Modelling COVID-19 in the Global Context

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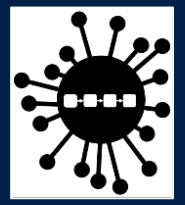
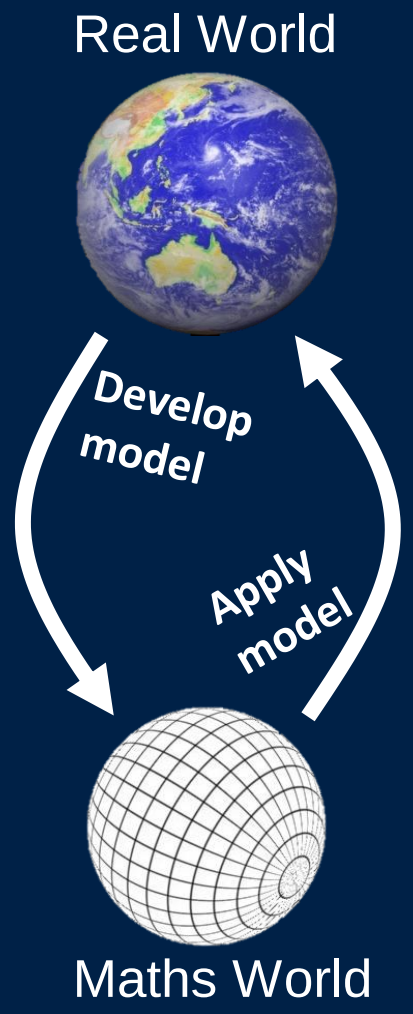
In collaboration with the CoMo Consortium



A mathematical model…

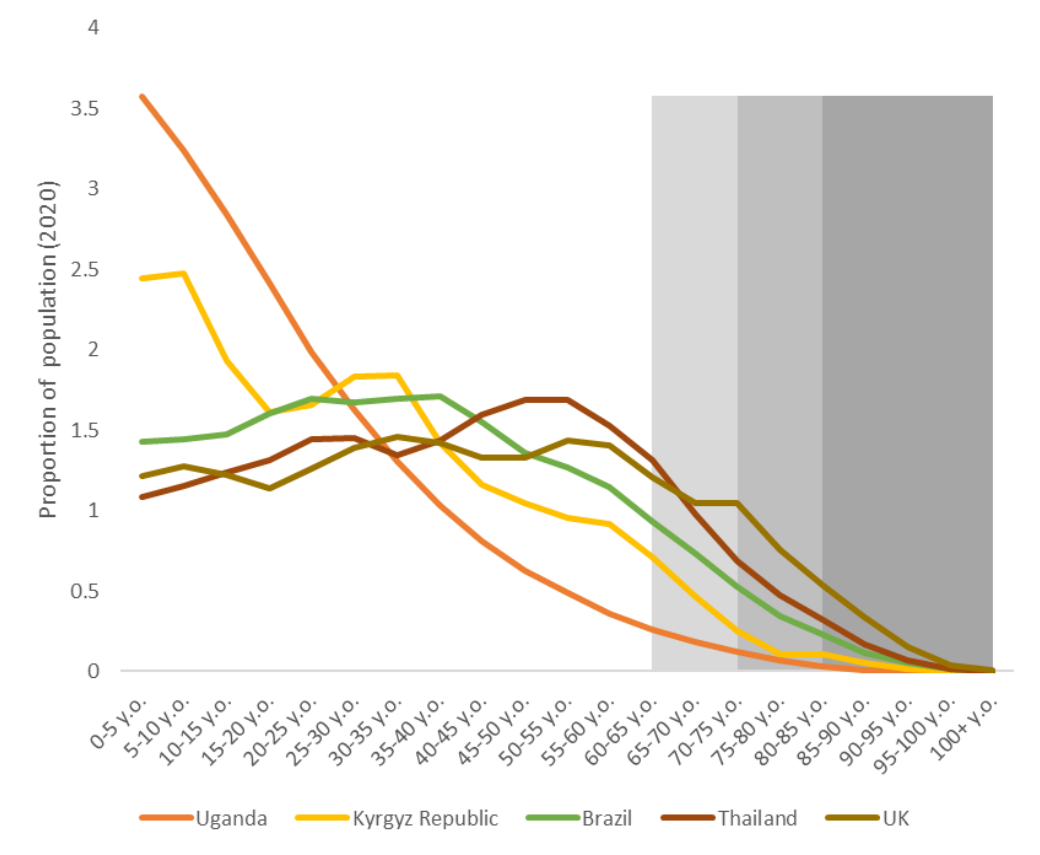
- is a description of a system or multiple interacting systems using mathematics
- can be used to answer “what if” questions about the system
  - what if lockdown is released?
  - what if health system capacity is doubled?
  - what is the optimal realistic intervention package?
- can be simple or complex
- has many limitations:
  - Simple models have more limitations in biology but are faster to write and run with small data
  - Complex models have more detail but are slower to write and run and demand large sets of data

