

Using R for mathematical modelling of SARS-CoV-2

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Throughout the pandemic, ongoing questions about who should be prioritised for vaccine delivery, e.g.:

- Within countries (e.g. healthcare workers, the elderly, working-age, priority groups)?
- Equitable and efficient global distribution of doses?
- How to allocate doses once program is underway?

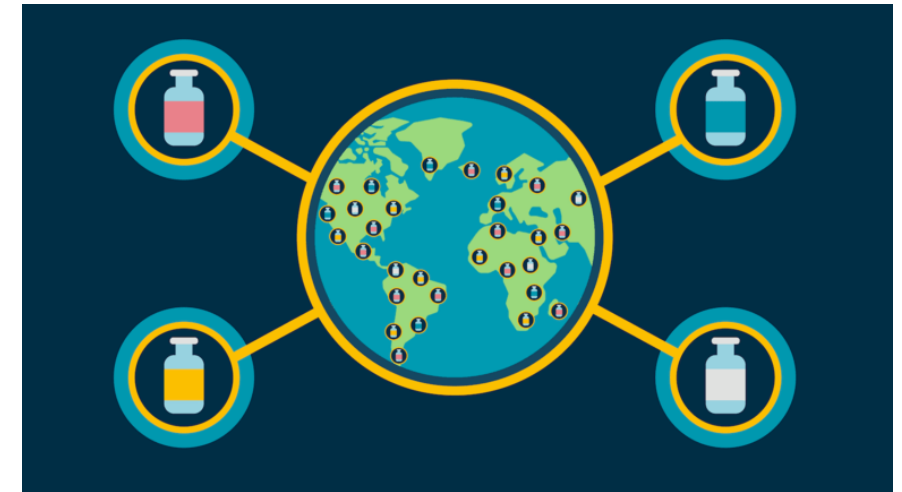
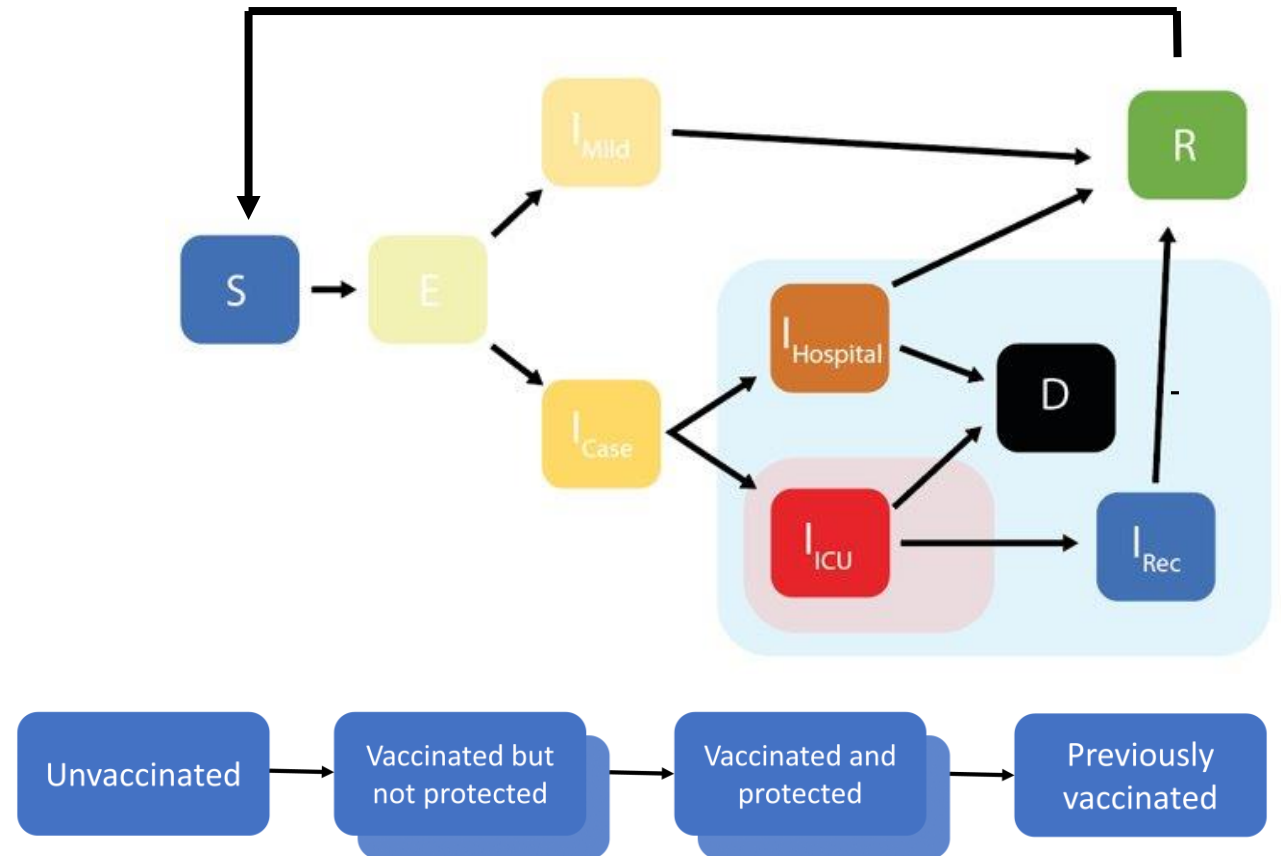


