Digital poster

Poster P2-L18

The impact of inaccurate assumptions about antibody test accuracy on the parametrisation and results of infectious disease models of epidemics

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Take-home message

Timely evaluations of diagnostic test accuracy in the real world are essential for accurate infectious disease modelling and thus better-informed public health decisions during epidemics of emerging infections.

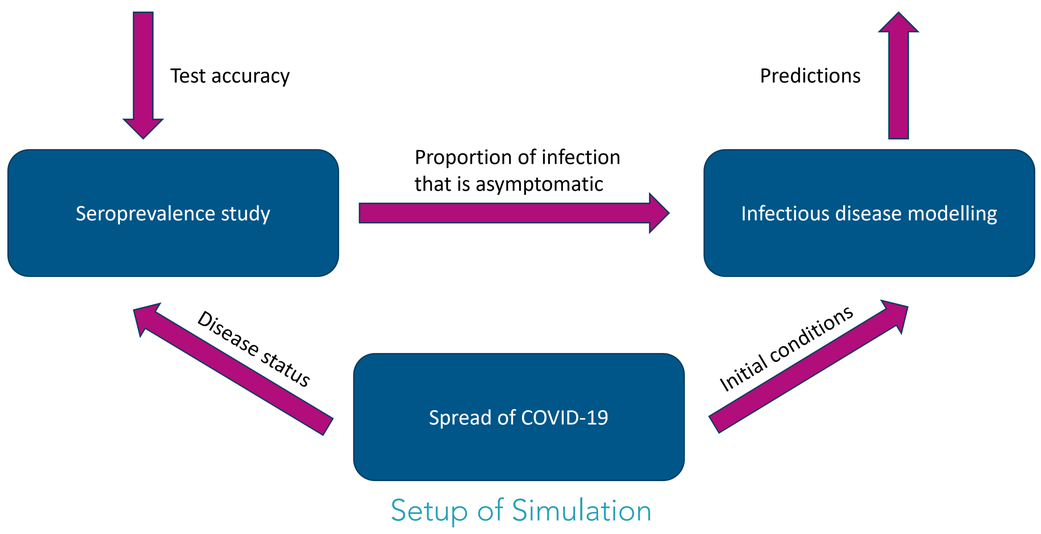
Background and Aim

- Infectious disease models are often parametrised based on results of primary epidemiological studies that use diagnostic tests to establish disease prevalence or seroprevalence.
- During outbreaks of an emerging infection, prevalence and seroprevalence studies are often conducted—and models parametrised—before evaluations of the real-world performance of the diagnostic tests used have concluded.
- Model-based projections of the course of the outbreak can be heavily impacted by assumptions about diagnostic test accuracy parameters, causing any public health decisions made based on these projections to be potentially ill-informed.

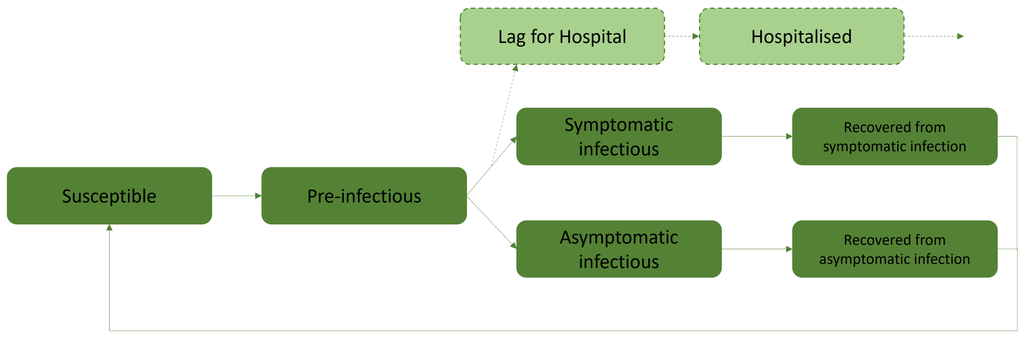
We conducted a **simulation study** based on the early stages of the SARS-CoV-2 pandemic in Germany to quantify the impact of **inaccurate assumptions about diagnostic test accuracy** on the **parametrisation and results of infectious disease models** used to inform public health decision-making.

What did we simulate?

- Spread of COVID-19 in Germany
- Seroprevalence study to establish proportion of infection that is symptomatic, modelled after the Heinsberg study conducted early in the course of the pandemic in Germany.
- Early infectious disease modelling efforts that informed public health decisions.



