How to End Lockdown Safely by September 2020

Preliminary Evaluation of Strategic Options

April 13, 2020

Caveats

- *We have almost no completely reliable data on the COVID-19 virus and its effects; even the UK death toll so far is a matter for debate*

- *Statements about the past are therefore not precisely correct*

- *Statements about the future are necessarily even more uncertain: they depend greatly on policy choices – the future trends shown should be interpreted as **what government could make happen** rather than what will happen*

- *In this paper, I have attempted to use the best data available to-date*

- *The conclusions, **and in particular the timing of when it could be safe to unlock,** will need to be kept in review as new data become available.*
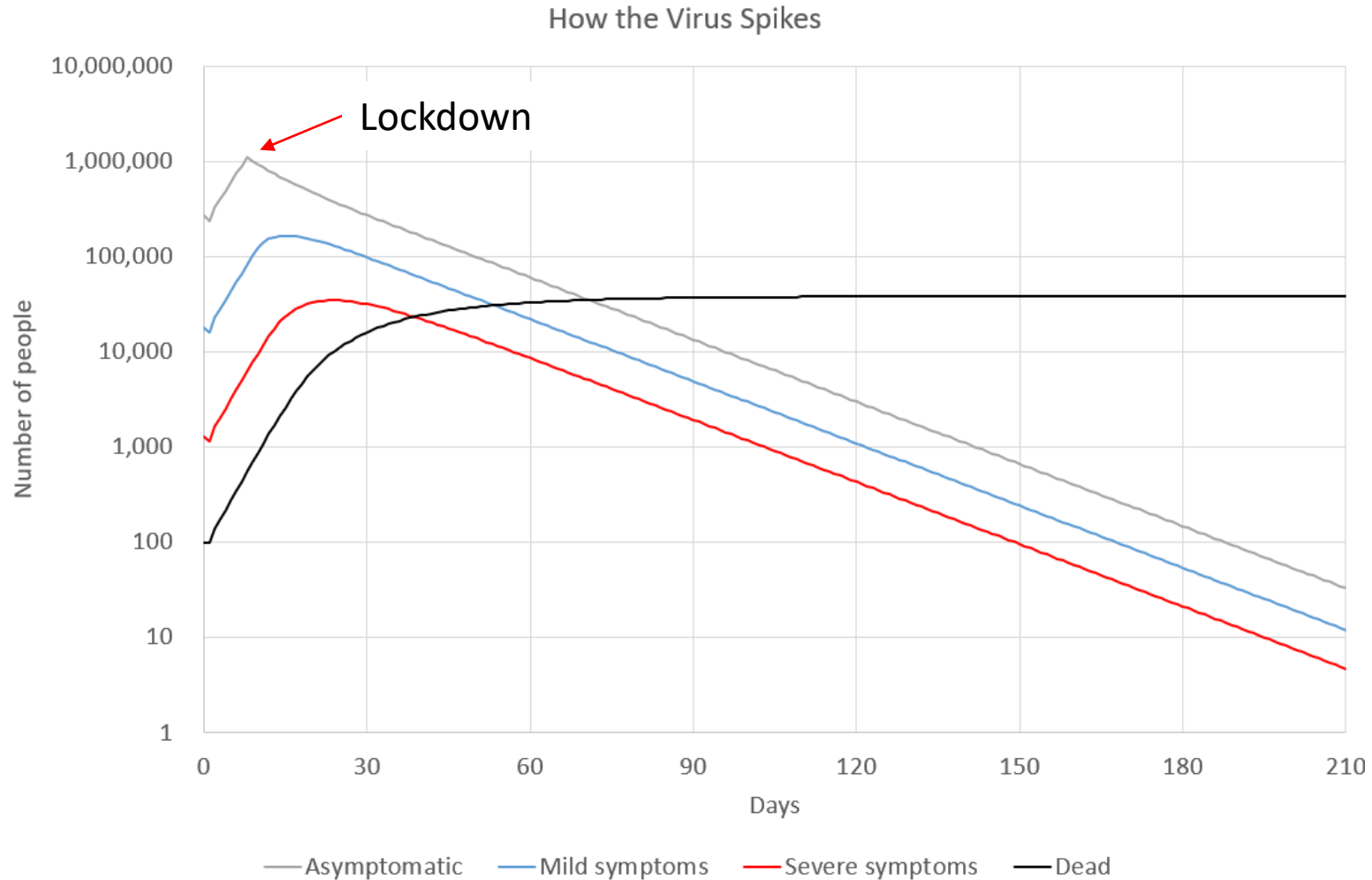
Conclusions

- There are four basic options for tackling the unlock problem
- Of those, the clear favourite is Testing, Tracing and Isolation (TTI)
- Making TTI work requires rapid build-up of the UK's testing and tracing capacity
- Doing this would enable a safe unlock by September
- No other option would be as quick and safe.

What Can We Expect from Lockdown?

