COVID-19 Impacts:

Navigating the Lockdown Labyrinth

by Russell Bradshaw, Independent Data Analyst and Statistician

Russell Bradshaw is an experienced analyst and statistician and now an independent consultant and he has worked across a wide variety of clients and industry sectors. 56 Degree Insight continue to partner with experts in different fields and we have both worked with Russell on many studies over the years. We are delighted to add him to our list of associates given his vast experience in advanced statistics and data modelling.

In this guest article, Russell leads us through the complexities of the statistical decisions being played out each day on our televisions as decisions are made on when it might be safe to ease certain elements of COVID-19 lockdown.

There's going to be a lot of ink spilled this week as Boris Johnson unveils more details of his plan for how we exit lockdown, there's still a lot of unanswered questions and unknown implications. When is the safest time to unlock? How much be can changed without risking a second peak? Are we easing restrictions too fast? Or are we going too slow?

Throw into the mix the complex mass of statistics and trends, and we seem no clearer as to how to get out of this lockdown safely. It's as if we're stuck in a complex labyrinth with the lights turned out.

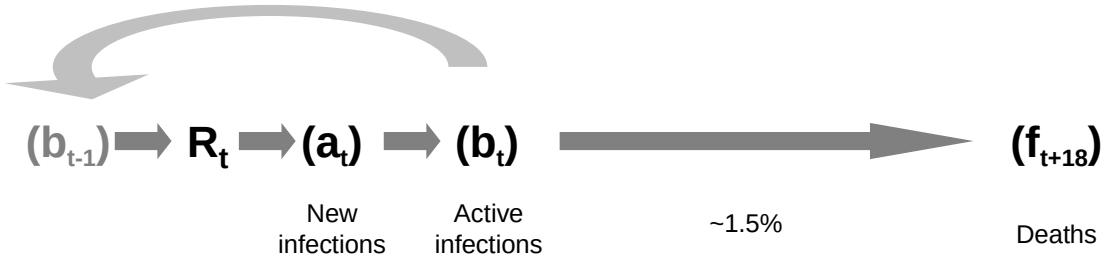
As ONS head Sir Ian Diamond has made clear, the vital pieces of information needed to guide us through the next stages is the prevalence of Covid-19 in the population, and the Reproduction number: R. Not only do we need to accurately measure and estimate these figures before making any major policy changes, but they also need tracking on a regular basis (with minimal reporting lags) to monitor the impact of any behaviour changes. This is the foundation of the new 20,000 household panel that the ONS is setting up. It may be some weeks before that data is available, so what can we do now?

Firstly, we need a credible model of the virus's spread in the UK. This is no easy challenge when the key measures are either not available or have inherent issues:

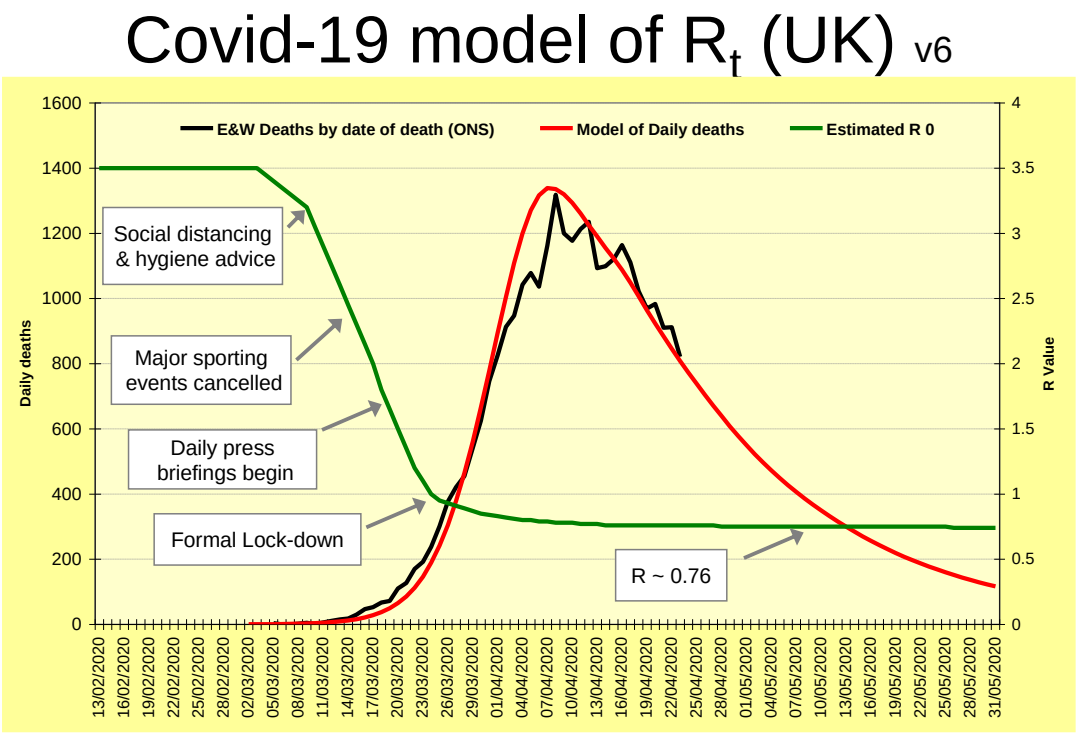
	Measure	Estimated Lag time	Description	Suitability
(a)	Actual new infections	0 days	Directly driven by R_t	NOT AVAILABLE
(b)	Active infections	3-5 days	Assuming a pro-active track & trace strategy	NOT AVAILABLE
(c)	Positive cases from symptomatic patients	5-7 days	Assuming reactive, so subject to testing amounts & policies	ERRATIC / UNRELIABLE
(d)	Hospitalisations	7-14 days		TOO SLOW
(e)	Daily reported deaths	15-25 days	Subject to fluctuations based on reporting delays	TOO ERRATIC AND TOO SLOW
(f)	Registered deaths by date of death	25-32 days	Gold standard of reporting by ONS	RELIABLE BUT FAR TOO SLOW

UK Government reporting is mainly focussed on publishing daily figures for (c), (d), and (e). These are intermediary measures that not only suffer from time lags, but also reporting biases and fluctuations.

The essential numbers that we need to track are (a) new infections to estimate R, and (b) the amount of active infections to understand the current prevalence. These are not readily available in the UK, partly because of the logistical challenges and testing capacity required to achieve it. But it is feasible to infer these from a credible model of infection spread that is calibrated to a reliable outcome measure (f):



Here is the latest model version (v6), using ONS data released on 5th May:



This enables us to calibrate R_t, up until the end of March. For estimating R during April, I have looked at the rate of change in deaths in hospital, using date of death. This suggests a halving time of around 13-14 days which equates to an R~0.72. However, as the overall death rate in all settings isn't quite declining as fast, then I've chosen the composite figure of R=0.76.