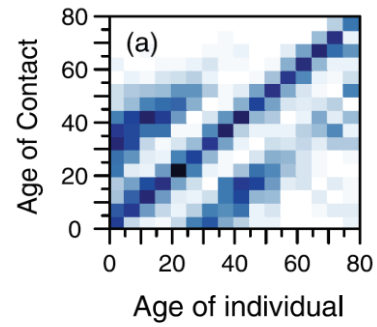
Image credit: wellcome.org

SARS-CoV-2 transmission model

- Age-structured deterministic SEIRS model (17 five-year age groups) with expanded healthcare component
- Age-dependent disease severity
- Setting-specific healthcare capacity, contact patterns, and demography
- Vaccination incorporated by replicating compartments across vaccine states
- Vaccines:
 - modes of action (infection, disease, and transmission)
 - age-targeting and prioritisation
- Fully open source as an R package



<https://github.com/mrc-ide/nimue>



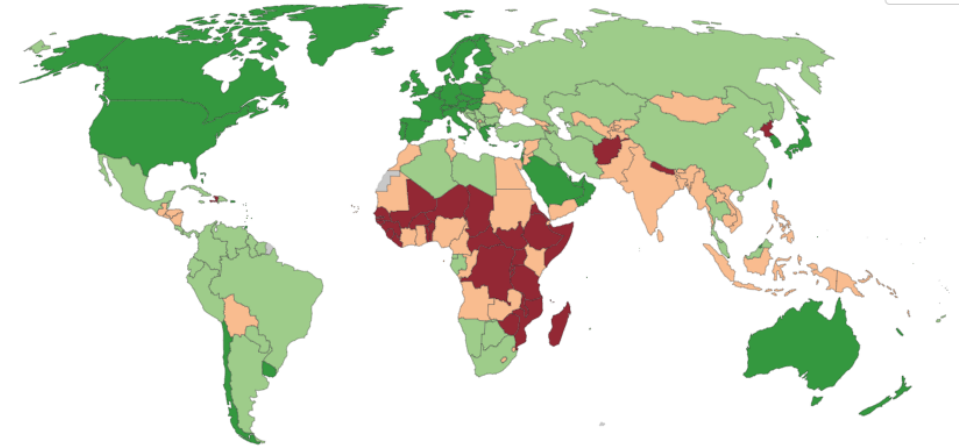
Patterns of mixing
between age-
groups.

World Bank's Income Groups, 2016

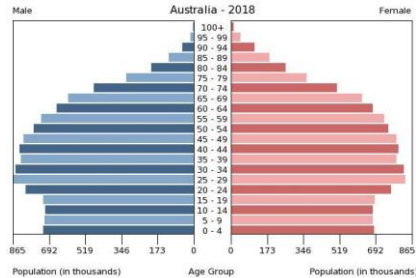
The World Bank's income classifications split countries into one of four categories determined by the country's gross national income (GNI) per capita in US\$. The GNI thresholds between income groups has changed through time based on World Bank definitions.

Our World
in Data

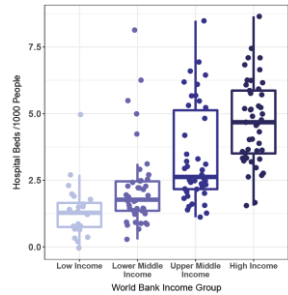
World



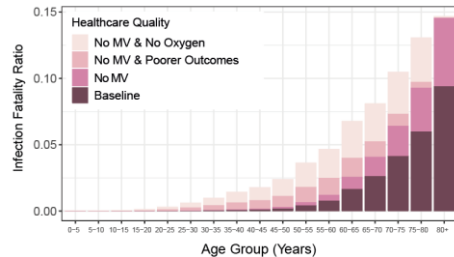
High income Low income Lower-middle income Not categorized Upper-middle income



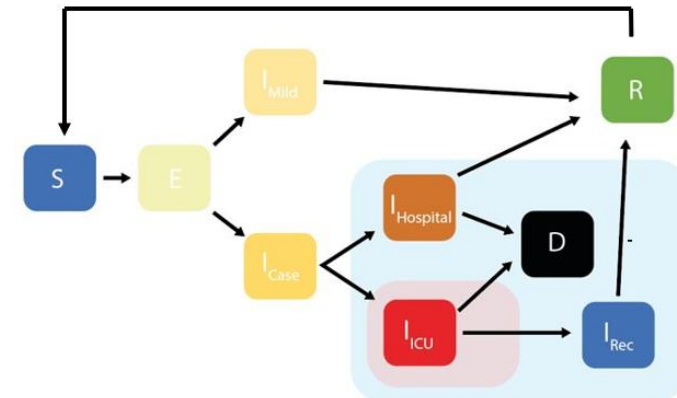
Age structure (UN World
Population Prospects)



Setting specific healthcare
capacity –for both general
hospital and ICU beds.



Age- and healthcare-
capacity-dependent
COVID-19 mortality



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Combating disease
threats worldwide



Resources

- Code for today's session:

https://github.com/abhogan/covid_model_workshop

- Paper on which today's modelling is based:

<https://www.sciencedirect.com/science/article/pii/S0264410X21004278?via%3Dihub>

- Code base for the paper above:

https://github.com/mrc-ide/covid_vaccine_allocation

- Documentation for the package *nimue*:

<https://mrc-ide.github.io/nimue/>