How the Virus Spikes

We don't have good data – even about deaths – but if lockdown is working, we have probably:
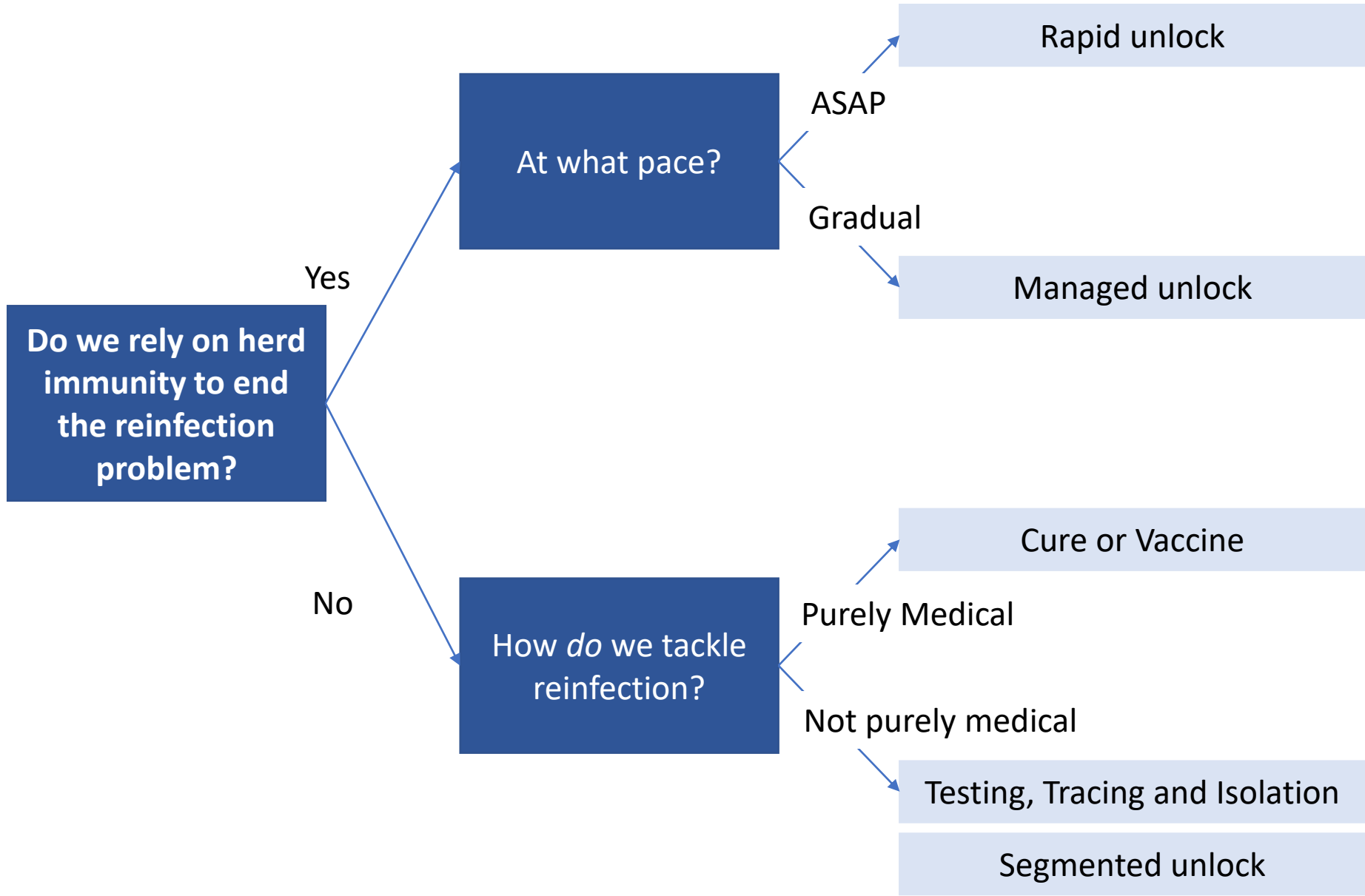
- Passed the peak for asymptomatic cases
- Passed the peak for new cases with mild symptoms
- Almost reached the peak for those with severe symptoms.

