

An intervention model for the COVID-19 epidemic in South Africa

Prof Alex van den Heever

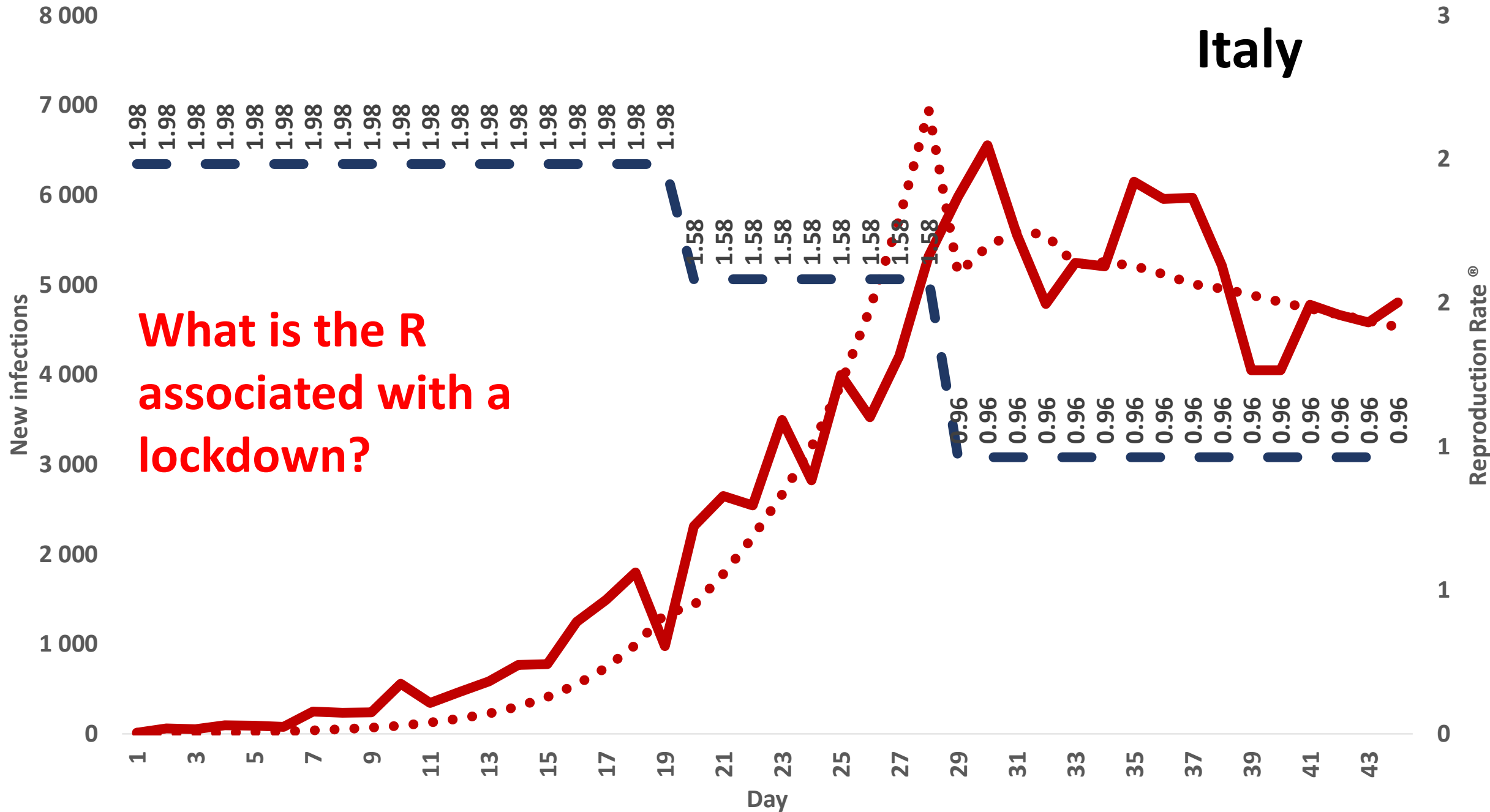
20 May 2020

“Model” features and objectives

- Follows the SEIR approaches
- Top-down
- Matches interventions to disease trajectory
- Purpose: examine optimal strategic intervention scenarios – and is not used for forecasting – focus is on informing decisions
- Estimates produced till 31 December 2020
- Calibrates “model” using intervention success in other countries and assumes we should get similar results in South Africa (which we haven’t)

