Forecasting: What do we learn?

“COVID-19 pandemic and how we deal with data”
Virtual BBS Seminar - 27 July 2021

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COVID-19 Forecasting: What do we learn?

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1. ICU?

Factors to consider:
- Age
- Sex
- Vaccination
- Saisonality
- Positive rate
- Number of tests
- Lockdown

Flowchart:
- Susceptible
- Infected
- Cases
- General ward
- ICU
- Ventilated
- Recovered
- Dead

NPI, VOC

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COVID-19 Simulator

Data: RKI, Morgenpost, Intensivregister, Ministeries, Presse Releases, MetaIT

https://covid-simulator.com/
R(t) Values

R(t) Values for different regions in Germany:
- Baden-Württemberg
- Bayern
- Berlin
- Brandenburg
- Bremen
- Niedersachsen
- Mecklenburg-Vorpommern
- Saarland
- Sachsen
- Sachsen-Anhalt

Forecasting: What do we learn?
Reproduktionszahl – R(t) Wert
Hospital admission

- Susceptible
  - NPI, VOC
  - Infected
    - Cases
      - Age, sex, number of tests, VOC
    - General ward
      - Age, sex, VOC
      - ICU
        - Age, sex
        - Ventilated
      - Test positive rate, age, sex
    - Recovered
    - Dead

Table 1: Durchschnittliche Liegedauern auf den verschiedenen Stationen

<table>
<thead>
<tr>
<th>Station</th>
<th>Liegedauer [Tage]</th>
<th>ICU [% Aufenthalt]</th>
<th>Beatmung [% Aufenthalt]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normalstation</td>
<td>Entlassen 11.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Verstorben 10.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ICU</td>
<td>Entlassen 20.4</td>
<td>29</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Verstorben 20.0</td>
<td>44</td>
<td>-</td>
</tr>
<tr>
<td>unbeatmet</td>
<td>Entlassen 28.6</td>
<td>43</td>
<td>28</td>
</tr>
<tr>
<td>ICU beatmet</td>
<td>Entlassen 15.5</td>
<td>68</td>
<td>63</td>
</tr>
</tbody>
</table>

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Age, Sex and Hospital Admission

- Hospitalisation rate
- Percentage of patients on intensive care unit
- Percentage of patients on ventilator
- Mortality rate on normal ward
- Mortality rate on intensive care unit without ventilator
- Mortality rate on intensive care unit with ventilator

Age groups:
- 0 to 4
- 5 to 14
- 15 to 34
- 35 to 59
- 60 to 79
- 80 and older

Geschlecht:
- Male
- Female

Altersgruppe:
- Age group
Test positive rate and number of tests

![Graph showing test positive rate and number of tests over time.](image-url)
Variants of Concern (VOC)
Vaccination

![Graph showing vaccination data over time](image)

- Bisherige Erstimpfungen
- Bisherige Zweitimpfungen
- Erwartete Zweitimpfungen

![Graph showing fully vaccinated percentages](image)

- 80+
- 60-79
- 35-59
- 15-34
- All

Forecasting: What do we learn?
Hospitalization and Death Rates
ICU and Deaths - Germany

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NUTS regions

NUTS: Nomenclature of Territorial Units for Statistics

D: NUTS-2 DE11 (Stuttgart): Observations and model prediction

C: NUTS-2 DE11 (Stuttgart), counties
NUTS regions

Germany, counties

Mean residuals per 100,000 inhabitants

Germany, NUTS-2

Mean residuals per 100,000 inhabitants
Forecasting

[Diagram of a disease progression model with nodes for susceptible, infected, ambulatory treatment, general ward, ICU, ventilated, test positive rate, and recovered, along with arrows indicating transitions and data points such as age, sex, VOC, and NPI, VOC.]
Saisonality
Scenario – Different vaccination rates

![Graph showing 7-day incidence rate per 100k with different vaccination rates: Impfquote 75%, Impfquote 85%, Impfquote 95%.]

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Scenario – Different vaccination rates

Belegung Intensivstation

- Impfquote 75%
- Impfquote 85%
- Impfquote 95%

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Covid-19 Simulator

https://covid-simulator.com/
Corona-Vergleich Schweiz vs. Deutschland

Was machen die Schweizer besser?

Nicht nur wandern in den Bergen, auch Restaurantbesuche sind in der Schweiz seit einem Monat möglich. Foto: imago images/YAY Micro
R(t) values

Grossregion
- Espace_Mitelland
- Genferseeuereiog
- Grossregion_Nordwestschweiz
- Ostschweiz
- Schweiz
- Tessin
- Zentralschweiz
- Zürich
Incidence

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Inzidenz

Schweiz

Espace Mitelland

Genfersee region

Grossregion Nordwestschweiz

Ostschweiz

Tessin

Zentralschweiz

Zürich
R(t) values
Incidence

![Graph showing incidence over time for Germany and Switzerland]

Country - Germany - Switzerland
Age – Switzerland vs Germany

Country: Germany, Switzerland
Age: >60, >80
Hospital and ICU

- Schweiz
- Espace Mitelland
- Genferseeregion
- Grossregion Nordwestschweiz
- Ostschweiz
- Tessin
- Zentralschweiz
- Zürich

Legend: Hospital • ICU
Rates – Switzerland vs Germany

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Death

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Death

Cumulative confirmed COVID-19 deaths per million people

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: Johns Hopkins University CSSE COVID-19 Data

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Mar 5, 2020
Mar 8, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Jul 26, 2021

CHART
MAP
TABLE
SOURCES
DOWNLOAD
Lessons learned

• Mathematical models are useful tools in the pandemic
• Difficult data and knowledge situation
  • Pandemic faster than science
• Long term prediction of infections impossible
  • Ir(r)ational human and politic behavior
• Hospital, ICU and outcome is predictable, if infections are known
• Simulations “what-if” scenarios important to assess interventions
  • “There is no glory in prevention”!!!
• Scientific communication to all stakeholders (public, politic, media, etc.) is a challenge – shitstorm guarantied