DOH Covid modelling symposium
Barry Childs, healthcare committee chair
2020 05 21

16 March

19 March

26 March

28 April

Called for volunteers from the healthcare committee and formed a working group and a modelling subgroup.

Divvied up tasks to data gathering, research and literature review and model building.

Wrote code, agonised over assumptions

Published first set of results

Received wide ranging feedback (some saying too high, some too low) and critique for model refinement.

Calibrate to emerging data (base scenario is below current deaths)

Approach is to produce a model for use by broader profession that is sound in its basis and provides guidance in its application. To contribute to national debate. To provide a flexible framework to allow for the application of actuarial judgement. To model the impact of Covid-19 on mortality as well as healthcare resource utilisation

Special thanks to:
Percept
Clinix
Alexander Forbes
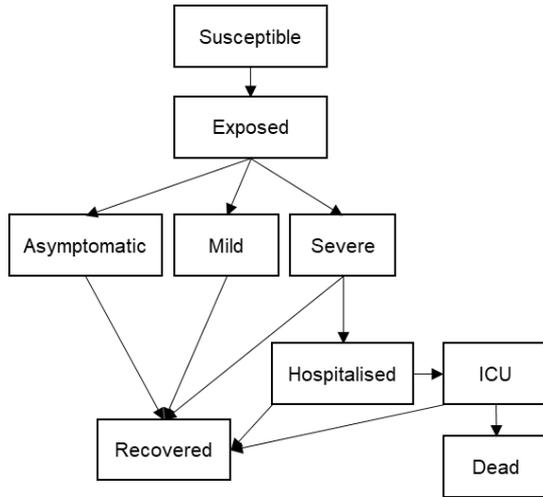Medscheme

NMG
3One
Discovery
Insight

Quantifying Risk, Enabling Opportunity.

Model structure

Base parameters

- *R0 = 3*
- *Proportion of asymptomatic cases = 75%*
- *Relative Infectiousness of asymptomatic cases (to symptomatic cases) – 50%*
- *30% of mild cases detected, all severe and critical cases detected**
- *Lockdown effect = 60% x R0*
- *NPIs after lockdown = 75% x R0*
- *Infectiousness pre isolation: Asymptomatic 10 days, Mild 7 days, Severe 2.3 days,*
- *Severe isolated in hospital for 3.7 days*
- *Hospital stay: 10 days if not critical, 6 critical days if critical plus 10 days in ICU if recover or 6 if die*
- *Proportion of admissions ending in ICU =21.3%.*

Scenario 2 (else equal to base)
- *R0 = 2.6*
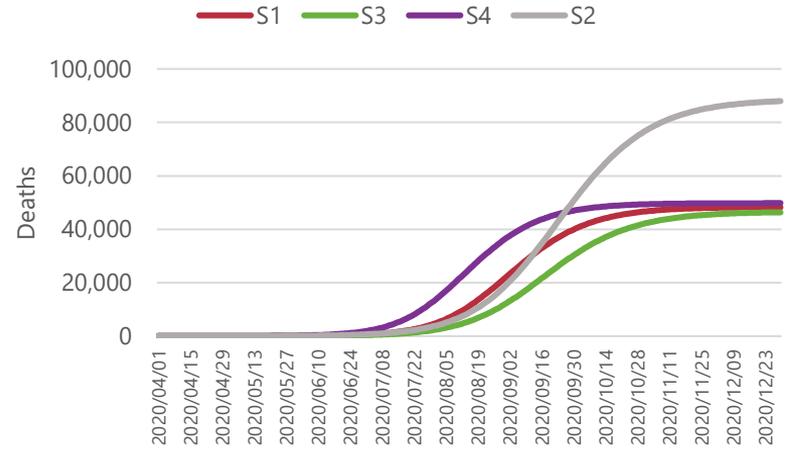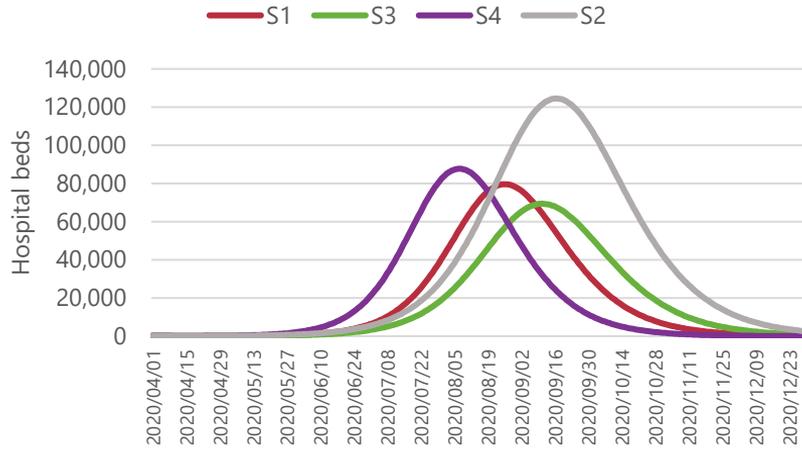- *Asymptomatic proportion = 50%*

