>
Age Distribution Matters

- If half the old get infected, mortality decreases by a factor of 2
- Age distribution of infected are important!
- Further studies were conducted on nursing home deaths
  - They need to be removed
Nursing Homes: Hotbed for Disease

- Population of nursing homes contain key demographic for deaths
- They are not general population → isolated population
Difficulties in Estimating Mortality by Age

- Distortion Effect
  - Older people symptoms: severe → more likely to get tested
Distortion Effect

COVID-19 Case by Age (EU)
How We Estimated Mortality By Age

- Spain: 700,000 large random survey
  - Number of dead in nursing homes is unknown
  - Data suggests 20,000 dead but there is 32,000 official deaths
- England & Wales: More complete datasets
- California & NYC: Closer to home
Questions?
COVID-19 Mortality by Age Distribution

Hannah Phillips, Henry Matzinger
Georgia Institute of Technology School of Mathematics

Abstract
COVID-19 is an ongoing global crisis. Currently, the scope of the disease is unknown. However it has been hypothesized that certain populations are more prone to succumb to the disease compared to others.

Hypothesis
Using infection fatality ratio (IFR), a more accurate mortality model can be created. Through analysis of randomized sampled populations, models can be created to accurately predict mortality and susceptible populations.

Background
Analysis is performed on continually updated public datasets provided by health ministries worldwide. In the past, countries have used case fatality ratio (CFR) to create mortality models.

Summary
It can be shown that older populations are more susceptible to COVID-19. With this knowledge we can apply this to our future papers on mortality and the susceptibility of reopening populations.

Limitations
Most data sets consider nursing homes. Testing is not identical. Every country has reported their data in different formats and consider different statistics important. Data sets must be checked and updated daily due to COVID-19’s volatility.

Acknowledgements
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