Generating the model parameters

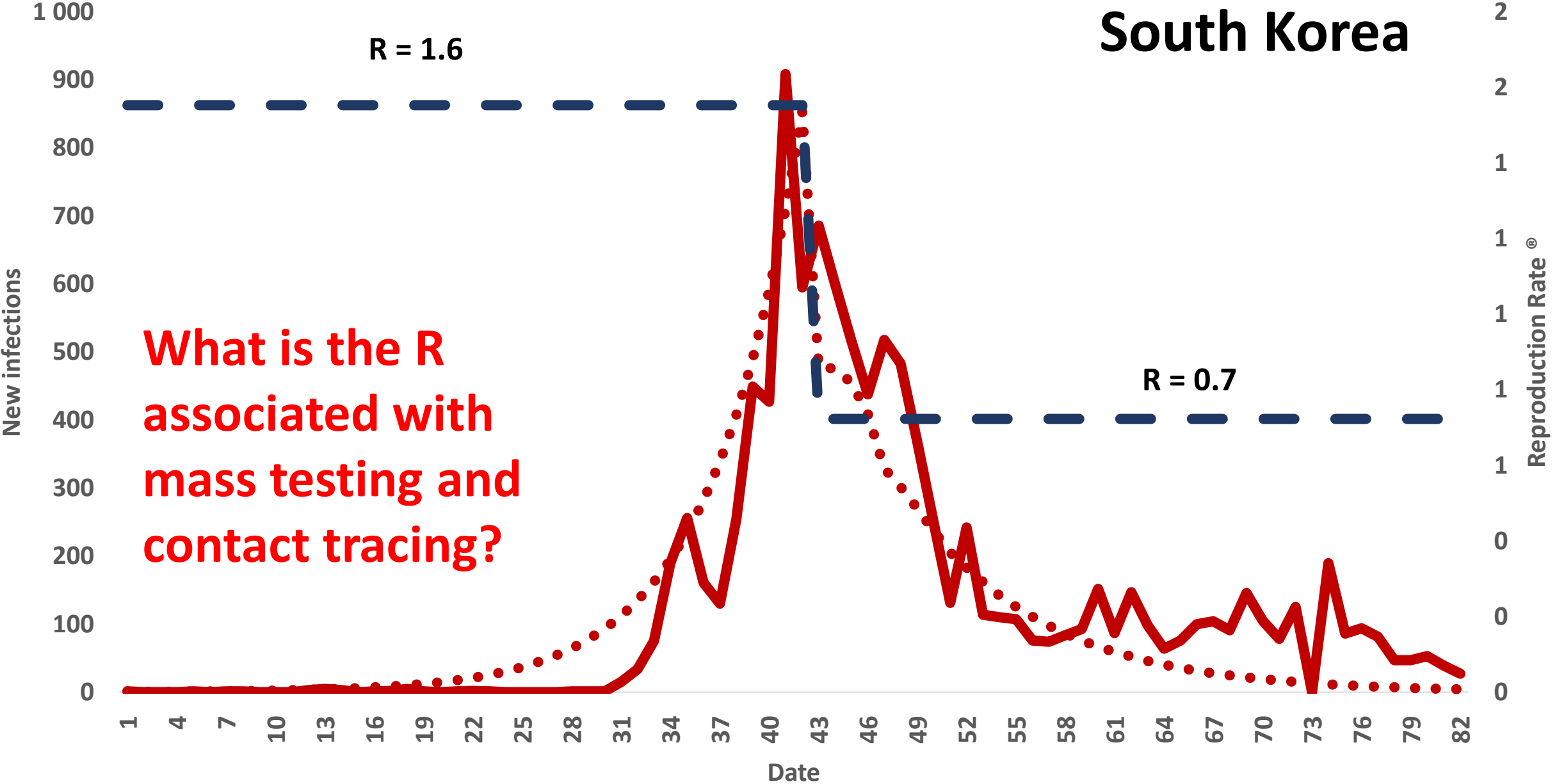
Italy



What is the R associated with a lockdown?

