

COVOID

e-RUM 2020 | Milano | 17 June

Oisín Fitzgerald, o.fitzgerald@unsw.edu.au -

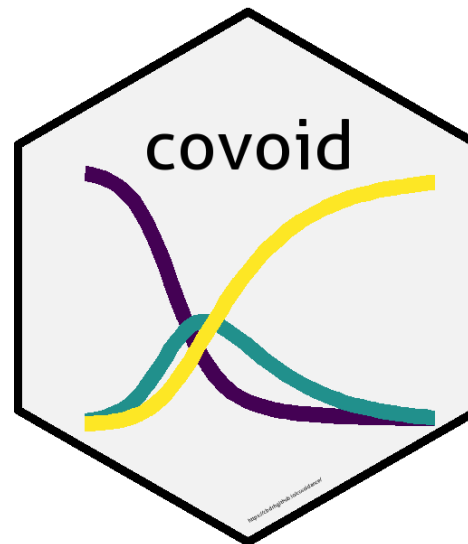
Mark Hanly, m.hanly@unsw.edu.au -

Tim Churches, timothy.churches@unsw.edu.au -

What is COVOID?

COVID-19 Opensource Infection Dynamics

github.com/CBDRH/covoid



- | R Package
- | Shiny Interface
- | Age-structured SEIR+ Compartmental Models
- | Time-varying Interventions

Motivation

Opensource Models | Transparent Assumptions | Reproducible

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16 March 2020

Imperial College COVID-19 Response Team

Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand

Neil M Ferguson, Daniel Laydon, Gemma Nedjati-Gilani, Natsuko Imai, Kylie Ainslie, Marc Baguelin, Sangeeta Bhatia, Adhiratha Boonyasiri, Zulma Cucunubá, Gina Cuomo-Dannenburg, Amy Dighe, Ilaria Dorigatti, Han Fu, Katy Gaythorpe, Will Green, Arran Hamlet, Wes Hinsley, Lucy C Okell, Sabine van Elsland, Hayley Thompson, Robert Verity, Erik Volz, Haowei Wang, Yuanrong Wang, Patrick GT Walker, Caroline Walters, Peter Winskill, Charles Whittaker, Christl A Donnelly, Steven Riley, Azra C Ghani.

On behalf of the Imperial College COVID-19 Response Team

WHO Collaborating Centre for Infectious Disease Modelling
MRC Centre for Global Infectious Disease Analysis
Abdul Latif Jameel Institute for Disease and Emergency Analytics
Imperial College London

TITLE: Modelling the impact of COVID-19 in Australia to inform transmission reducing measures and health system preparedness

Authors: Moss R (PhD)¹, Wood J (PhD)², Brown D (MBBS)³, Shearer F (PhD)¹, Black, AJ (PhD)⁴, Cheng AC (FRACP)⁵, McCaw JM (PhD)^{1,3,6}, McVernon J (FAFPHM)^{1,3,7}

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Email: j.mcvernon@unimelb.edu.au; Tel: +61 3 8344 0633 **ABSTRACT (300 words limit)**

Background The ability of global health systems to cope with increasing numbers of COVID-19 cases is of major concern. In readiness for this challenge, Australia has drawn on clinical pathway models developed over many years in preparation for influenza pandemics. These models have been used to estimate health care requirements for COVID-19 patients, in the context of broader public health measures.

Motivation

Opensource Models | Transparent Assumptions | Reproducible



John Carmack  @ID_AA_Carmack · Apr 28

Replying to [@ID_AA_Carmack](#)

Before the GitHub team started working on the code it was a single 15k line C file that had been worked on for a decade, and some of the functions looked like they were machine translated from Fortran. There are some tropes about academic code that have grains of truth, but \

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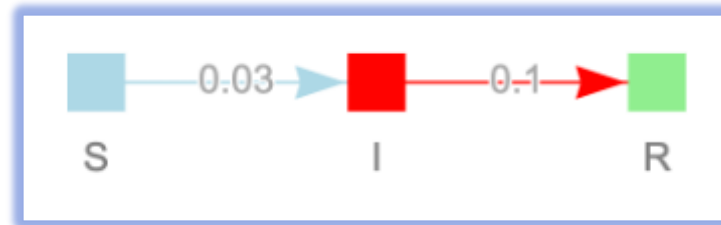
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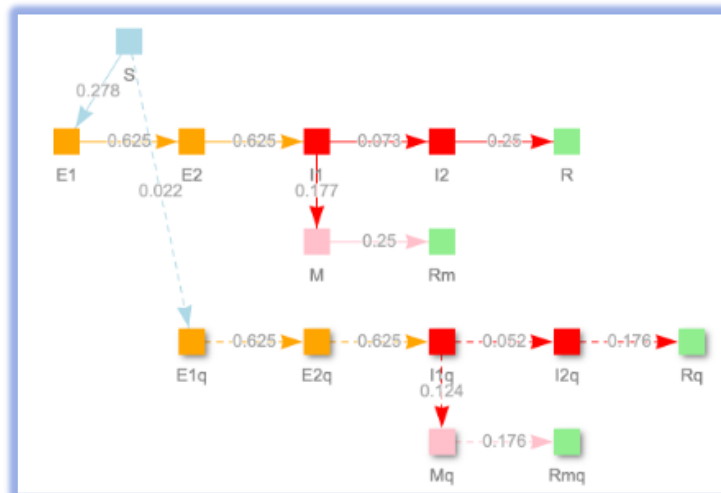
Model Features

