Professor Paul Johnson
Senior Medical Advisor, DHHS

Infectious Diseases Physicians, Austin Health

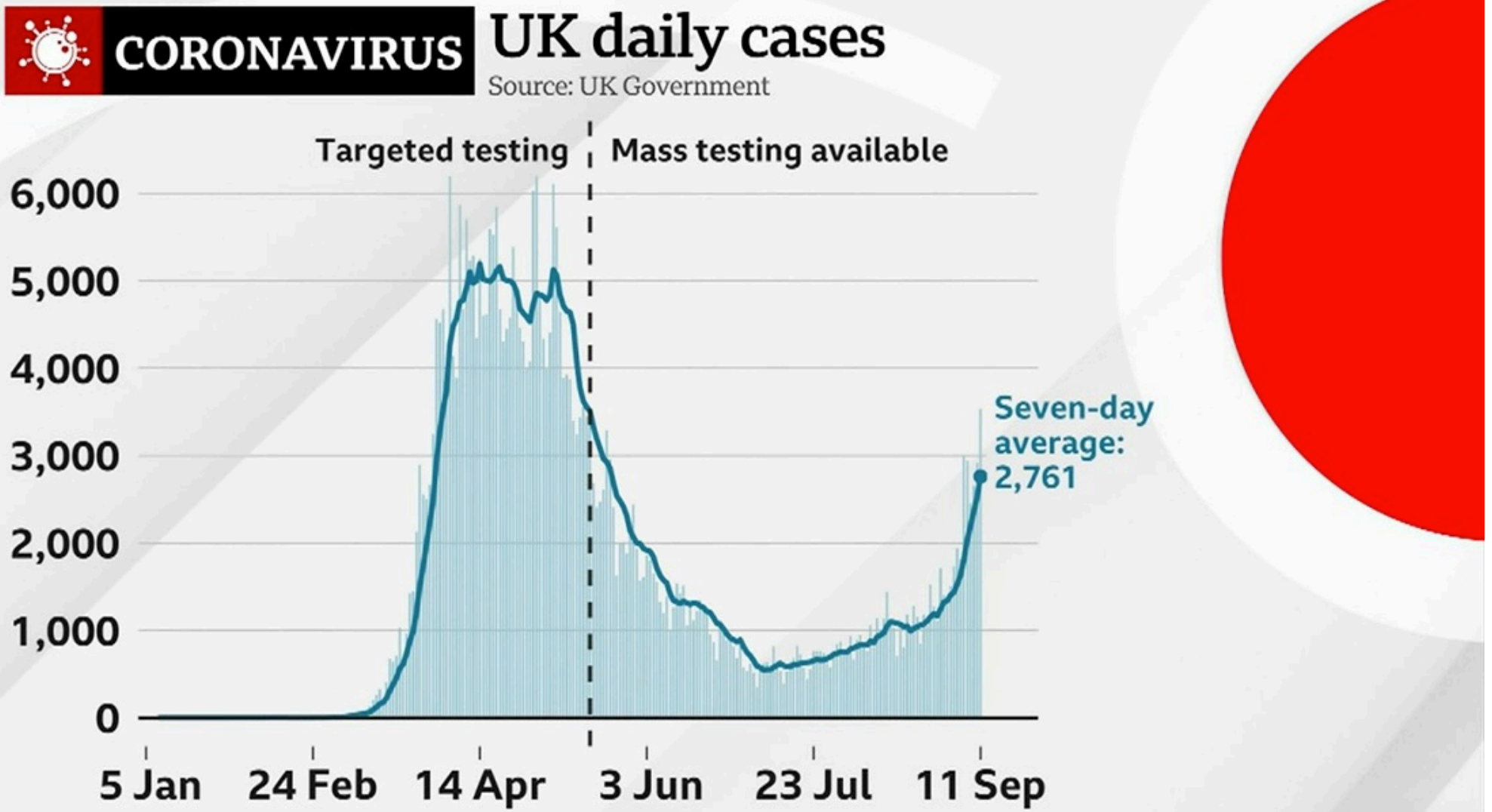
August 2020

COVID-19
How will it end?