But even so, it will be months before we are even down to double figures for those with mild symptoms and meanwhile the economic and social cost is huge
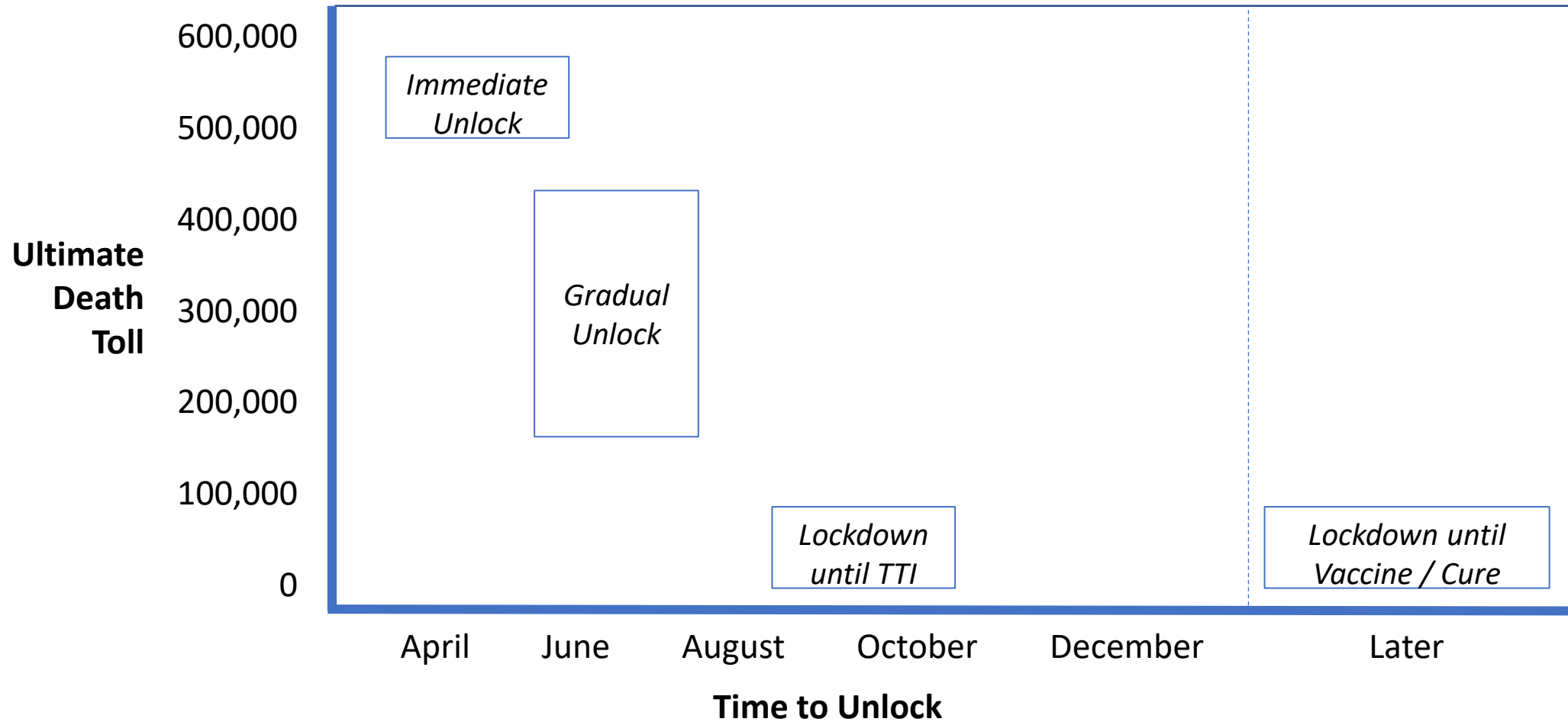
How will we get out of lockdown?

Source: Worldometers.info; 99% analysis

There are Four Basic Options

Do we rely on herd immunity to end the reinfection problem?

Yes → At what pace?

ASAP → Rapid unlock

Gradual → Managed unlock

No → How *do* we tackle reinfection?

Purely Medical → Cure or Vaccine

Not purely medical → Testing, Tracing and Isolation

Segmented unlock

The Four options Compared

ILLUSTRATIVE

Ultimate Death Toll (y-axis): 0, 100,000, 200,000, 300,000, 400,000, 500,000, 600,000

Time to Unlock (x-axis): April, June, August, October, December, Later

- *Immediate Unlock*
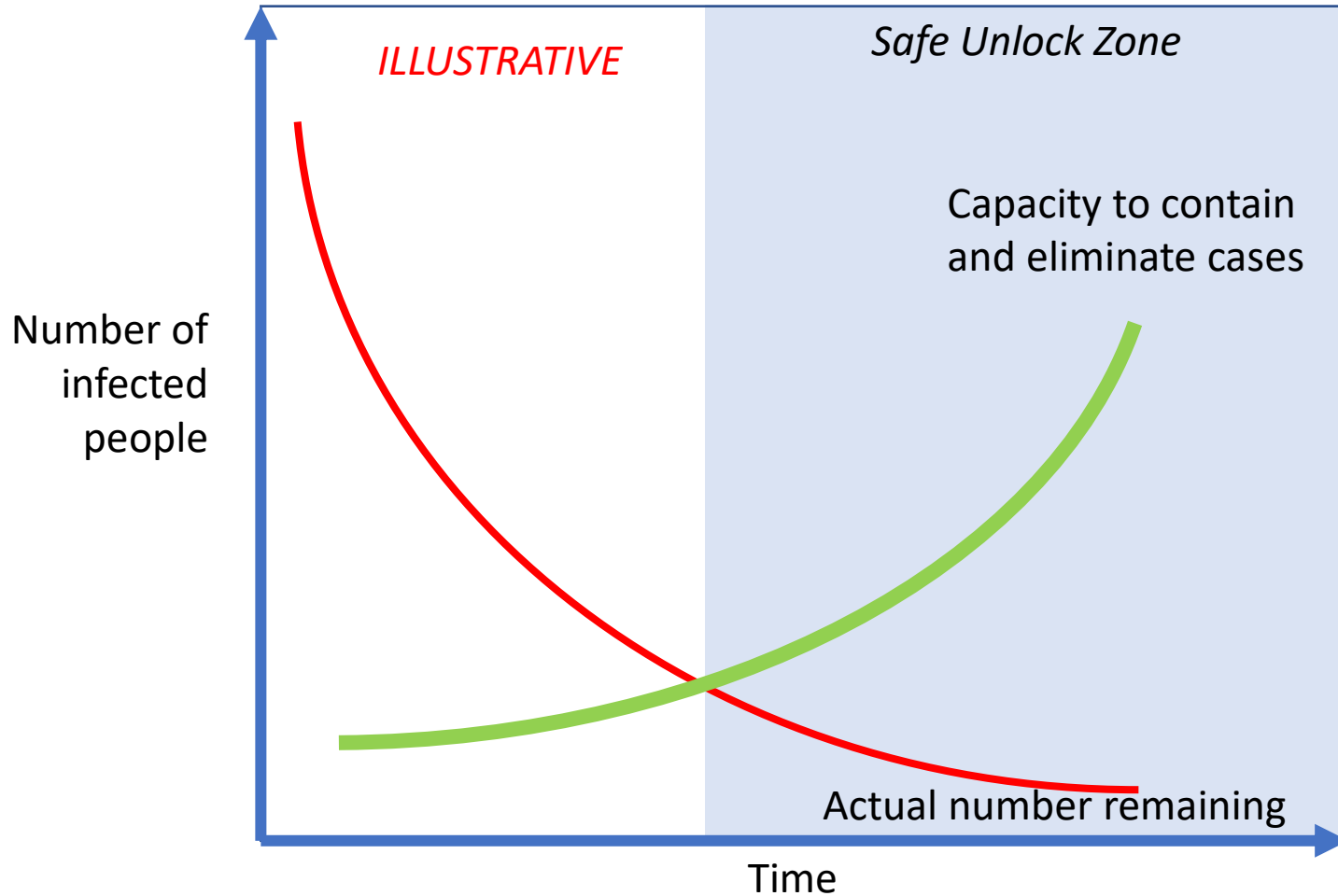- *Gradual Unlock*
- *Lockdown until TTI*
- *Lockdown until Vaccine / Cure*