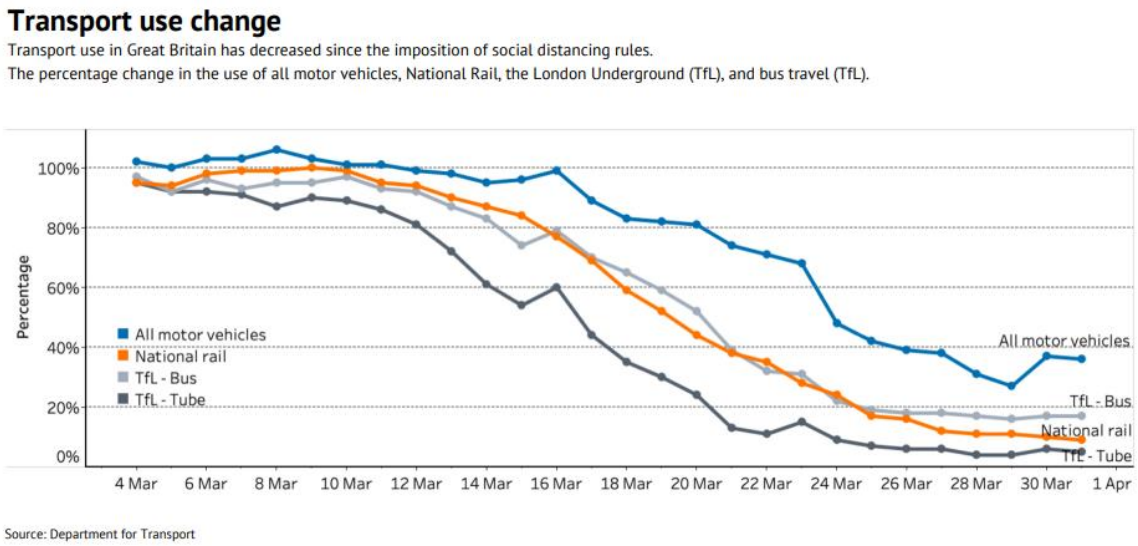
This model is very useful for understanding where we have been. But for future policy decisions we actually need something more up-to-date that doesn't suffer from reporting lags. It is with some irony that the cautious entry into the lockdown taken by the UK Government in the early weeks of March, might provide some useful data points to help address this knowledge gap. That's because the R rate was likely to have declined over a period of around

two weeks; ample time to see if there are corresponding indicators that trended in a similar manner.

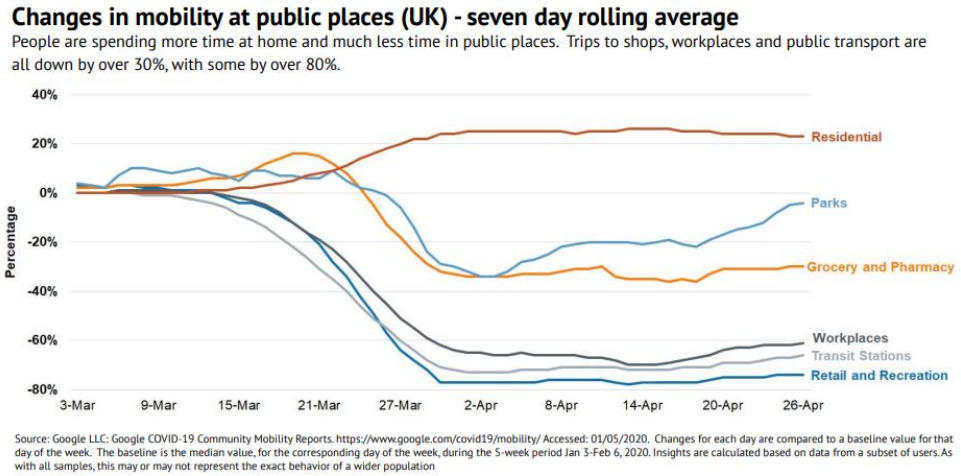
Just as with Theseus's journey into the labyrinth to confront the Minotaur, our slow entry into the lockdown has left us with a trail of thread to help guide our way out.

As can be seen from the trend estimate of R (green line in the chart above), the model suggests it was declining during the earlier parts of March. The rate was probably trending down at this point to reflect the informal actions being undertaken as people were becoming aware of the virus and what they could do to mitigate the spread. Government communications were advising us to try and work from home and avoid discretionary social activities like going to bars, restaurants and pubs.