Austin HEALTH

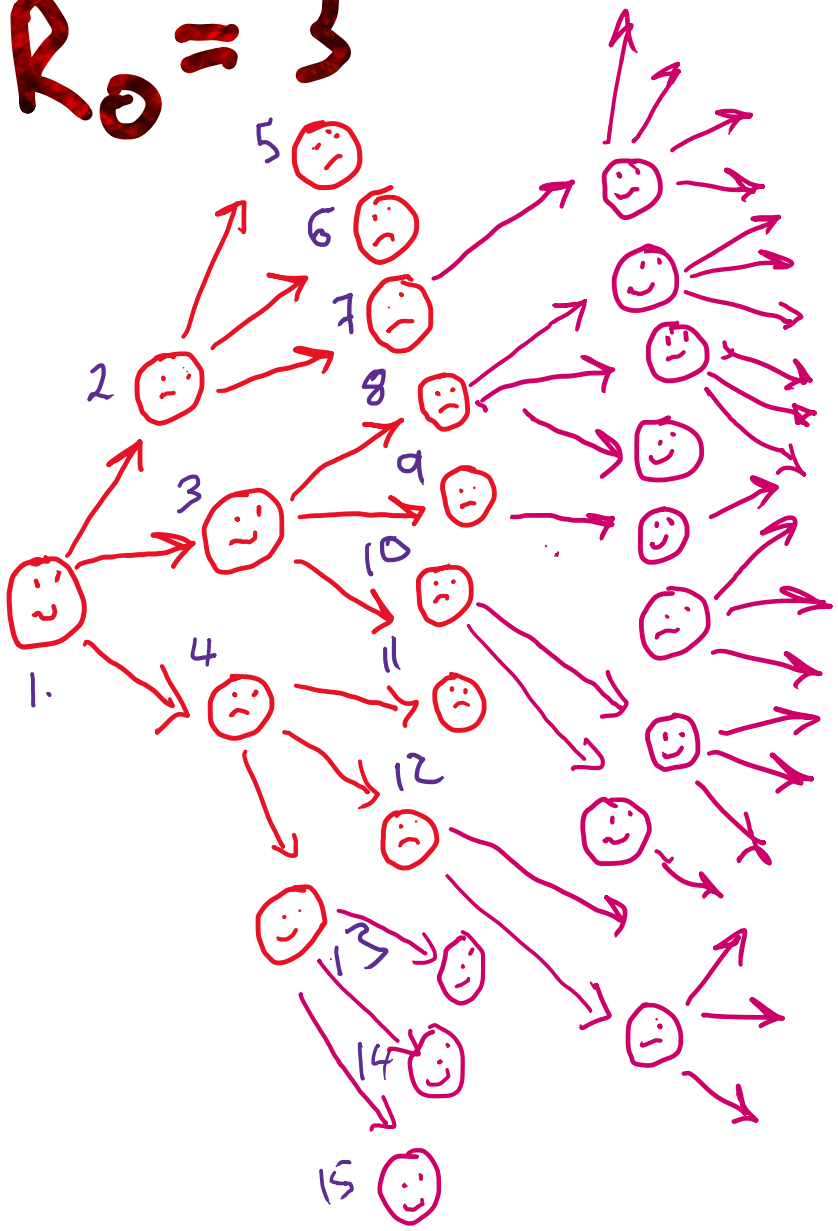
CORONAVIRUS
Source: UK Government
41,614
total UK deaths
Deaths for any reason within 28 days of a positive test
05:45
32:15

FHP
ecco
BBC NEWS
R number rises
00:48
32:15


CORONAVIRUS
UK daily cases
Source: UK Government
Targeted testing
Mass testing available
6,000
5,000
4,000
3,000
2,000
1,000
0
Seven-day average: 2,761
5 Jan
24 Feb
14 Apr
3 Jun
23 Jul
11 Sep

05:25

$R_0 = 3$



1 → 3 → 27 → 81 → 243

(CASE) (2 WEEKS)

243 → 729 → 2,187 → 6,561

(4 weeks)