Note: 'Lockdown until TTI' assumes that a lockdown can be sustained until September without sparking riots on such a scale that they imperil the effectiveness of the lockdown or cause loss of life running into hundreds of thousands.
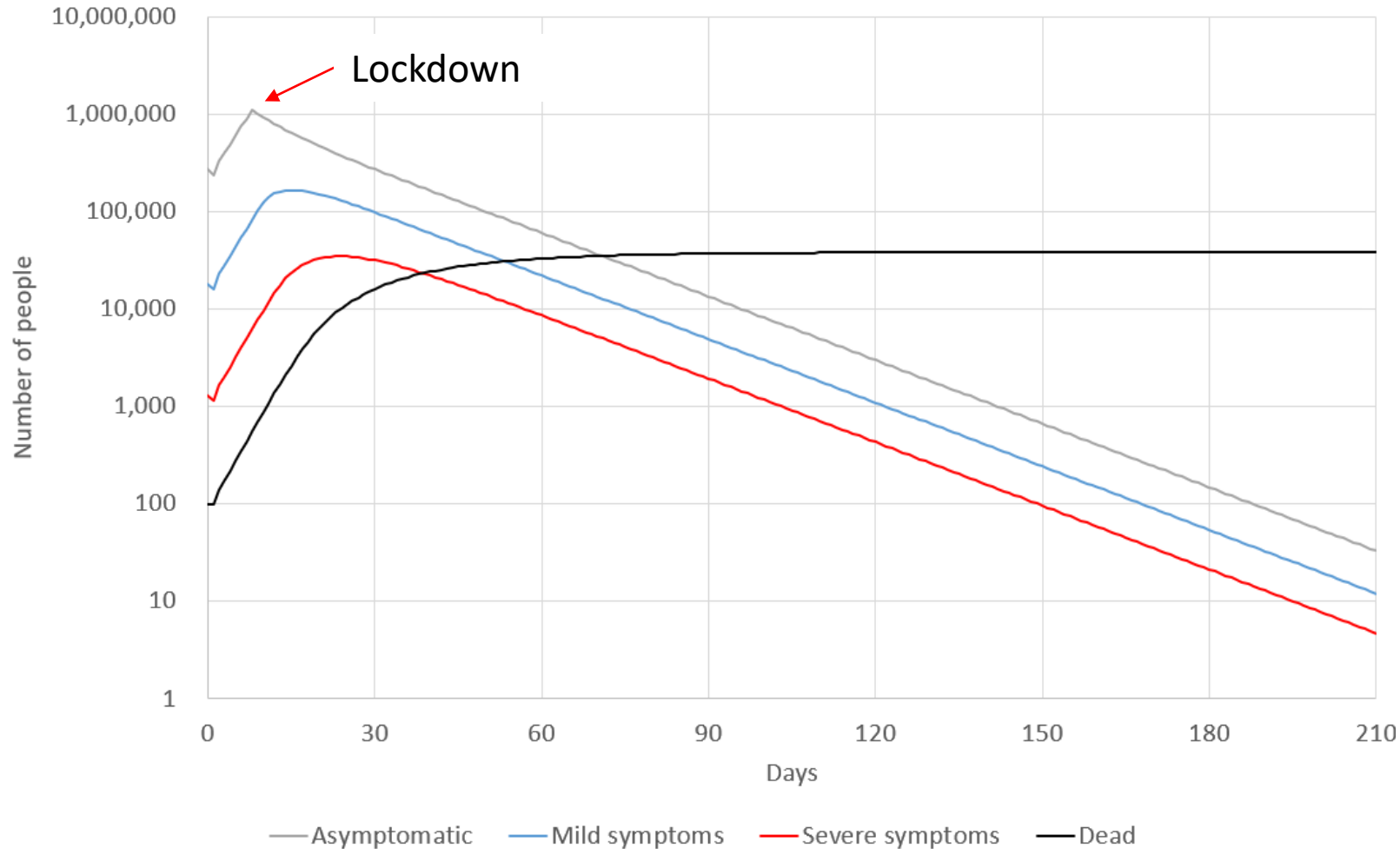
When can we Safely End lockdown?

A successful lockdown produces a rapidly declining number of cases, and at some point that number is small enough that our capacity to deal with remaining, previously unidentified, cases is enough to prevent widespread reinfection.

At that point, we can safely unlock, and the problem of reinfection is effectively solved.