••• New infections (est) — New infections (actual) ■ Reproduction Rate (R)

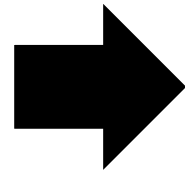
South Korea



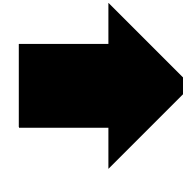
••• New infections (est) — New infections (actual) — Reproduction Rate (R)

How do we get to scenarios for 2020?

Individual interventions
with associated reductions in R



Response packages
involving combinations of interventions with an aggregate R



2020 scenarios
involving the application of different packages to specific periods

Interventions and the assumed reduction in R

Interventions	Days	R
Normal behaviour - cold climate	4	2.43
Normal behaviour - hot climate	4	-0.24
Border screening and advice	4	-0.05
Close borders	4	-0.20
Social distancing	4	-0.30
Employer protocols	4	-0.30
Lock-down - targeted	4	-0.20
Lock-down - general	4	-0.55
Targeted testing and contact tracing	4	-0.05
Mass testing and contact tracing	4	-0.50

Intervention packages

Level 4 Intervention	L4: General lock-down with targeted screening - cold weather		
Intervention scenario	Days	R	Intervention
Normal behaviour - cold climate	4	2.43	
Normal behaviour - hot climate	4	0.00	No
Border screening and advice	4	-0.05	Yes
Close borders	4	-0.20	Yes
Social distancing	4	-0.30	Yes
Lock-down - targeted	4	0.00	No
Lock-down - general	4	-0.55	Yes
Targeted testing and contact tracing	4	-0.55	Yes
Mass testing and contact tracing	4	0.00	No
R outcome	4	0.79	

Make choices about the configuration of interventions (packages)

SCENARIOS TO DECEMBER 2020 – each package has an aggregate R based on the intervention configurations



March

December

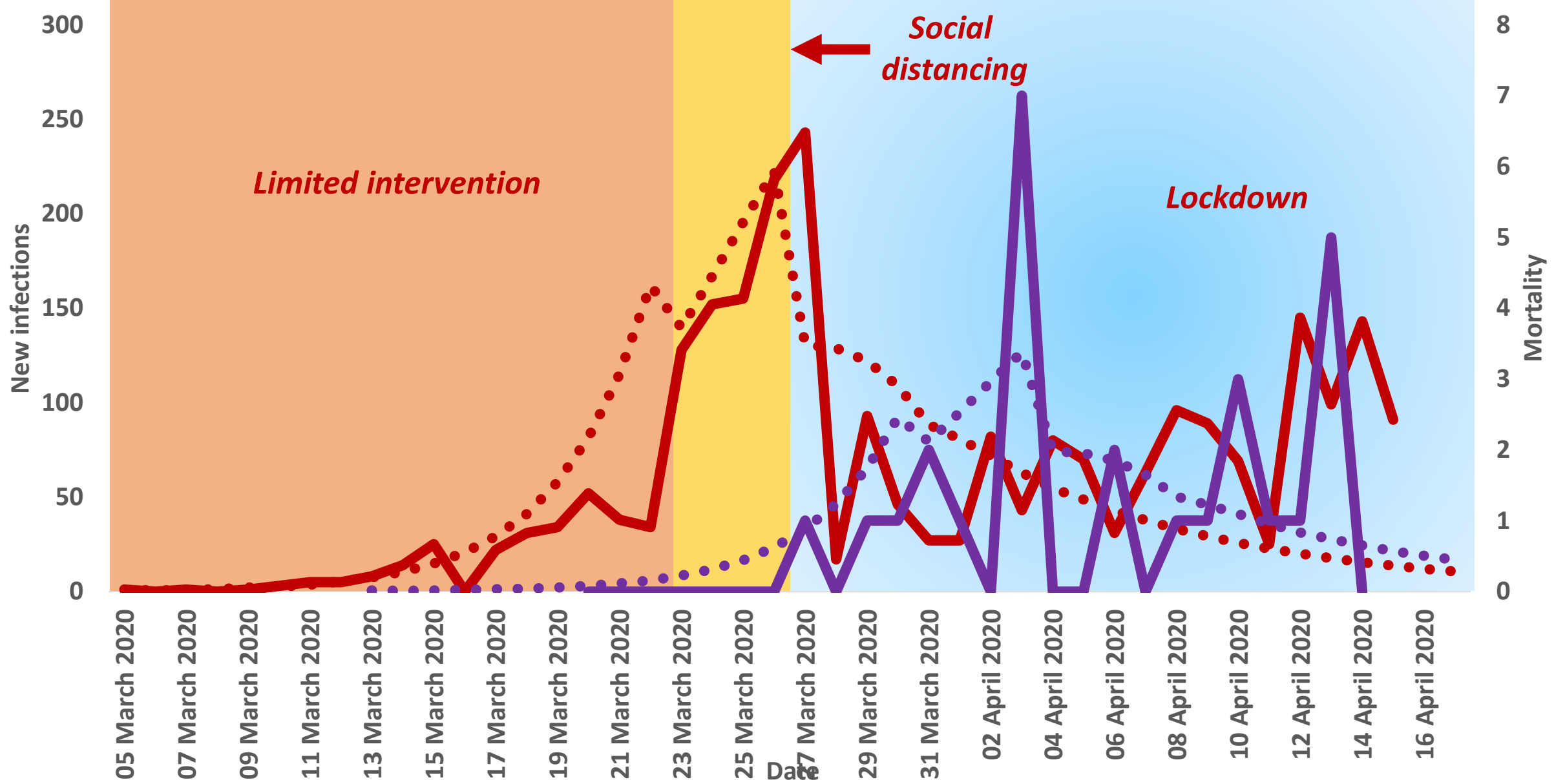
Scenarios are generated by day of the year