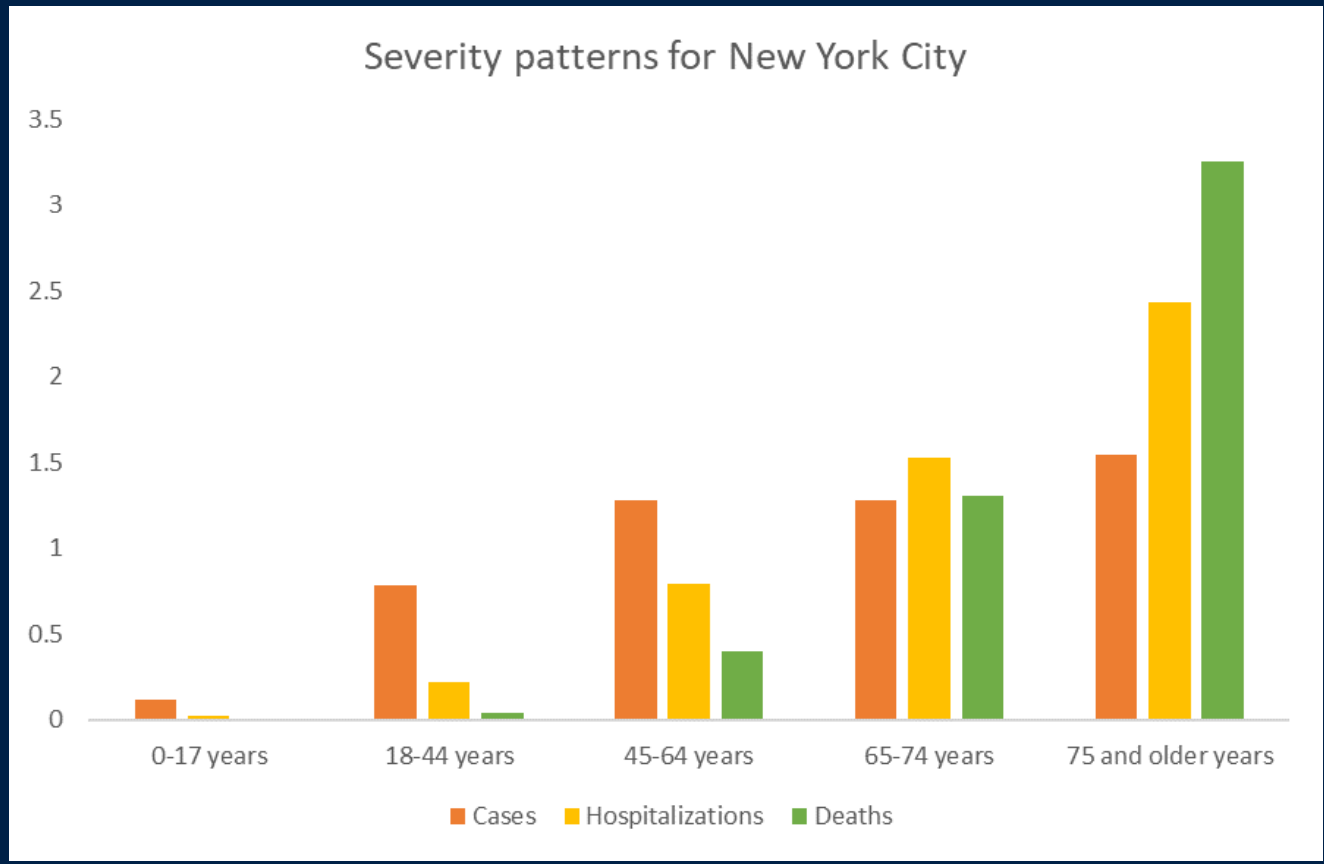


Background on COVID-19

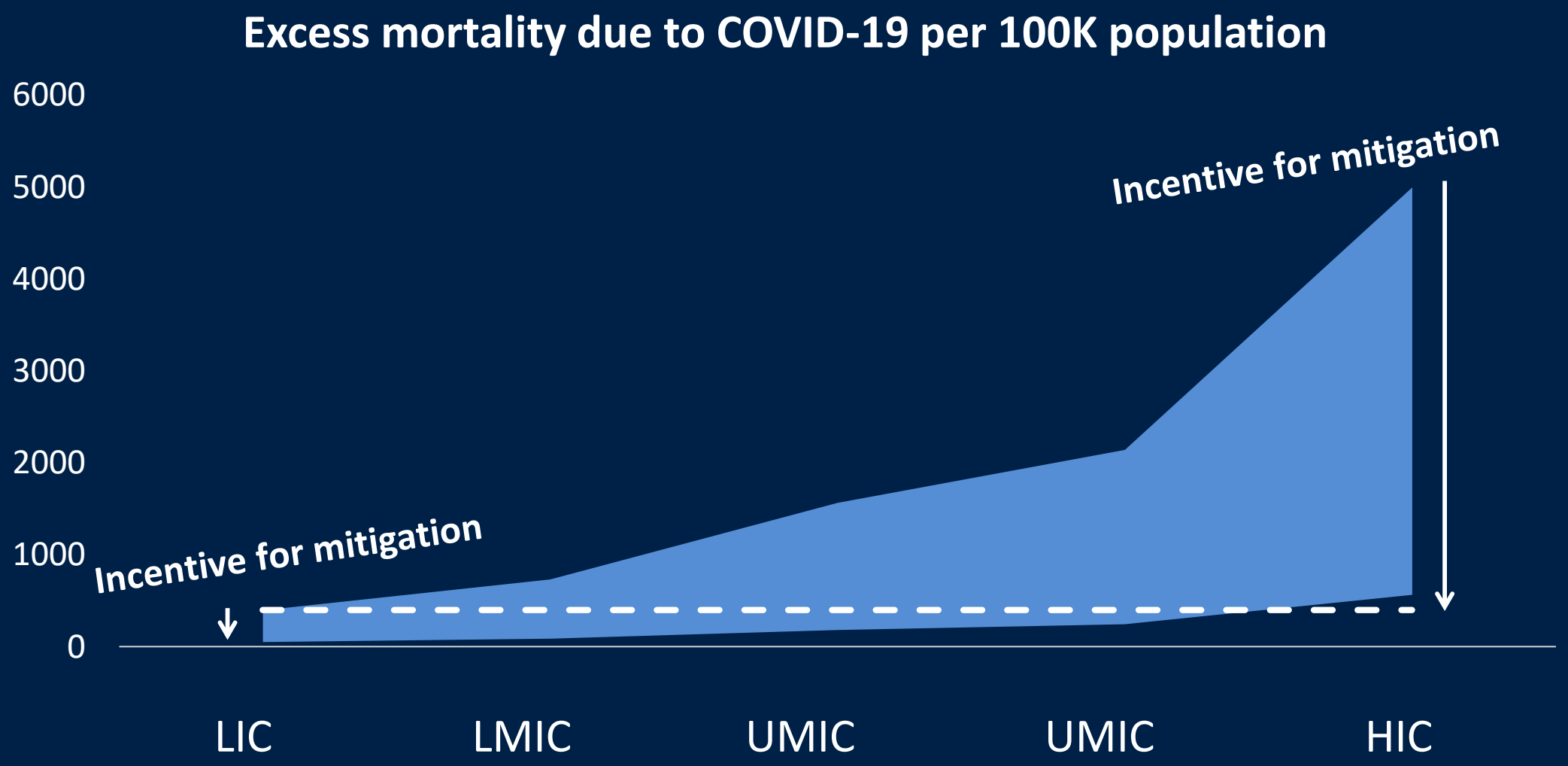
- SARS-CoV-2 has spread across the world at a rapid scale
- No consensus model to predict spread
- No pharmaceutical interventions currently available
- Countries rely on various non-pharmaceutical interventions (NPI) to suppress the spread
- Mathematical modelling of viral spread and resultant clinical disease in light of national healthcare treatment capacity
- Countries at various stages of relaxing lockdown measures