Number of cases

How the Virus Spikes

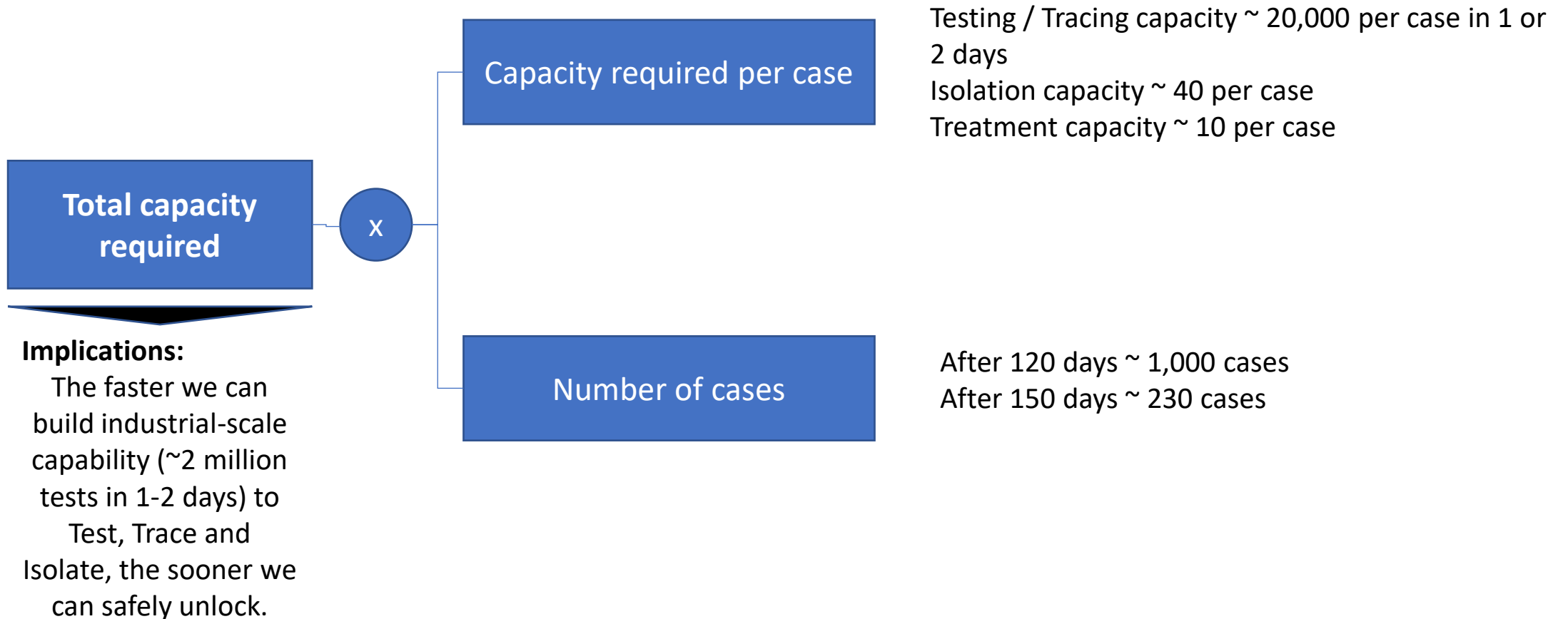Source: Worldometers.info; 99% analysis

The downward slope of these lines depends on how effective the government's lockdown is proving.

Recommendation 1: Government should commit today to keeping lockdown under review and adjusting the restraints to ensure that the decline is at least as fast as shown.