Return to ASSUMPTIONS		Lockdown-dependent	Risk-adjusted	Do nothing
Active scenario =	Risk-adjusted	Choose your strategy (by day) in this column		
Day	Quick result on New Infections	Policy choice	Policy choice	Policy choice
05 March 2020	0.5	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
06 March 2020	0.5	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
07 March 2020	0.8	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
08 March 2020	1.3	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
09 March 2020	2.0	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
10 March 2020	2.6	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
11 March 2020	3.7	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
12 March 2020	5.3	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
13 March 2020	7.5	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
14 March 2020	10.4	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
15 March 2020	14.7	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
16 March 2020	20.8	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
17 March 2020	29.2	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
18 March 2020	41.1	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
19 March 2020	58.0	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
20 March 2020	81.6	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
21 March 2020	115.0	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
22 March 2020	162.0	L0: No intervention - warm weather	L0: No intervention - warm weather	L0: No intervention - warm weather
23 March 2020	166.0	L1: Limited - warm weather	L1: Limited - warm weather	L1: Limited - warm weather
24 March 2020	209.0	L1: Limited - warm weather	L1: Limited - warm weather	L1: Limited - warm weather
25 March 2020	259.7	L1: Limited - warm weather	L1: Limited - warm weather	L1: Limited - warm weather
26 March 2020	317.4	L1: Limited - warm weather	L1: Limited - warm weather	L1: Limited - warm weather
27 March 2020	130.2	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather
28 March 2020	125.3	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather
29 March 2020	113.9	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather
30 March 2020	93.9	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather
31 March 2020	63.4	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather
01 April 2020	54.2	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather
02 April 2020	44.5	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather
03 April 2020	35.0	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather
04 April 2020	27.0	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather	L4: General lock-downs with targeted screening - warm weather