Age structure is important for COVID-19





Age structure is important for COVID-19 strategy

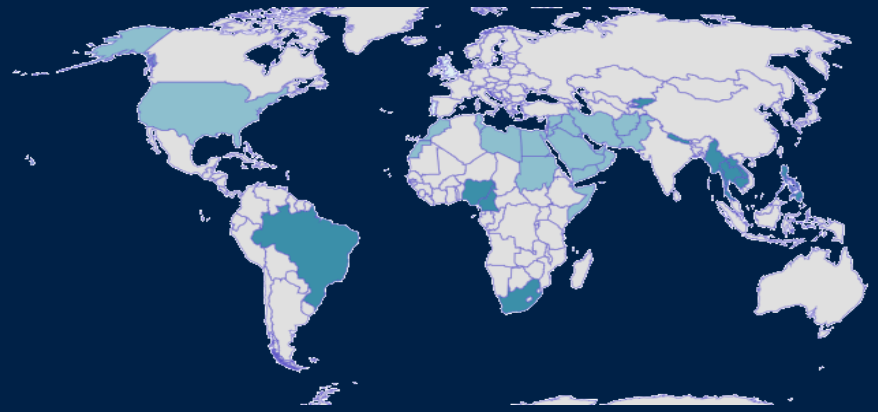


The need for context-specific approaches

- Huge expected differences in mortality between different countries
- An evidence-based approach is needed to evaluate the balance between harm from COVID-19 and harm from COVID-19 prevention
- Modelling is one part of a larger evidence base for decision-making and ideally should be performed in a continuous collaborative relationship

COVID-19 Modelling Consortium (CoMo)

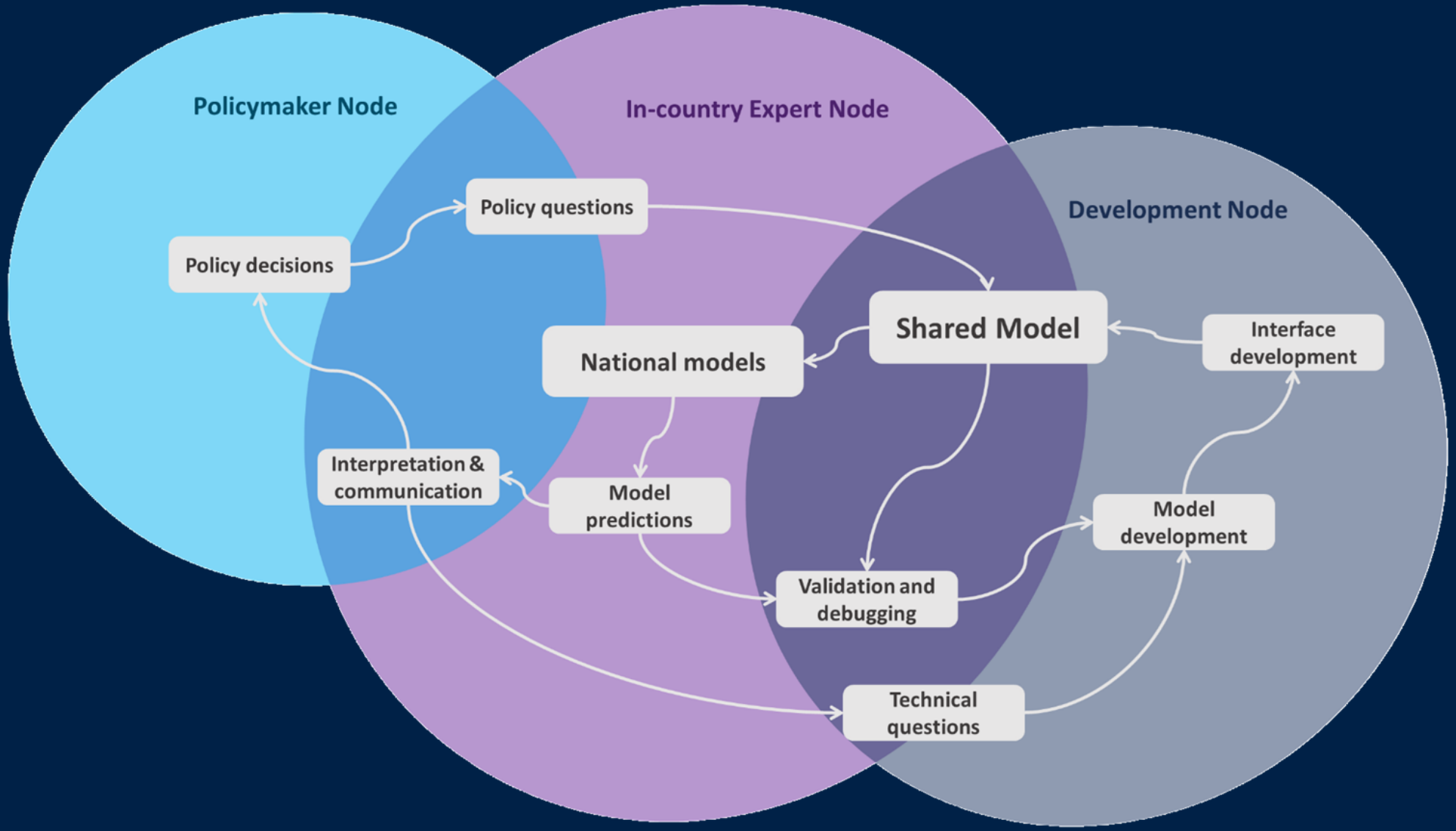
- International group of infectious disease modellers and public health experts in 45+ countries
- Developed model structures to estimate the impact of potential mitigation strategies in national and subnational settings
- User friendly application and interface to enable widespread utility