7 Compartmental models

```
covoid::simulate_sir( ... )
```



```
covoid::simulate_seimrqc( ... )
```



Basic Model Syntax

```
# Set model parameters
param <- sir_param(R0 = 2.5,
                  gamma = 0.1)

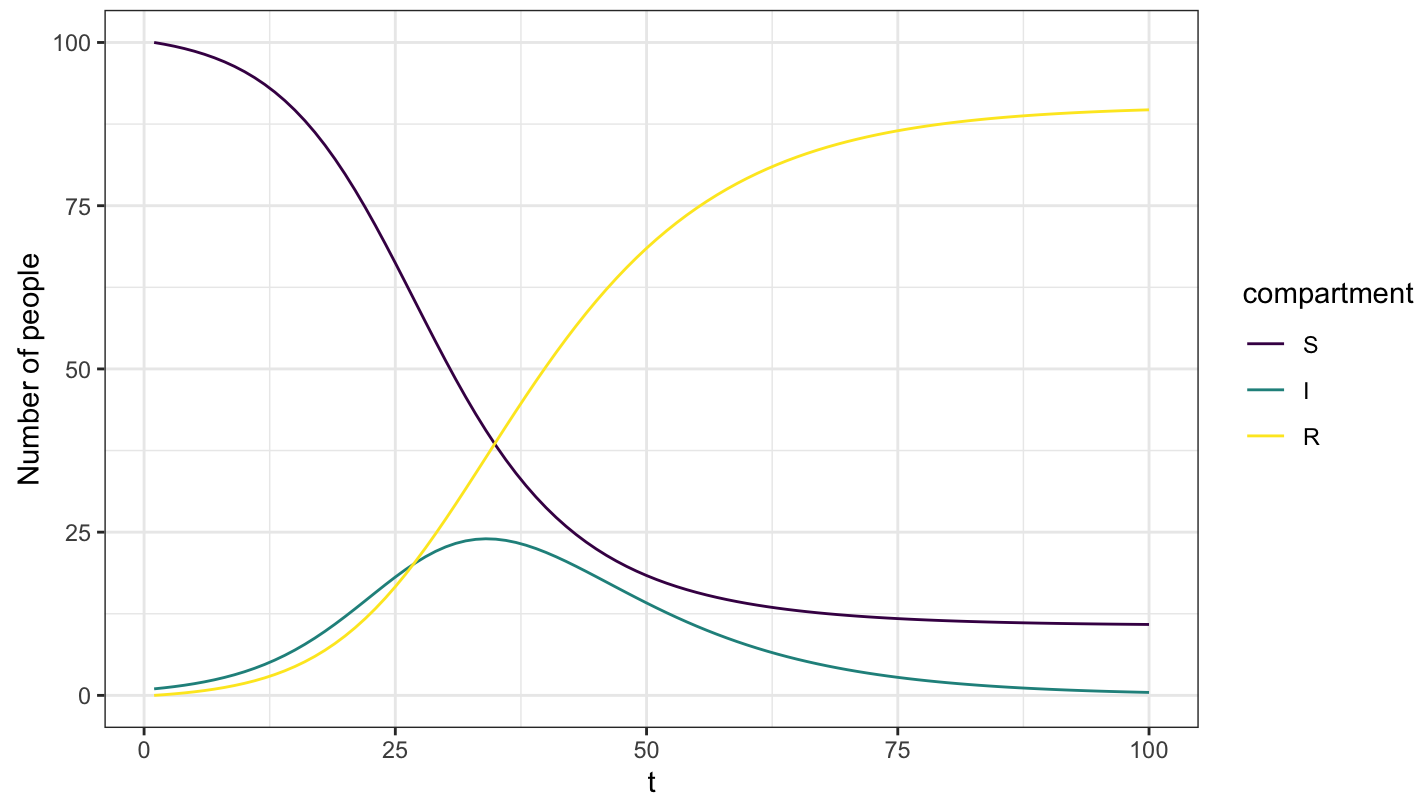
# Set initial conditions
state0 <- sir_state0(S = 100,
                    I = 1,
                    R = 0)

# Run simulation
res <- simulate_sir(t = 100,
                  state_t0 = state0,
                  param = param)
```