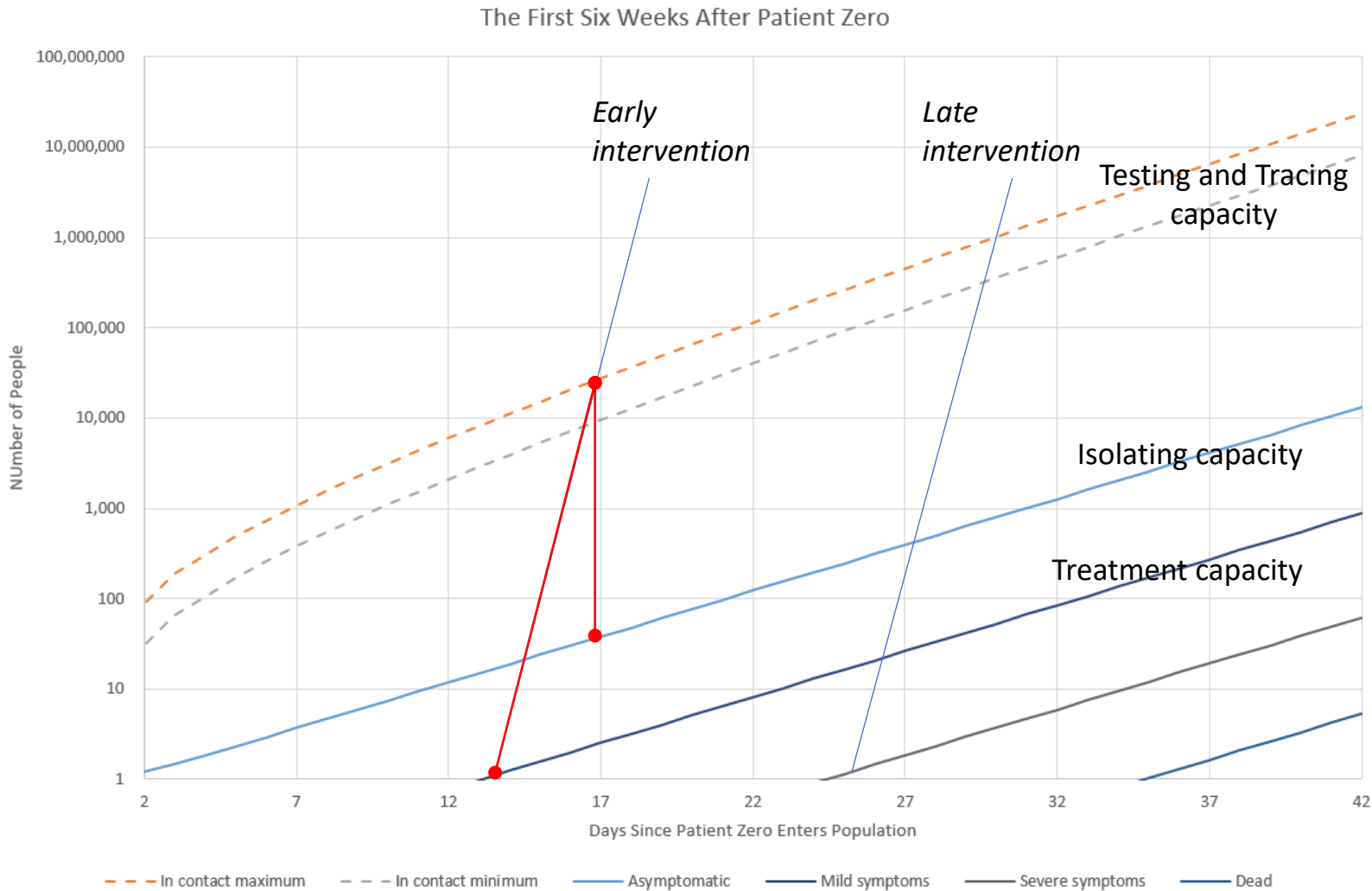If we go for 120 days since first 100 deaths, then known cases would be around 1,000.

If we go for 150 days, it would be only around 230

Testing, Tracing and Isolation (TTI) Capacity required to contain and eliminate cases

Total capacity required

x

Capacity required per case

Testing / Tracing capacity ~ 20,000 per case in 1 or 2 days
Isolation capacity ~ 40 per case
Treatment capacity ~ 10 per case

Number of cases

After 120 days ~ 1,000 cases
After 150 days ~ 230 cases

Implications:
The faster we can build industrial-scale capability (~2 million tests in 1-2 days) to Test, Trace and Isolate, the sooner we can safely unlock.

99%

Capacity needed for TTI per case

The First Six Weeks After Patient Zero

If one asymptomatic case ('patient zero') is introduced into a non-immune population, the virus grows exponentially. Most of the cases are asymptomatic, and it might take around 13 days for the first symptoms to be visible.

By that stage, around 10,000-20,000 people would have been in close contact with 'patient zero' and others with whom he or she had been in contact, and up to 40 or so would have become infected (mainly asymptomatic).

To contain the infection, all of those 10,000-20,000 people would have to be identified and tested, and any found to be infected would need to be isolated for 14 days.
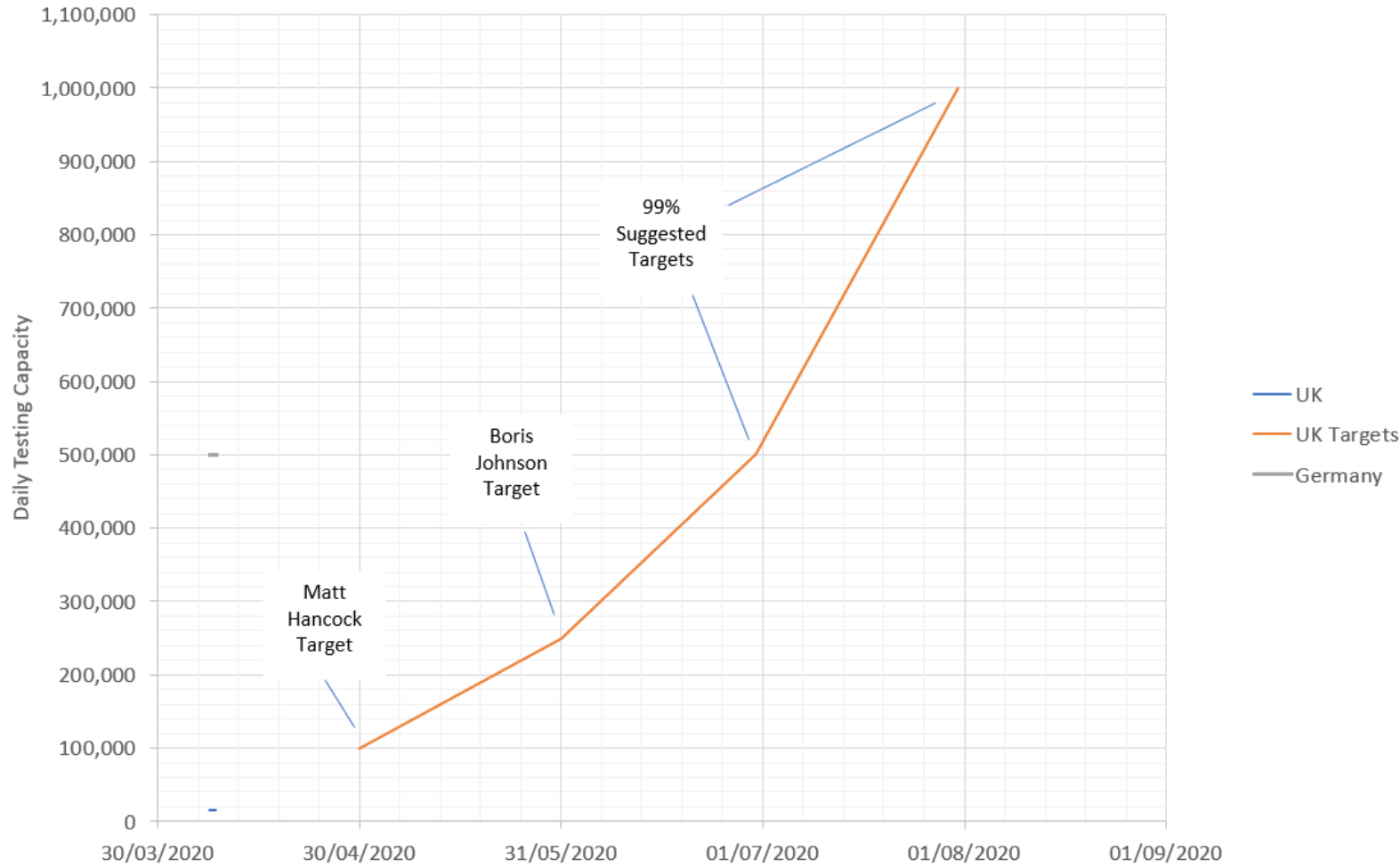
If this happens, the reinfection has been successfully snuffed out.