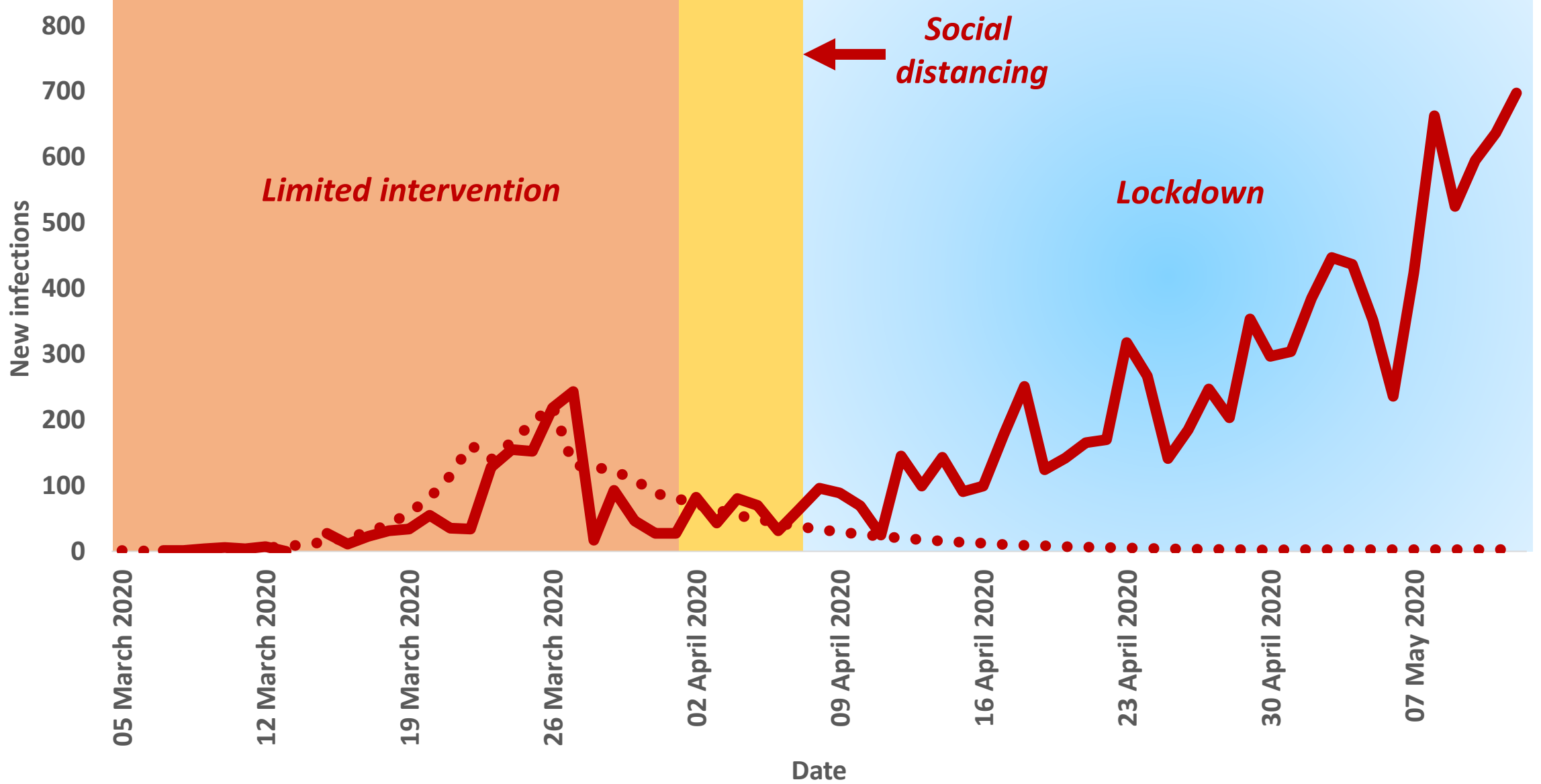
L0: No intervention - warm weather	2.19
L0: No intervention - cold weather	2.43
L1: Limited - warm weather	2.09
L1: Limited - cold weather	1.98
L2: Intermediate - warm weather	1.34
L2: Intermediate - cold weather	1.58
L3: Mass screening with selective lock-downs - warm weather	0.79
L3: Mass screening with selective lock-downs - cold weather	1.03
L4: General lock-downs with targeted screening - warm weather	0.72
L4: General lock-down with targeted screening - cold weather	0.96

Level 4 Intervention	L4: General lock-downs with targeted screening - warm weather		
Intervention scenario	Days	R	Intervention
Normal behaviour - cold climate	4	2.43	
Normal behaviour - hot climate	4	-0.24	Yes
Border screening and advice	4	-0.05	Yes
Close borders	4	-0.10	Yes
Social distancing	4	-0.65	Yes
Lock-down - targeted	4	0.00	No
Lock-down - general	4	-0.62	Yes
Targeted testing and contact tracing	4	-0.05	Yes
Mass testing and contact tracing	4	0.00	No
R outcome	4	0.72	