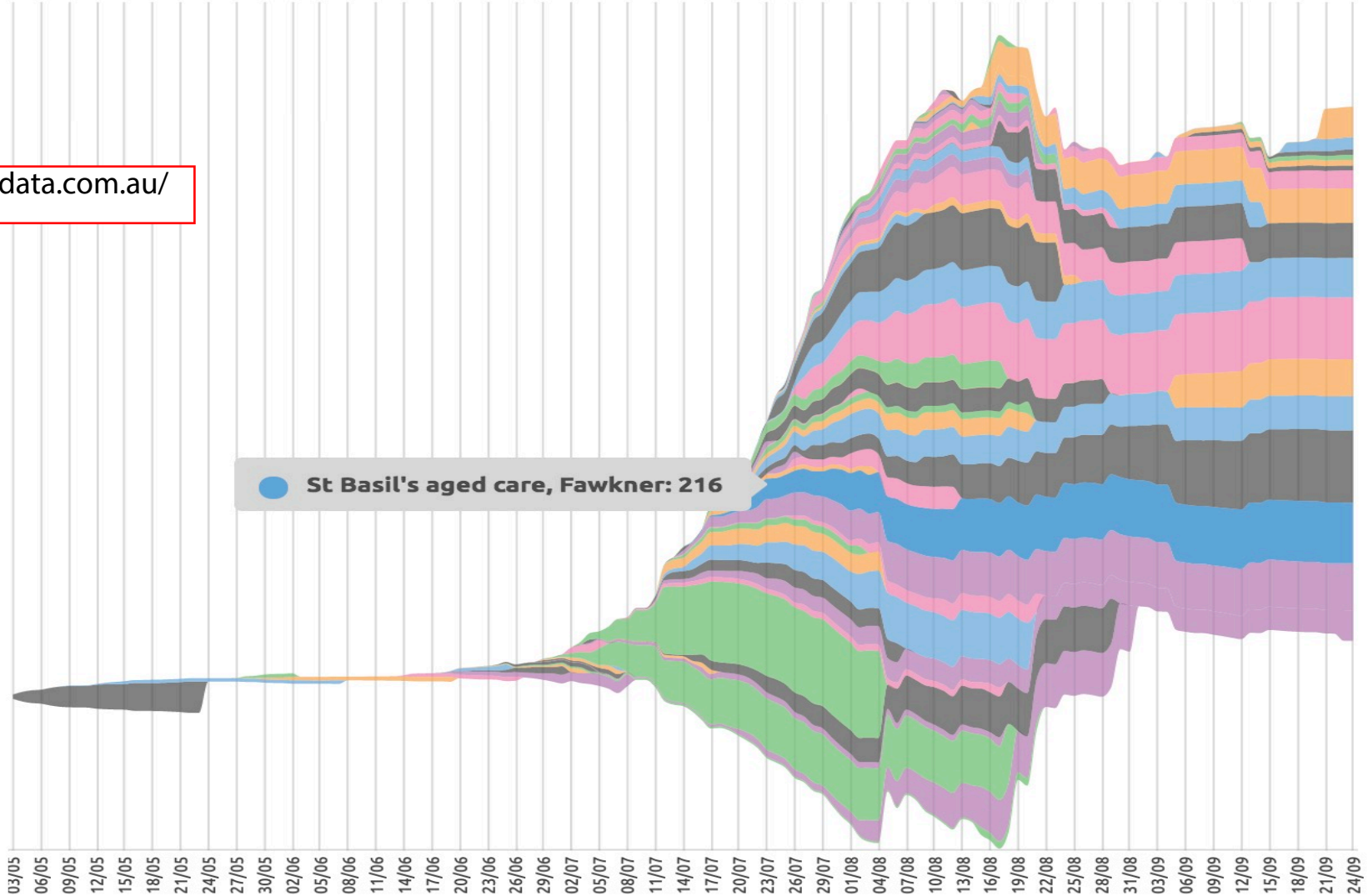
CASES PER DAY

R_0 COVID-19 = 3

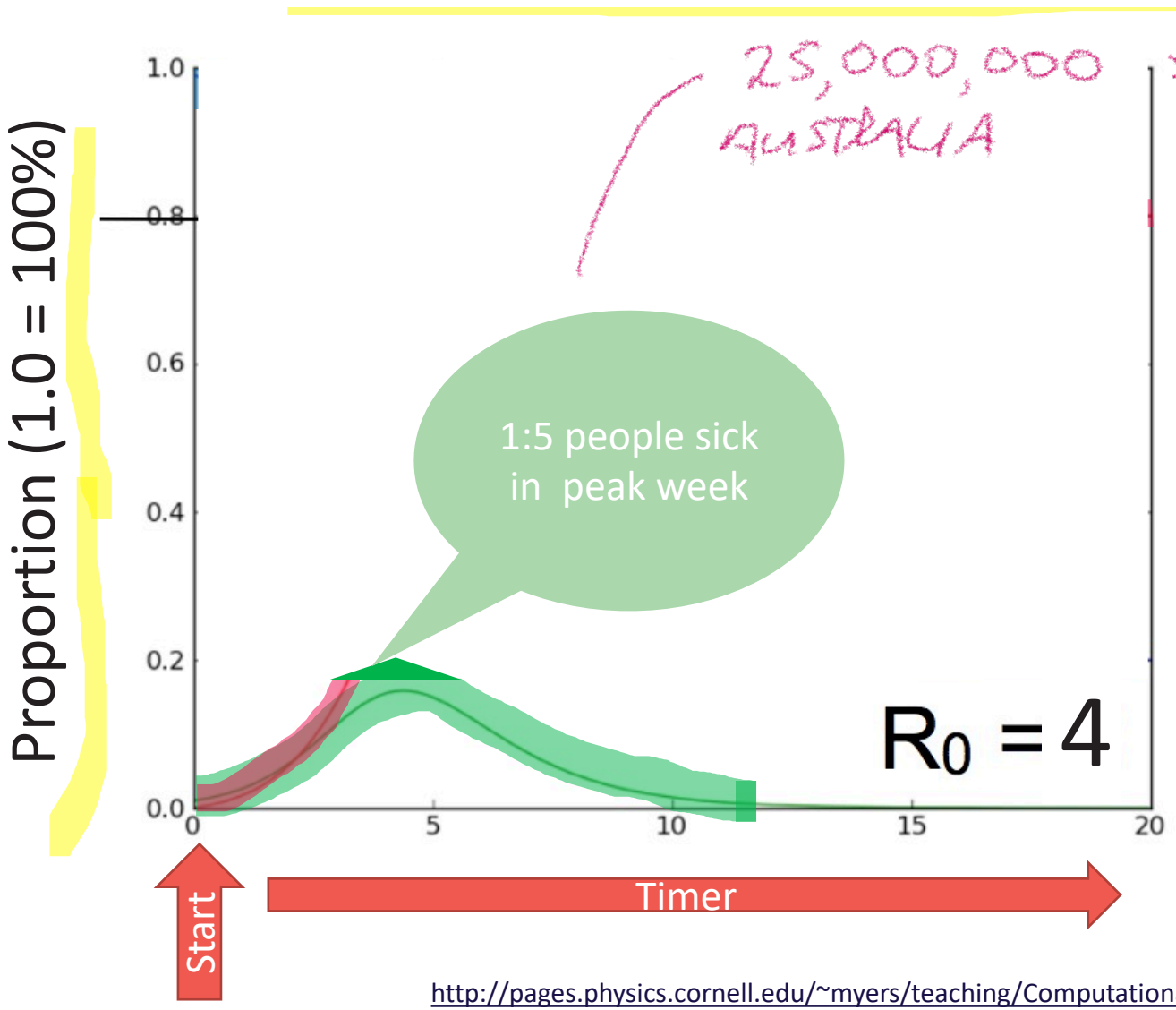
Progression of Victoria's largest clusters and outbreaks (tap ••• rollover for details)