Basic Model Syntax

```
# View results
```

```
plot(res,c("S","I","R"))
```



Model Features

Age-Structured Models

- | Age distribution
- | Social contacts
- | 150 Countries

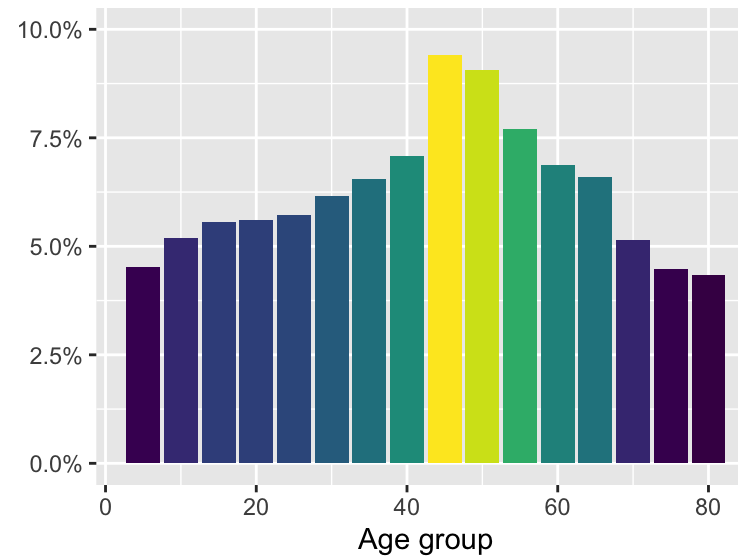
Model Features

Age-Structured Models: Age distribution

- United Nations [World Population Prospects 2019](#)

Italy

```
italyAge <- covoid::import_age_distribution("Italy")
```



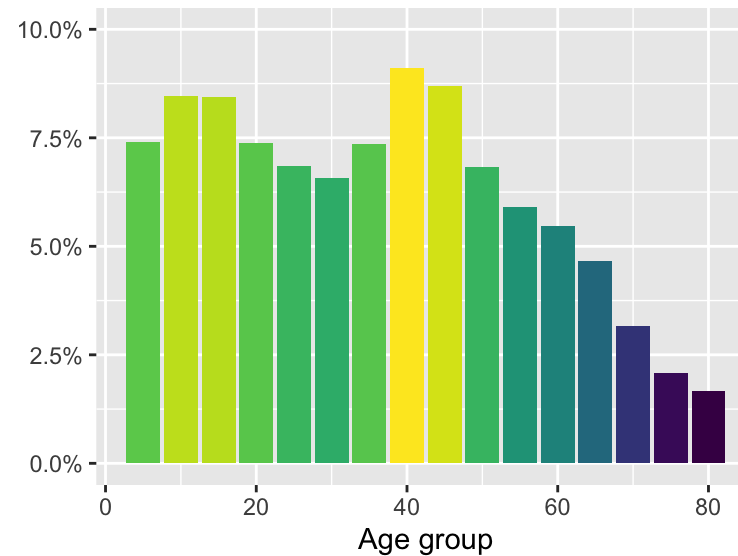
Model Features

Age-Structured Models: Age distribution

- United Nations [World Population Prospects 2019](#)

```
# Ireland
```

```
irelandAge <- covoid::import_age_distribution("Ireland")
```



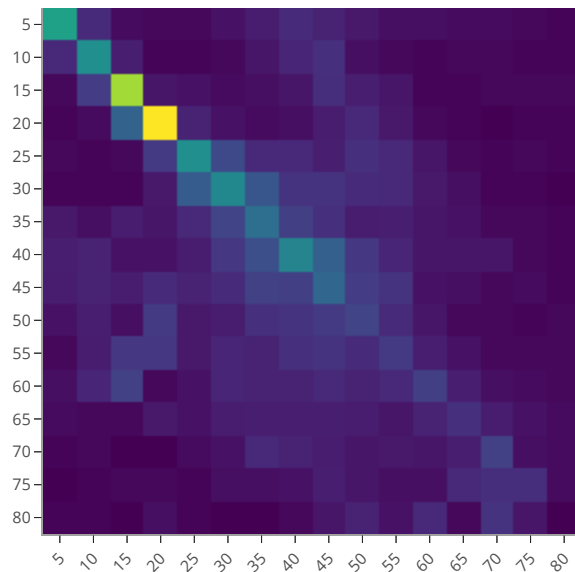
Model Features

Age-Structured Models: Number of daily social contacts

- Derived from the POLYMOD Study
- See [Prem et al 2017](#)