- Aim to provide policy makers the timely and dynamic support. Co-production of knowledge between modelers and policy makers to assist policy decisions

https://www.tropicalmedicine.ox.ac.uk/news/como-consortium-the-covid-19-pandemic-modelling-in-context

The CoMo style of working

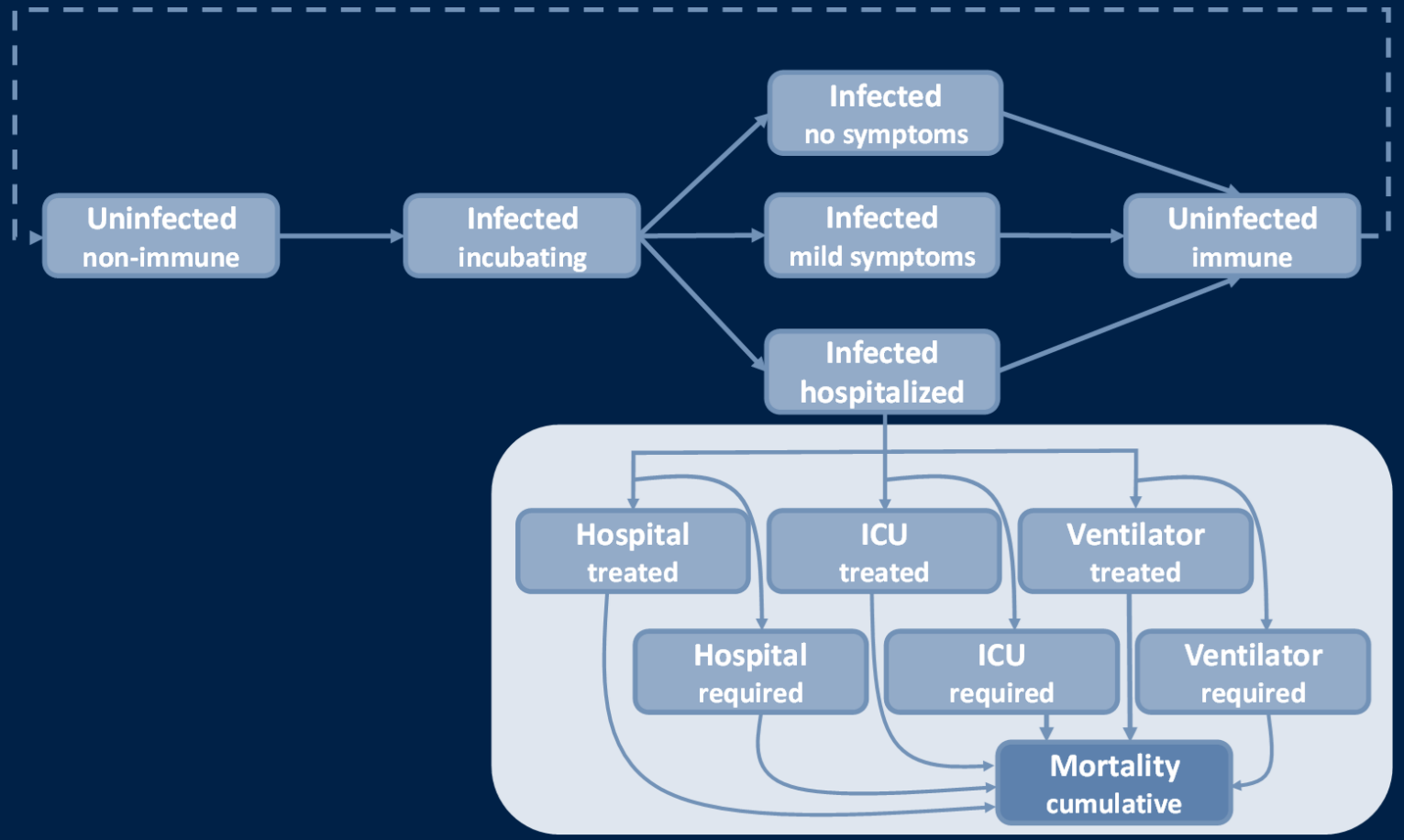


Use cases for CoMo membership

- Modellers who already have a COVID-19 model and would like to share ideas in a supportive environment
- Modellers/programmers who would like to modify the CoMo model code for use in their country
- Public health, statistics and other experts who would like to use the CoMo model to address questions in their country

CoMo model

- Age structured SEIR model
- Infected compartments stratified by symptoms, severity, treatment seeking and access