Setup of Simulation



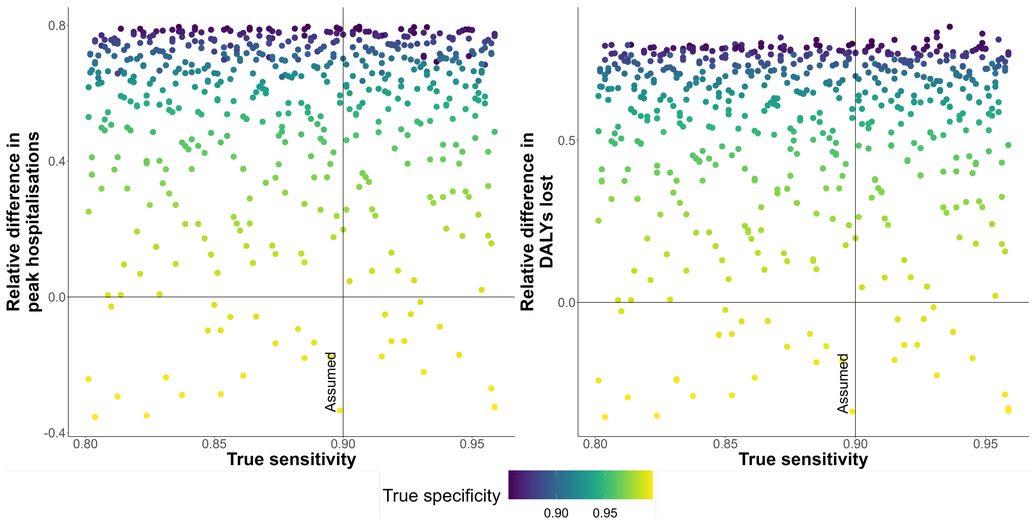
Structure of Epidemic Model

Methods

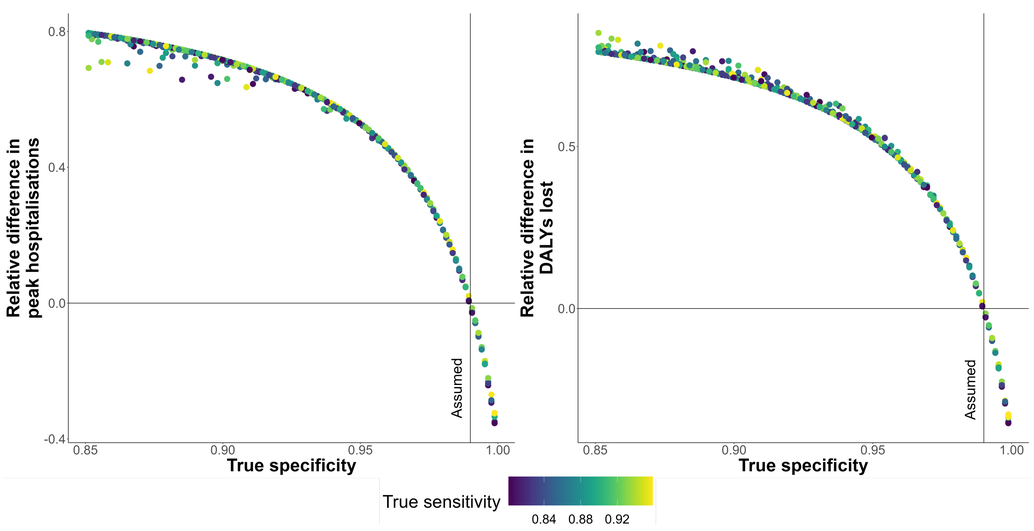
- Stochastic, compartmental model, henceforth called the **epidemic model**, to simulate the spread of COVID-19.
- Deterministic compartmental model for simulated early disease modelling (henceforth called the **prediction model**) with the same structure as the epidemic model. This is used to make predictions about the future course of the epidemic, with initial conditions derived from the epidemic model.
- Simulated seroprevalence study with number of seropositives generated using varying antibody test accuracy parameters (the **true parameters**), but corrected using an **assumed sensitivity of 0.9** and **assumed specificity of 0.99** to mimic the Heinsberg study.
- **Outcome of interest:** Relative difference in model projections of peak hospitalisations and DALYs lost between the correctly- and incorrectly-parameterised prediction model.

Results

We found that inaccurate assumptions about antibody test sensitivity did not have a large impact on the accuracy of model projections of peak hospitalisations and DALYs lost, as indicated by the horizontal strata in the figure below.



On the other hand, the clear vertical trend in the figure below shows that inaccurate assumptions about antiobody test specificity had a very large impact on the accuracy of model predictions, regardless of the accuracy of assumptions about sensitivity.



Implications

Inaccurate assumptions about antibody test specificity during seroprevalence studies can potentially lead to very underestimated model-based predictions about the future course of an epidemic and thus false security about the need for public health interventions.

Acknowledgement

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