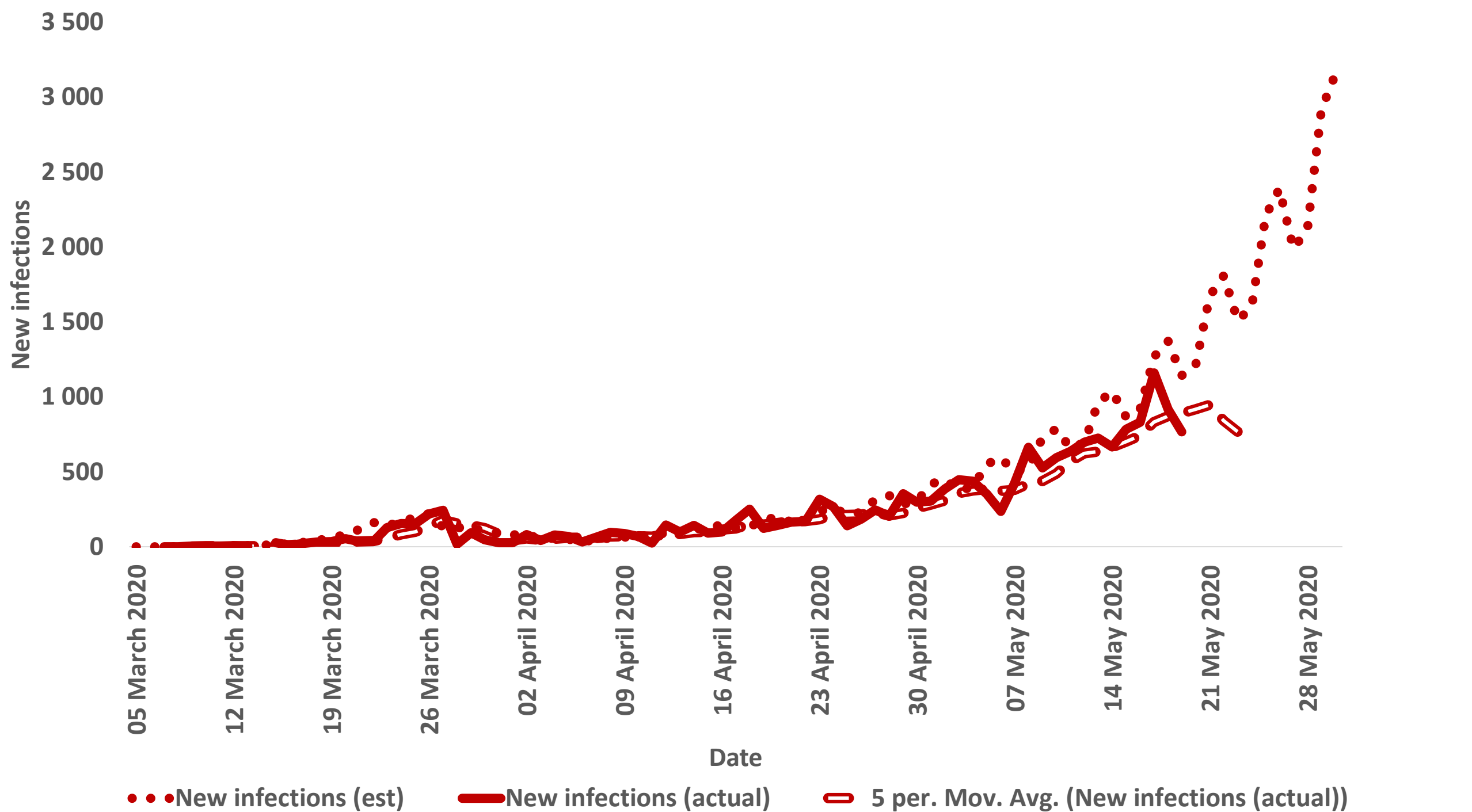
Do the parameters predict the
South African epidemic –
accounting for interventions?