The reduction in discretionary activities is reflected in the downward trend of UK transport usage from around 12th March:

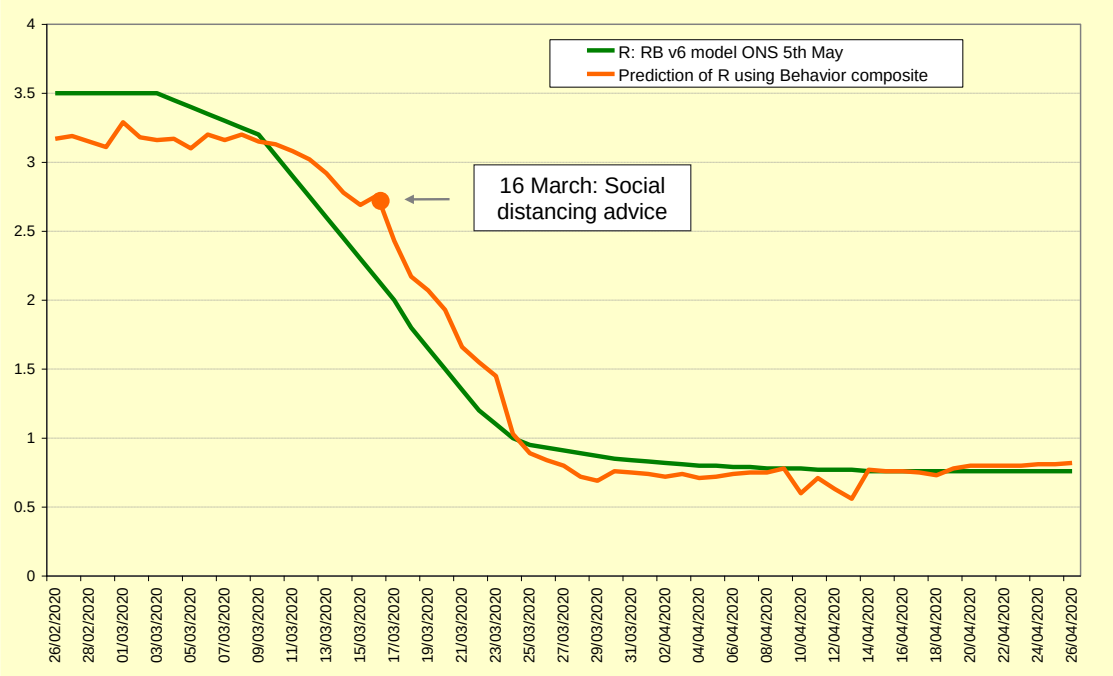


Also the Google Community Mobility Report (https://www.google.com/covid19/mobility/) shows declining visits to workplaces, transit stations, retail and recreation:



This suggests that there is a strong link between these behaviour measures and the R value. Both are likely a reflection of the amount and intensity of social interactions occurring on that

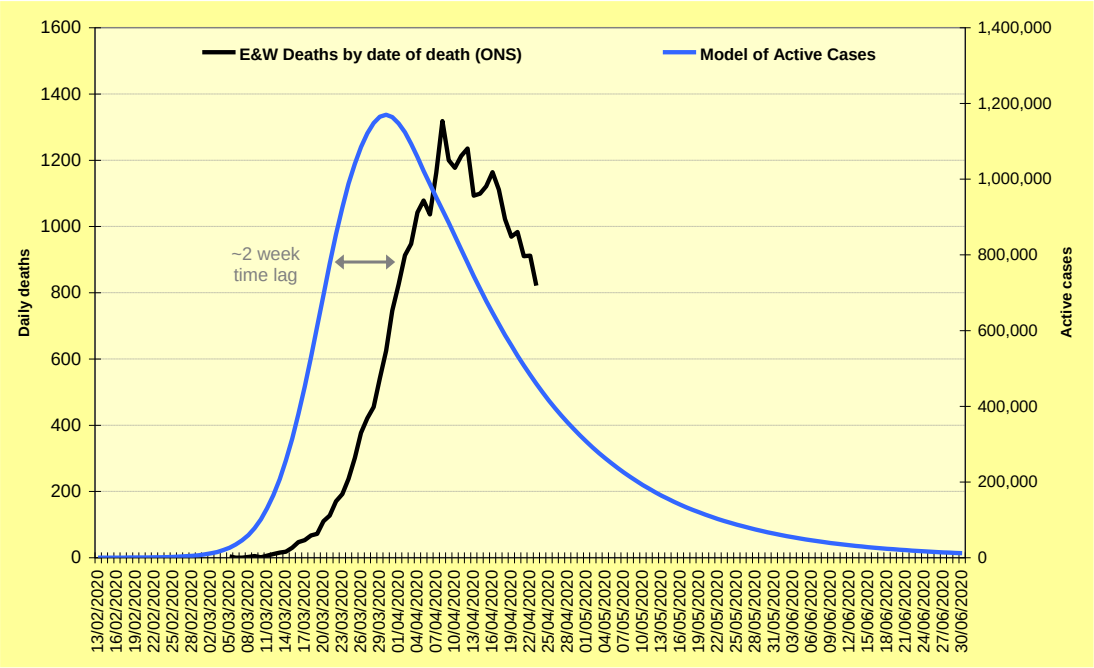
day. So knowing the activity levels of a particular day means we can estimate the likely R value.
A regression model has been developed to assess the linkage, and is shown here:



This means that with these input numbers, we can approximate R using up to date behavioural measures. The ball of thread can be unwound and so we hope to be able to track the level of R, as any easing occurs. If transport usage increases and people visit more workplace, retail and recreation sites, this offers greater opportunity for the virus to spread; notwithstanding the efforts of social distancing measures.

These behavioural measures may not be precision level estimates of R, but they certainly could provide us with an early warning system to check if relaxation strategies are risking a sharp uptick. It also could help to spot poor compliance with guidelines, too. For instance, there are tentative signs that R might have been creeping up slightly from late April.

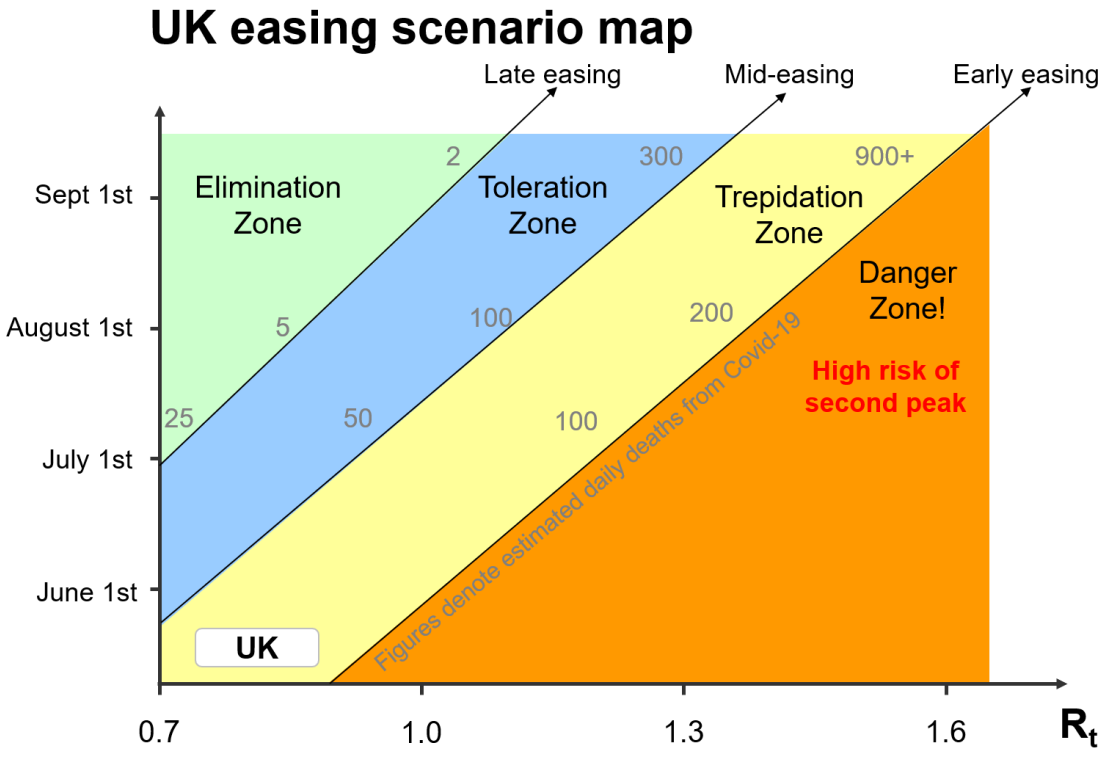
Finally, the virus model also enables us to understand the prevalence of Covid-19, both historically and projected forwards in time. This chart plots the estimated amount of cases (right hand axis), against the ONS statistics of daily deaths from Covid-19 (left hand axis):