Source: 99% analysis

Building Testing Capacity

How the UK Needs to Grow Testing Capability

These targets look ambitious.

But, on the other hand, they give the UK government two and a half months to catch up with where Germany is today.

With enough determination, this should be perfectly possible.

Recommendation 2: Government should commit today to building capacity at least as fast as indicated.

Source: https://twitter.com/DHSCgovuk/status/1248318961252544515; 99% analysis
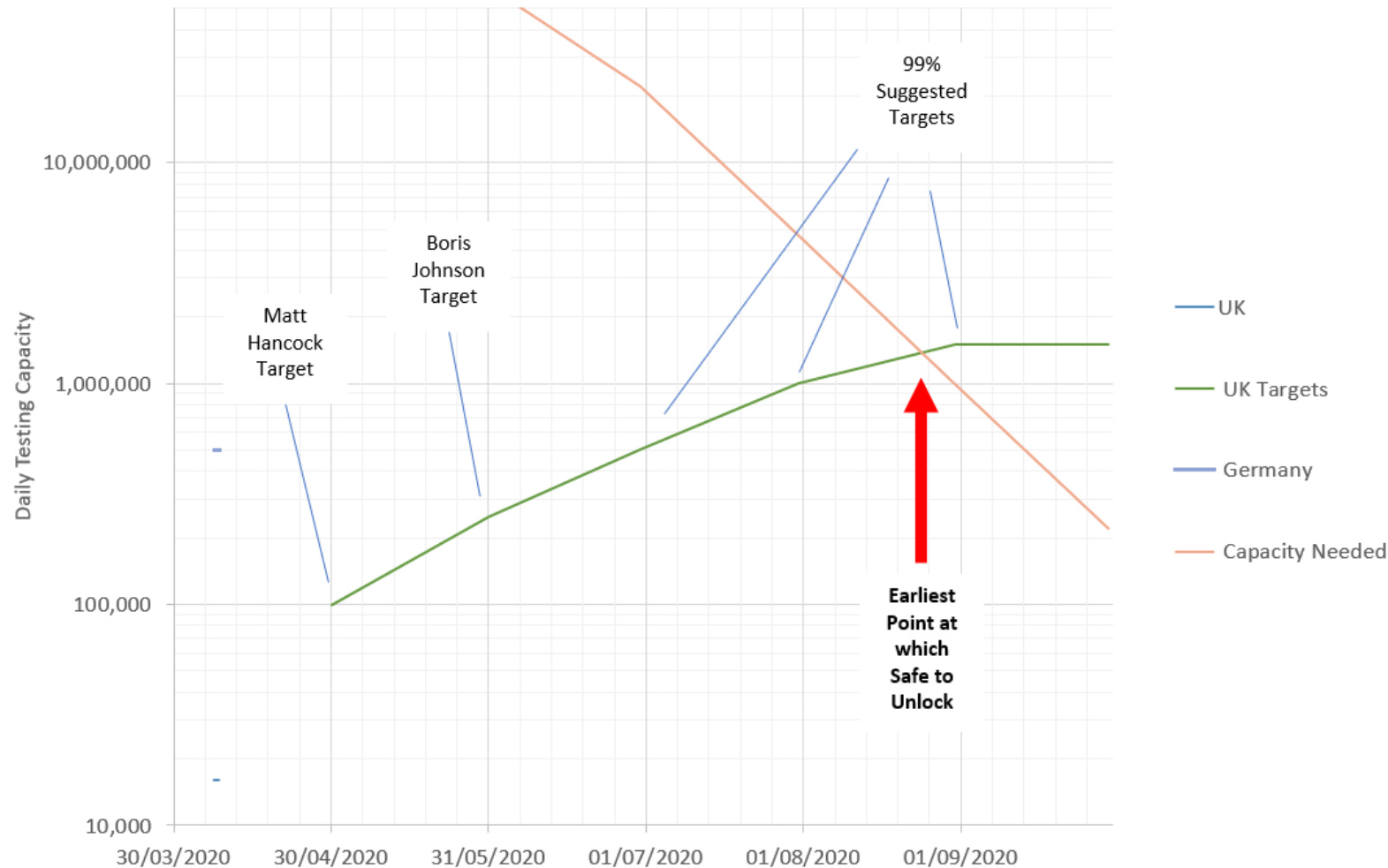
Building Tracing Capability