Scenario 3 (else equal to base)
- *Lockdown effect = 50% x R0*
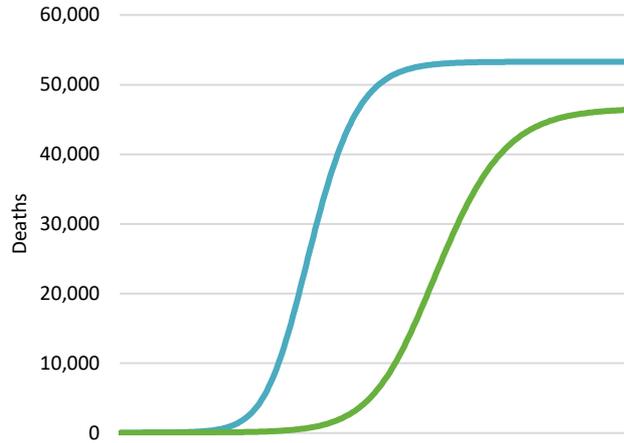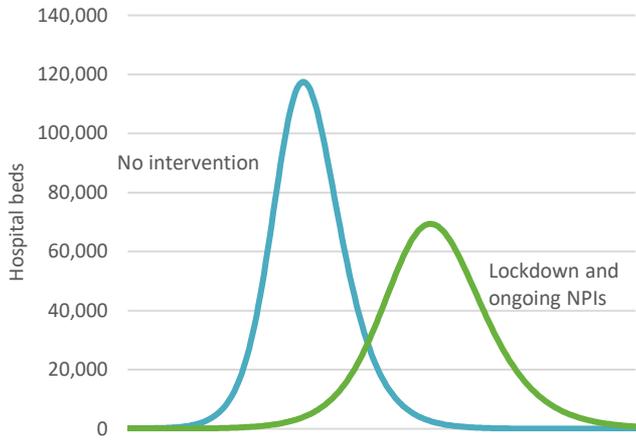- *NPIs after lockdown effect = 70% x R0*

Scenario 4 (else equal to base)
- *Lockdown effect = 70% x R0*
- *NPIs after lockdown effect = 80% x R0*

First set of scenarios

Model outputs illustrate sensitivity to some key parameter values. Lowering the Reproduction rate pushes curves back but overall figures remain similar unless R0 can be maintained below 1. Altering asymptomatic assumption has a significant effect. Based on feedback and critique from the broader profession models and parameters are being refined.

Models

No intervention

Lockdown and ongoing NPIs

Hospital beds
140,000
120,000
100,000
80,000
60,000
40,000
20,000
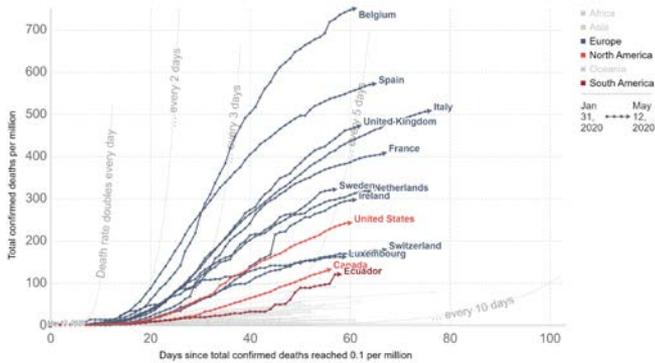0

Deaths
60,000
50,000
40,000
30,000
20,000
10,000
0

Models driven by parameters, informed by research and literature. Useful for predictions and policy testing. Sensitive to model structure and parameter choices. Much remains unknown. Model shortcomings such as spatial dynamics, population heterogeneity, variations in infectivity, etc still need to be allowed for.

International data

Total confirmed COVID-19 deaths per million: how rapidly are they increasing?
Shown are the total confirmed 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.

Daily confirmed COVID-19 cases per million, 3-day rolling average
The number of confirmed cases is lower than the number of total cases. The main reason for this is limited testing.
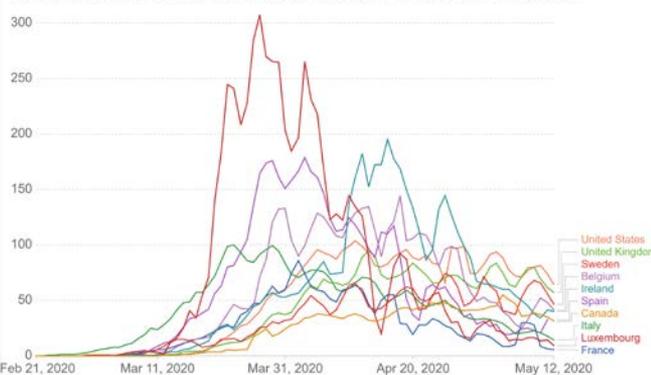
Source: European CDC – Situation Update Worldwide – Last updated 12th May, 11:15 (London time)   OurWorldInData.org/coronavirus • CC BY

Note: The rolling average is the average across three days – the confirmed cases on the particular date, and the two previous days. For example, the value for 27th March is the average over the 25th, 26th and 27th March.