● ● ● New infections (est)
 — New infections (actual)
 ● ● ● Mortality (est)
 — Mortality (actual)

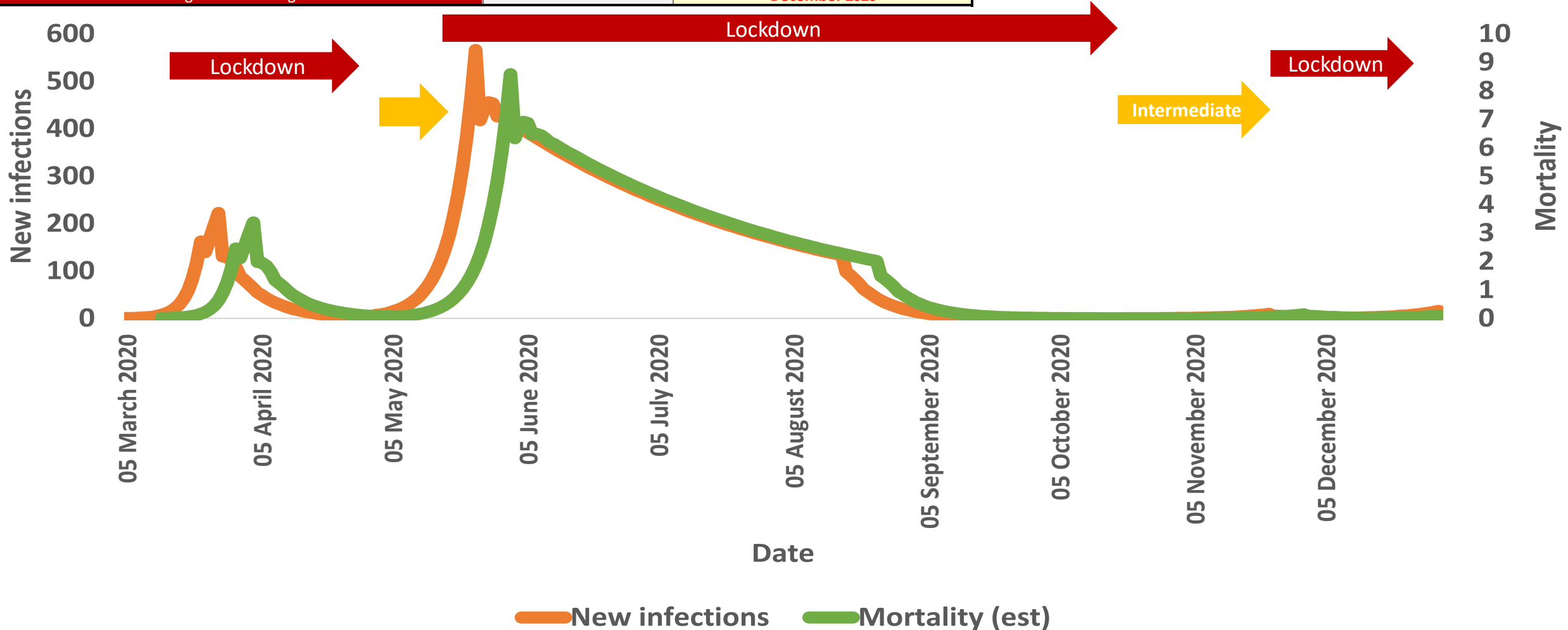


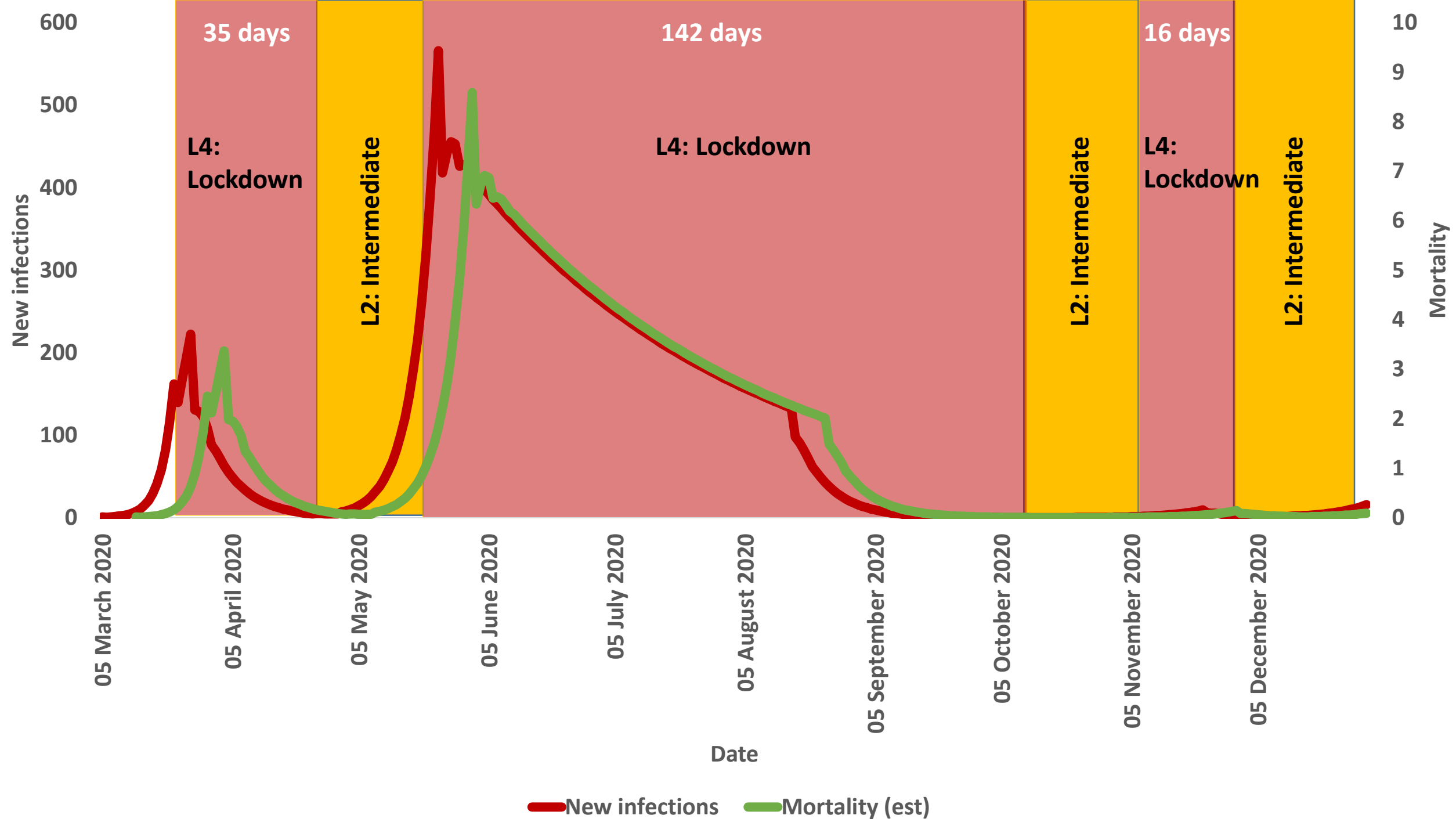
• • • Series2 — Series1



Lockdown-dependent strategy

Intervention level options		
L0: No intervention - warm weather	2.19	Choose intervention scenario Lockdown-dependent  These reflect the number of people each infected person would infect associated with each intervention level. Above you can selected the overall scenario to 31 December 2020
L0: No intervention - cold weather	2.43	
L1: Limited - warm weather	2.09	
L1: Limited - cold weather	1.98	
L2: Intermediate - warm weather	1.34	
L2: Intermediate - cold weather	1.58	
L3: Mass screening with selective lock-downs - warm weather	0.37	
L3: Mass screening with selective lock-downs - cold weather	0.61	
L4: General lock-downs with targeted screening - warm weather	0.72	
L4: General lock-down with targeted screening - cold weather	0.96	





35 days

142 days

16 days

L4:
Lockdown

L2: Intermediate

L4: Lockdown

L2: Intermediate

L4:
Lockdown


L2: Intermediate

New infections

Mortality

New infections Mortality (est)

Risk-adjusted strategy

L0: No intervention - warm weather	2.19	Choose intervention scenario
L0: No intervention - cold weather	2.43	
L1: Limited - warm weather	2.09	 <p>These reflect the number of people each infected person would infect associated with each intervention level. Above you can selected the overall scenario to 31 December 2020</p>
L1: Limited - cold weather	1.98	
L2: Intermediate - warm weather	1.34	
L2: Intermediate - cold weather	1.58	
L3: Mass screening with selective lock-downs - warm weather	0.37	
L3: Mass screening with selective lock-downs - cold weather	0.61	
L4: General lock-downs with targeted screening - warm weather	0.72	
L4: General lock-down with targeted screening - cold weather	0.96	