Italy

```
italyContacts <- covoid::import_contact_matrix("Italy", "general")
```



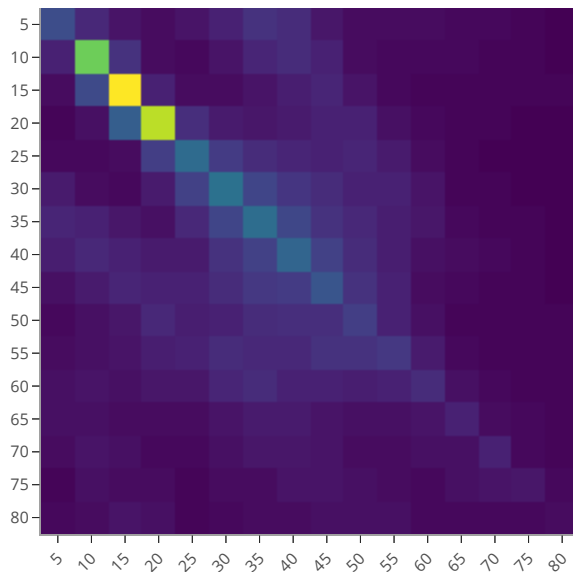
Model Features

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Ireland

```
irelandContacts <- covoid::import_contact_matrix("Ireland", "general")
```



Introducing interventions

Flexible | Time-varying | % of pre-pandemic levels

1. Number of daily contacts

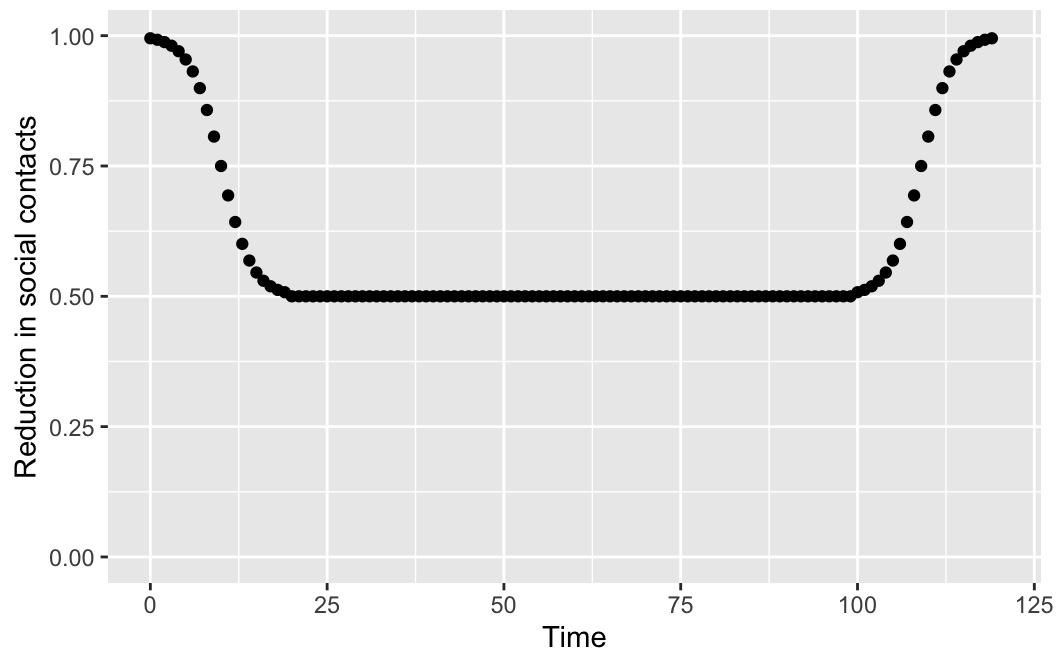
- Lockdown
- Working from home
- Social distancing

2. Probability of transmission

- Wearing facemasks
- Hand washing
- Good hygiene

Introducing interventions

```
int = covid::contact_intervention(start = 0,  
                                  stop = 100,  
                                  start_delay = 20,  
                                  stop_delay = 20,  
                                  reduce = 0.5)
```



Shiny interface

Familiarise yourself with workflow | Good for non-coders

```
# Launch SEIR model shiny interface  
covid::covid("seir")
```

Also available at cbdrh.shinyapps.io/cavoidance