The amount of cases is worked back from an estimated Infection Fatality Rate. For this model, a figure of 1.5% has been used. There is still a lot of uncertainty around this figure, and it could vary from country to country because of demographic differences.

However, taking these assumption on board, it would suggest that on 10th May, there was likely to be around 190,000 active cases in the UK; an amount that would certainly overwhelm a “track and trace” operation. However, if R is kept around 0.75 throughout May and June, then the UK could be down to 12,000 active cases and less than 25 daily deaths by 30th June.

Holding on that level of reduction for another 6 weeks will require quite a bit of stamina. But, the longer we can wait before relaxing the lockdown, the lower the incidence. Once incidence is lower then we are better placed to cope with R creeping up a bit. Here is a summary of various easing scenarios tested using the modelling:



Currently we are sitting in the Trepidation Zone; because the prevalence is still quite high and we are hovering with R somewhere around 0.72 – 0.85. It means we are treading a fine line between bringing the virus under control and risking a flare up.

In an early easing scenario where R creeps over 1 before June and slowly climbs up, we risk entering the Danger Zone. That's because we still have a high amount of active cases and so we risk a second peak in the summer.

If R can stay under 1 until July we have the opportunity to enter the Toleration Zone. This is where the prevalence is broadly under control, but not eliminated. It would mean we have a modest but manageable spread of the virus. A country like Germany is currently in this zone, where a low percentage of cases are tolerated in order to balance the risks of the virus with attempts to return to normality. However, care needs to be taken not to slip back into the Trepidation Zone.

The only way to reach the Elimination Zone is to adopt a very late easing strategy that keeps R comfortably below 1 until August. That might be a tough ask of people to stay in some form of lockdown conditions for a total of 4 months, not to mention the impact it would have on the economy. However, a tougher suppression now creates better options in the longer run.

Keeping R down for as long as possible will not be easy. High volume and high density sectors like pubs, theatres, sports venues and even public transport pose the highest risk. Therefore, these may not be released from lockdown for many months. Low density or low volume sectors might be able to be released earlier. So leisure and tourism could look very different this summer. Camping and self-catering holidays might replace the traditional package holiday, as there's better opportunity to implement social distancing. The retail sector is already learning to adapt. Meanwhile office workers will be encouraged to work from home wherever possible for the foreseeable future.

By passing the peak, we have managed to slay the Minotaur. But the way out of the labyrinth is still a treacherous journey fraught with extra hazards. Our rapid dash into lockdown is now going to require a slow and cautious exit. Keeping R at manageable levels whilst trying to re-open various sectors of the economy is going to involve a very fine balancing act indeed.

Russell Bradshaw – 11th May 2020

Russell Bradshaw, MSc, MBA is an experienced analyst and statistician who has conducted many hundreds of complex data modelling studies and statistical analyses for a wide variety of clients and industry sectors. He has an MSc in Statistics and an MBA providing a rare blend of analytical acumen with a commercial emphasis. He is a member of the Royal Statistical Society working toward Chartered Statistician status

56 Degree Insight are a research and insights consultancy based in Edinburgh. Over the years, the team have undertaken a great deal of research in relation to tourism, leisure, the environment, transport, food and drink and outdoor recreation.

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