covid19data.com.au
Multiple outbreaks adding together....

https://www.covid19data.com.au/



How does a pandemic eventually stop?

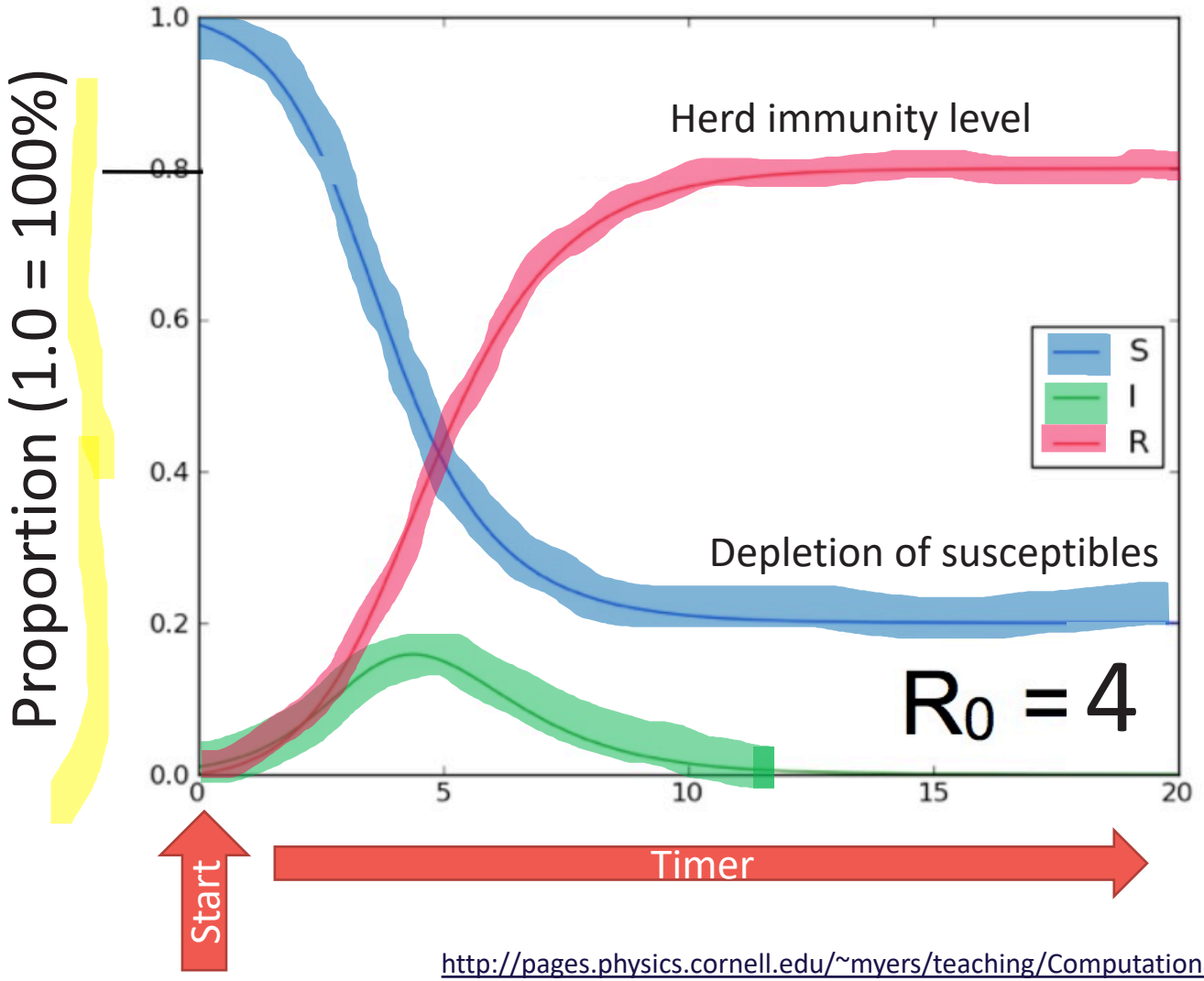


R0 = 4
= each case infects four others on average

(COVID-19 R0 is about 3)

http://pages.physics.cornell.edu/~myers/teaching/ComputationalMethods/LectureNotes/InfectiousDiseases.pdf