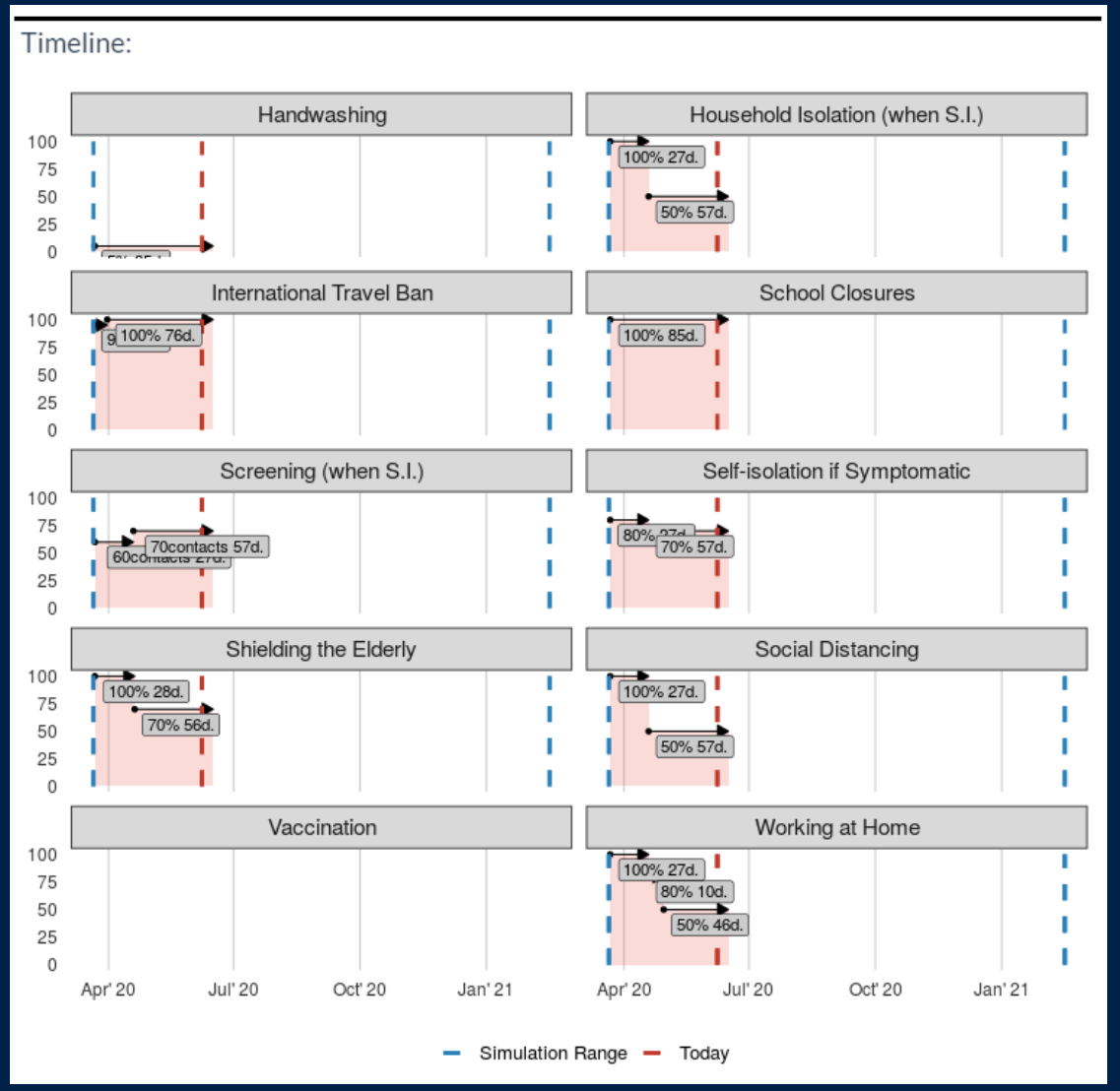


CoMo model: main features

Tailor the model assumptions to individual country's context

Simulation of different intervention scenarios that changes in coverage over time

Possible impact of epidemics to hospital capacity (hospital beds, ICU beds, Ventilators)



Uncertainties and assumptions

- COVID-19 is a novel disease – knowledge on transmission dynamics is still being discovered
- Models are therefore based on assumptions and unknown information about the disease
- Model inputs and outputs will change as we learn more about the disease and the impact of interventions on the disease
- Uncertainty is even bigger if the epidemic is still at early stage in a country or population
- Options will change once better serology, treatments, vaccines become widely available
- There are an extensive set of model assumptions listed in detail in the CoMo description document which can be downloaded from here: https://www.tropicalmedicine.ox.ac.uk/news/como-consortium-the-covid-19-pandemic-modelling-in-context

CoMo model – a demo

COVID-19 App | CoMo Consortium v13.13.1 | Visual Calibration

COVID-19 App | CoMo Consortium

v13.13.1

The Covid-19 International Modelling Consortium (CoMo Consortium) comprises several working groups. Each working group plays a specific role in formulating a mathematical modelling response to help guide policymaking responses to the Covid-19 pandemic. These responses can be tailored to the specific Covid-19 context at a national or sub-national level.

Important Disclaimer:

Whilst every effort has been taken during the development of this tool/model for it to be as accurate and reliable as possible it is important that the user understands that the outputs are a prediction based on the assumptions chosen through the input parameter values. In view of the current uncertainty on the COVID-19 mechanisms of action, the output of the model should be used to explore multiple scenarios and in combination with a larger evidence base during decision-making.

The appropriate use of this tool/model and its output can contribute to effective policymaking, but misuse or misinterpretation of the output can mislead decision-making. Any decisions taken whist using these tools are the responsibility of the user and no liability whatsoever will be taken by the developers/authors of the tool.

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Sources of Data:

Demographic Data:

UN 2019 Revision of World Population Prospects.

Social Contacts Data:

Prem K, Cook AR, Jit M (2017) Projecting social contact matrices in 152 countries using contact surveys and demographic data.

Cases/Deaths Data:

European Centre for Disease Prevention and Control. Updated 2020-06-08

Severity/Mortality by Age Category:

- Vital Surveillances: The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020
- Adjusted Age-Specific Case Fatality Ratio During The COVID-19 Epidemic In Hubei, China, January And February 2020

Acknowledgments

- The CoMo members
- Li Ka Shing Foundation
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- Department for International Development, UK
- Oxford Policy Management

Any questions?