- In some regions, tracing individuals' contacts could probably be done manually. But in London and other major metropolitan centres, that would simply not be feasible – someone using the tube in rush hour will be in close physical proximity with many people they do not know and cannot identify

- it is certainly possible (and has been done in Singapore, though with disappointing uptake) to create a phone app which identifies anyone who has been in contact with an infected individual – and this would allow rapid tracing.

- there are two issues which would need to be addressed to make this approach work:
    - 1) ensuring universal uptake of the app; and
    - 2) addressing Civil Liberties concerns.

- The first could be addressed by the government introducing a temporary Universal Basic Income which is accessed via the app (whose primary function would therefore be as a phone wallet) and by making the wallet the only way of paying for (for example) public transport

- the second could be addressed by creating a special purpose Commission to oversee the app whose Board would include medics, lawyers and Civil Liberties campaigners.

We Should Aim to be ready for Safe Unlocking by September

How the UK Needs to Grow Testing Capability

If the government has committed to the two recommendations above, a safe unlock should be possible by September.

To be certain the unlock is safe, there would need to be enormous effort on piloting and testing the TTI technology, processes and procedures

Recommendation 3: Government should put in place a comprehensive testing and piloting programme before unlocking.

Source: https://twitter.com/DHSCgovuk/status/1248318961252544515; 99% analysis

Segmented Unlock: e.g. Region / Age group / Immunity

- In principle, Testing Tracing and Isolation in combination with a segmented unlock would produce the same results as shown for TTI, but allow an earlier start to the unlock
- in practice, there are problems with the segment-based unlocking:
  - in all cases, it will be hard to maintain the separation between the segment unlocked and the rest of the population – except in specific instances such as small islands; where it can be safely tested, it should be
  - a segmented unlock on the basis of immunity would also create a dangerous moral hazard. Those who have not been economically protected by the government's measures will have a huge incentive to become immune, and may strive *en masse* to become infected, causing the failure of the lockdown strategy.

Conclusions

- There are four basic options for tackling the unlock problem
- Of those, the clear favourite is Testing, Tracing and Isolation (TTI)
- Making TTI work requires rapid build-up of the UK's testing and tracing capacity
- Doing this would enable a safe unlock by September
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The government should immediately commit to the three key recommendations in this paper

Key Assumptions – 1

Assumption	Value	Rationale	Source
Initial rate of infectivity per person per day	0.45	The growth rate in many countries before lockdown suggested a doubling every three days. This value gives that kind of doubling rate and roughly corresponds to an R0 of 3.5 which is at the high end of what several studies seem to suggest	https://ourworldindata.org/grapher/covid-confirmed-deaths-since-5th-death https://www.forbes.com/sites/startswithabang/2020/03/17/why-exponential-growth-is-so-scary-for-the-covid-19-coronavirus/ https://www.medicalnewstoday.com/articles/coronavirus-may-spread-faster-than-who-estimate#Higher-estimates-than-WHO-predict
Lockdown day	24/03/2020	Johnson announced on March 23	https://www.birminghammail.co.uk/news/midlands-news/what-date-uk-go-lockdown-18025541
Subsequent infectivity per person	N/A	I will use a range of values for this ranging from 0.45 – i.e. no-lockdown – to zero.	N/A
Asymptomatic duration	6	Average incubation 5-6 days	https://medicalxpress.com/news/2020-03-covid-sick-fever.html
Mild duration	7	CDC guidelines say isolate for 7 days after symptoms start	https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/steps-when-sick.html

Key Assumptions – 2

Assumption	Value	Rationale	Source
Severe duration	7	Assume three weeks from symptom onset to death	https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30195-X/fulltext
Dying duration	7		
Asymptomatic recovery rate	80%	The mortality rate overall (not case fatality rate) is thought to be ~0.6%, so the product of the non-recovery rates should be 0.6%. About 6% end up with severe symptoms, so 16% of those die – gives 84% recovery rate. Of the severe, assume 1 in 3 reaches ICU and half of those die.	https://www.theguardian.com/world/2020/apr/01/what-is-coronavirus-and-what-is-the-mortality-rate-covid-19 https://theconversation.com/coronavirus-bmj-study-suggests-78-dont-show-symptoms-heres-what-that-could-mean-135732?utm https://www.bmj.com/content/369/bmj.m1327
Mild recovery rate	80%		https://www.livescience.com/undetected-infections-coronavirus-widespread.html
Severe recovery rate	84%		https://text.npr.org/s.php?sId=805289669
Asymptomatic on day zero	300,000	Based on what model predicts on day when patient zero has caused ~100 deaths.	See the argument about the lag times in the article https://99-percent.org/3019-2/
Mild on day zero	25,000		
Severe on day zero	1,500		
Dead on day zero	100	Based on actual data for next day (104)	https://www.worldometers.info/coronavirus/country/UK/