Dynamics of an R0 4 infection



The[illegible] will always be some SU[illegible]LES (eg 20% in this [illegible]ne infection

For CO[illegible]% of population [illegible] fizzle out

UK currently about 8% seropositive

COVID-19 R_0 is about 3

http://pages.physics.cornell.edu/~myers/teaching/ComputationalMethods/LectureNotes/InfectiousDiseases.pdf

How do we change R?

$$\mathcal{R}_0 = \tau \cdot \bar{c} \cdot d$$

r = transmissibility

$\bar{c}$ = average rate of contacts between cases and susceptible people

d = duration of infectiousness

How do we change R?

$$\mathcal{R}_0 = \tau \cdot \bar{c} \cdot d$$

wash hands
social distance
wear a mask

r = transmissibility

$\bar{c}$ = average rate of contacts between cases and susceptible people

→ stay home

d = duration of infectiousness

→ find, isolate all cases

Norman Swan

7.30

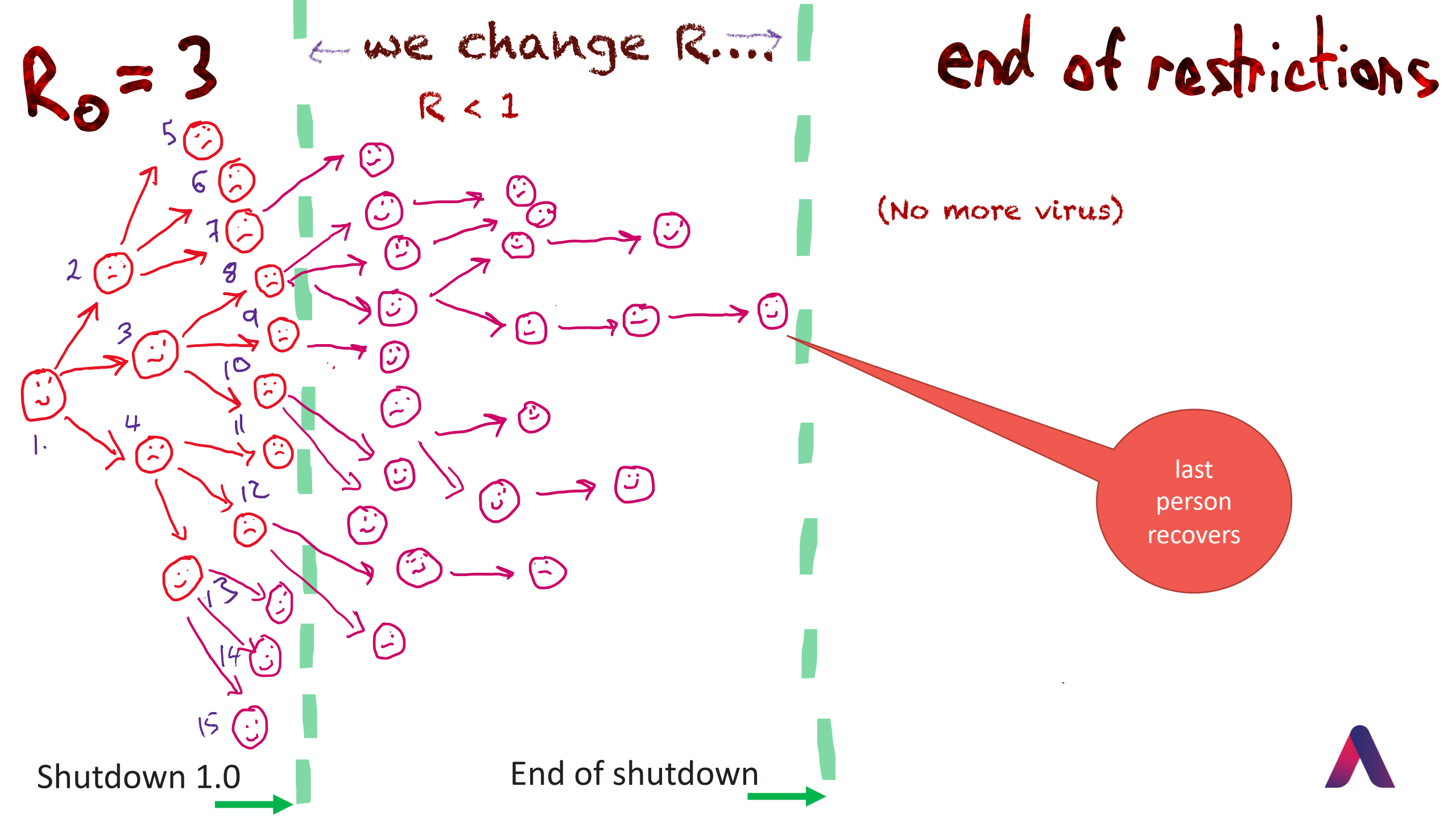
Wash hands

Social distance

Wear masks

Get tested with even the mildest symptoms…

ABC

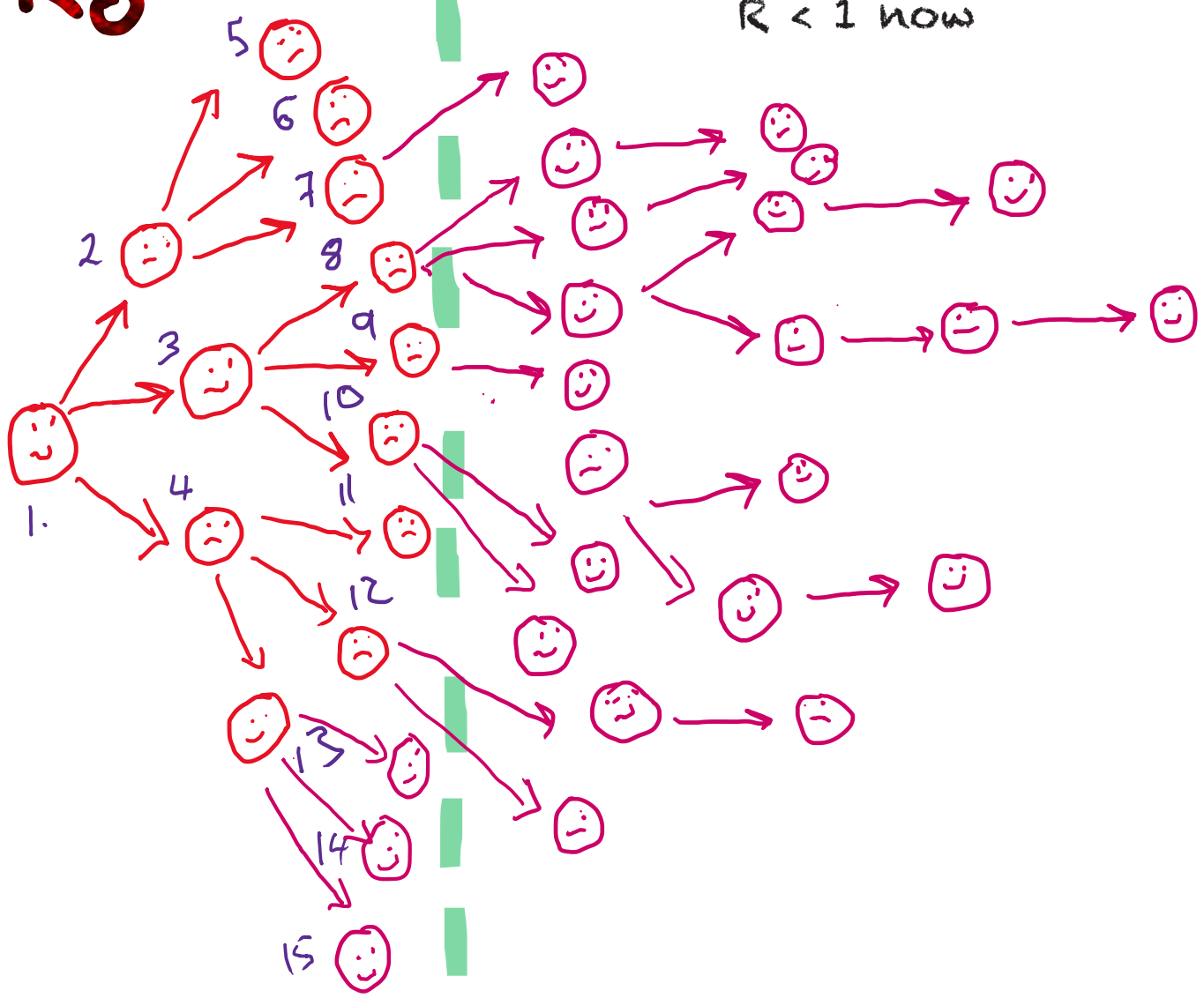

$R_0 = 3$
← we change R... →
R < 1
end of restrictions
(No more virus)
last person recovers
Shutdown 1.0
End of shutdown