Worst affected countries starting to level off, topping out at 600 deaths per million (excl. Belgium*). Many countries, especially developing countries have followed a much lower path. Concerns remain about under reported deaths and excess mortality which will still aggravate figures, and re-emergence of cases
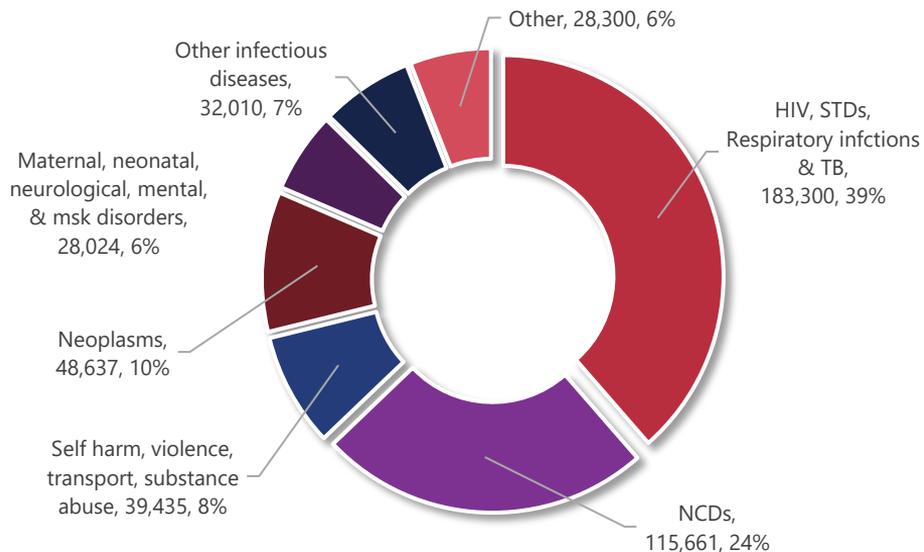
2017 Cause of death estimates
Global health data exchange

~ 1,300 deaths a day

Significant concern that management of other conditions fall by the way side due to focus on Covid-19

"In high burden settings, HIV, TB and malaria related deaths over 5 years may be increased by up to 10%, 20% and 36%, respectively, compared to if there were no COVID-19 epidemic. We estimate the greatest impact on HIV to be from interruption to ART, which may occur during a period of high or extremely high health system demand; for TB, we estimate the greatest impact is from reductions in timely diagnosis and treatment of new cases, which may result from a long period of COVID-19 suppression interventions"

Report 19 - The Potential Impact of the COVID-19 Epidemic on HIV, TB and Malaria in Low- and Middle-Income Countries, Imperial College London

ACTUARIAL SOCIETY OF SOUTH AFRICA

Quantifying Risk, Enabling Opportunity.

Contributors to disease progression and effect

Latent factors

| Age profile | Young age profile by international standards should keep mortality rates low |

| Comorbidities | Moderate relative burdens of NCDs |

| HIV and TB | High burden but not yet indicated as significant risk factors. HIV not on treatment remain a concern |

| Obesity | Moderate to high levels of obesity |

| Density | High proportion of population in urban areas. Large geographies have low density |

Policy factors

| Early lockdown | Early lockdown bought time for scaling up testing, planning, training, facility preparedness |

| Testing | High levels of testing by international standards, positive rate of +/- 1/30 tests but delays are a problem |

| Bed capacity | Overall hospitals bed capacity looks manageable. ICU capacity may still be breached if the surge comes |

| Education Awareness Mobility NPI Compliance | High general awareness and education of hand washing, social distancing, mask wearing. Difficulties persist in compliance – some related to queuing for food, grants, etc |

Share of men that are obese, 2016
Obesity is defined as having a body-mass index (BMI) equal to or greater than 30. Body mass index is a person's weight in kilograms divided by his height in metres squared.

Our World in Data
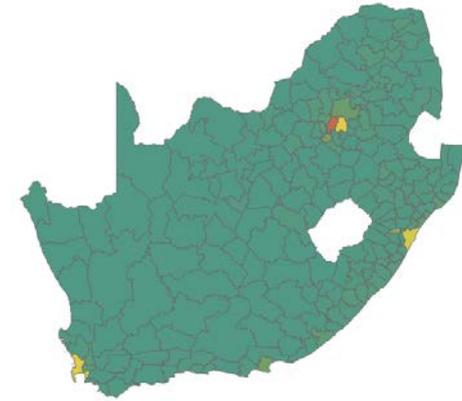
Persons per km sq

0   3,009

No data   0%   5%   10%   15%   20%   25%   30%   35%   >40%

Source: WHO, Global Health Observatory   OurWorldInData.org/obesity • CC BY