$R_0 = 3$

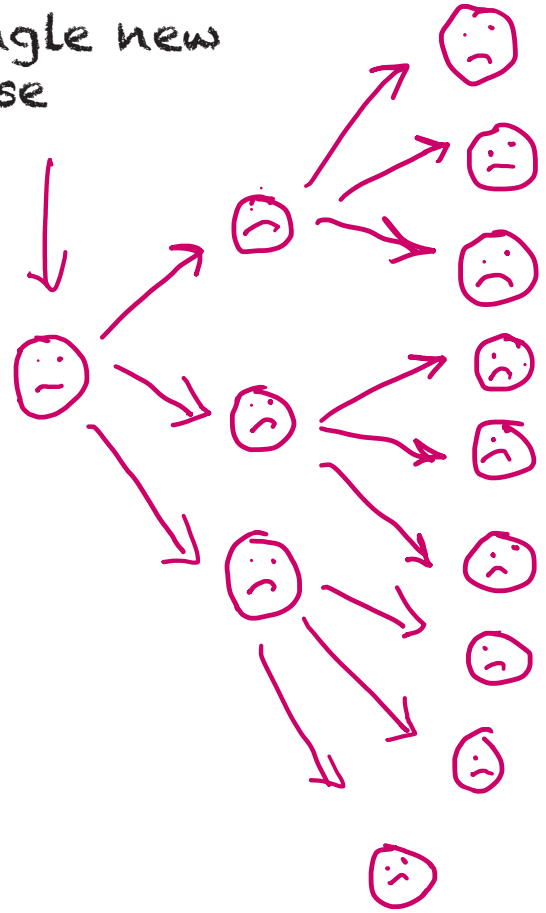
← we change R... →

R < 1 now

end of restrictions



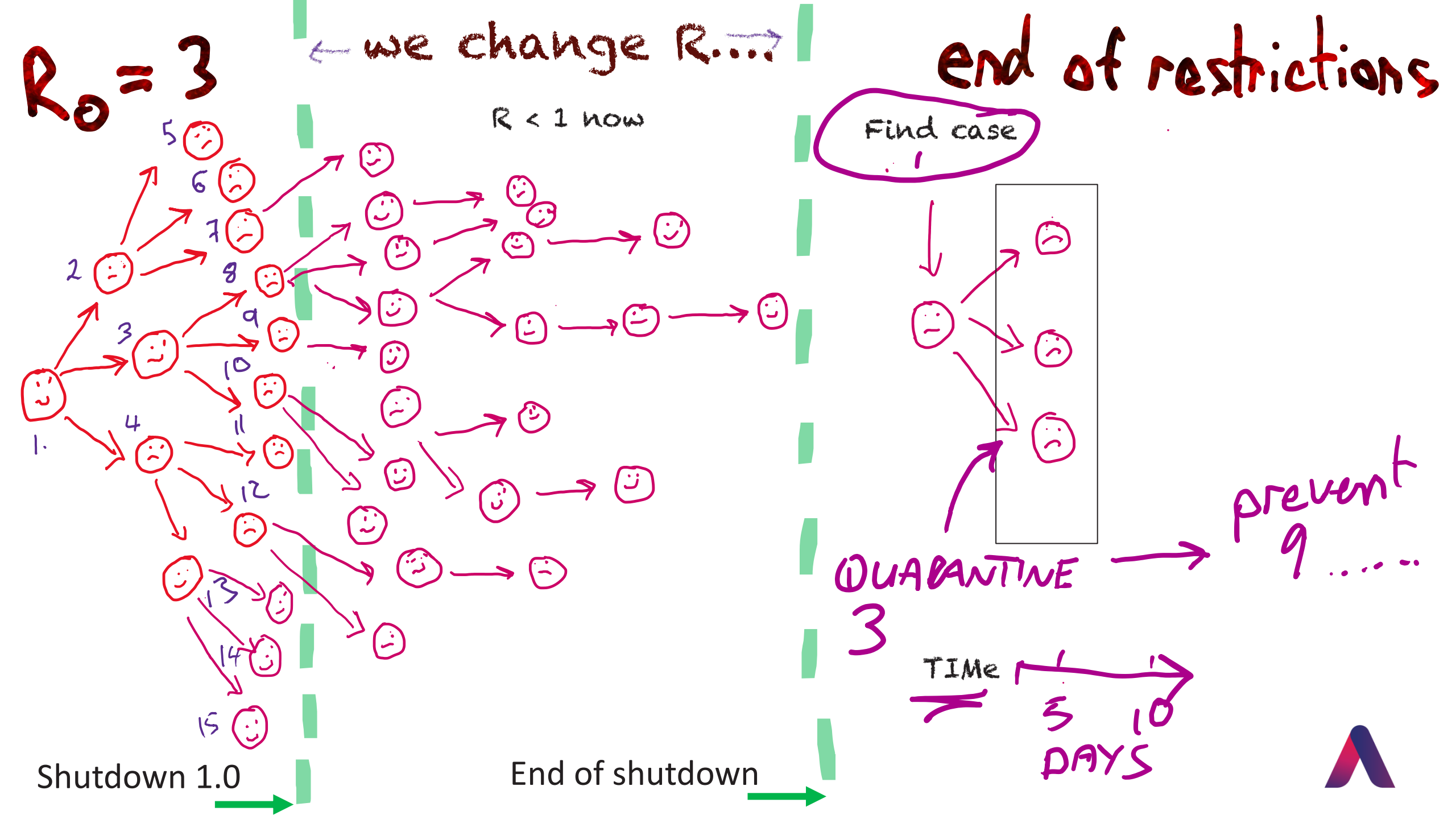
Single new case

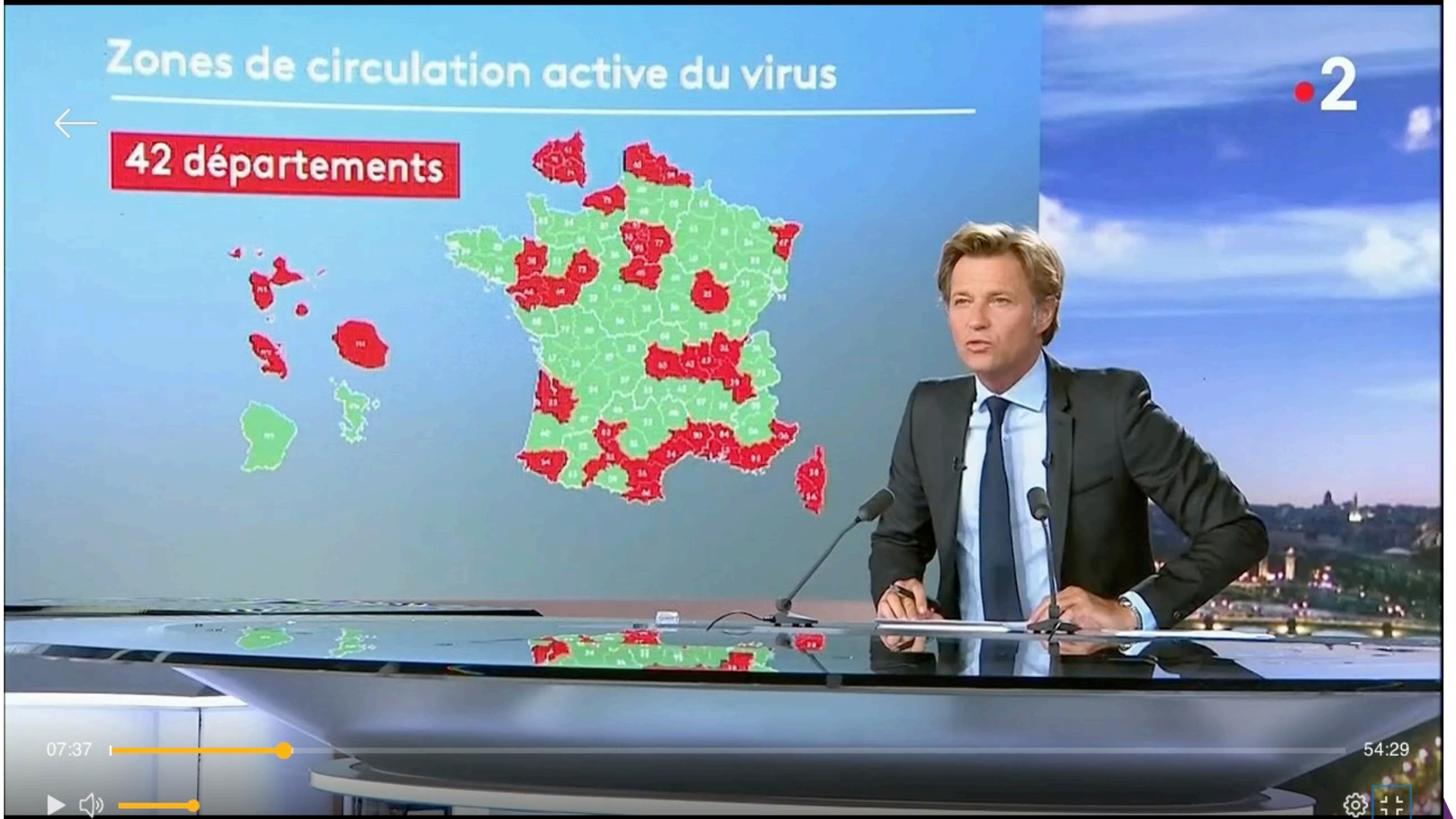


Human and virus biology the same, back to R = 3

Shutdown 1.0

End of shutdown


$R_0 = 3$
← we change R... →
R < 1 now
end of restrictions
Find case
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
QUARANTINE
3
prevent
9 ....
TIME
5
10
DAYS
Shutdown 1.0
End of shutdown


Zones de circulation active du virus
42 départements
2
07:37
54:29

Mortalité en réanimation

SOURCE : SANTÉ PUBLIQUE FRANCE / REVA

Mars-avril	35 à 40 %
Aujourd'hui	25 à 30 %

20h Week-end
13:07
Covid-19 Une meilleure prise en charge en réanimation
54:36

2
08:09
38:24