

# The Case for Cadence Lockdowns

## **Summary**

This paper makes the case for Cadence lockdowns to tackle the spread of Covid. A Cadence lockdown is a cycle of a short lockdown followed by a period of fewer lockdown restrictions. For example, 1 week strong lockdown followed by 3 weeks of lighter lockdown restrictions. This cycle is then repeated until the number of Covid cases drops either due to a change in season, a vaccine becomes available or herd immunity develops.

The goal of Cadence lockdowns is to reduce the spread of the virus while minimising the impact on the economy and people's livelihoods and wellbeing.

This work found that Cadence lockdowns do indeed have the mathematical potential to reduce the impact of Covid. To that end the authors wish to encourage the relevant authorities to do further research on the potential for Cadence Lockdowns.

## **Observations**

Covid is a highly contagious disease that has the potential to cause a large number of deaths in the UK population.

Lockdowns, wherein the activities of citizens are restricted, are a key method of reducing the spread of the virus. While lockdowns help reduce the spread of the virus, they can also be detrimental to the economy of the country, people's livelihoods and their physical and mental health.

This presents a dichotomy. To stop the virus killing people it is necessary to prevent the spread of the virus by restricting the amount people interact using strong lockdowns. However, such lockdowns cause damage to the economy and people's health as well, favouring limited or no lockdowns.

This paper explores the potential for Cadence lockdowns wherein a strong lockdown is implemented for a short time (say a week) and then lighter restrictions remain in place for a subsequent longer period. This cycle (or possibly adapted cycles as the understanding of the impact develops) is repeated until the strong lockdowns are no longer required.

Specifically, this paper aims to explore whether a lockdown shorter than the period over which a typical covid sufferer remains contagious would have a beneficial effect.

## Analysis

To explore the potential for Cadence lockdowns, a simple Ruby program has been written [<https://github.com/cadencecovid/covidcadence>].

The program models at a statistical level how a number of Covid cases can lead to creating subsequent Covid cases via infection and how from that can lead to deaths.

The program is configurable, but the baseline parameters assume that someone who contracts Covid is contagious 2 days after contact with the virus and remains contagious for 12 days.

The program does not operate at the individual patient level. Instead, to model the impact of R (the number of people a person infected with Covid will on average infect) the program first decides whether the day being considered is one in a strong lockdown or weak lockdown period. If the day is a strong lockdown is in effect, a (configurable) low value of R is used. Conversely, for a lighter lockdown day a higher value of R is used.

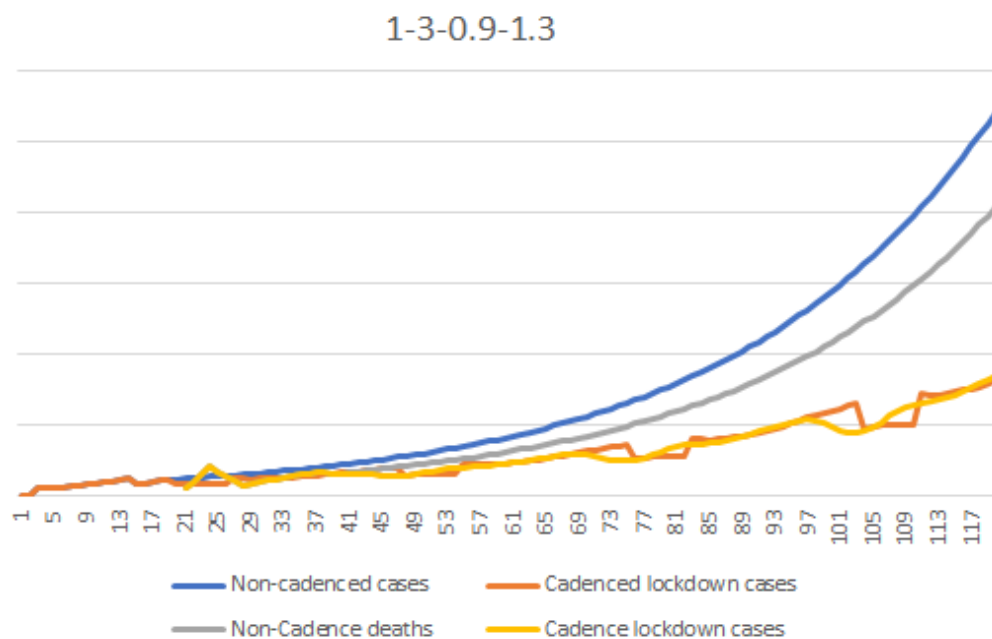
The program then essentially considers (in function "make\_cases") that, on this day people could be infected by people who were infected (using the default parameter above) 2 + 12 days ago, 2 + 11 days ago, 2 + 10 days ago and so on. So that the R is relevant to the entire period the infection ratio is taken as R divided by the contagion period. Thus the cases for the day being analysed is the sum of the number of cases 2 + 12 days ago multiplied by R divided by 12 (the contagion period), plus the result for 2 + 11 days ago and so on.

Deaths are computed by projecting forwards (in function "deaths\_from\_case"). Mortalities from Covid occur over a window of days after infection. The default values for this program are that deaths start to occur on the 21<sup>st</sup> day of infection, increase linearly and peak on the 24<sup>th</sup> day and then decrease linearly and finish on the 27<sup>th</sup> day. This is obviously an approximation but hopefully sufficient for the purposes here.

## Results

The impact of Cadence lockdowns can vary dramatically depending on the characteristics of the disease and the effectiveness of the lockdowns. The following graphs show the impact of a cadence of 1 week strong lockdown followed by 3 weeks with lighter restrictions.

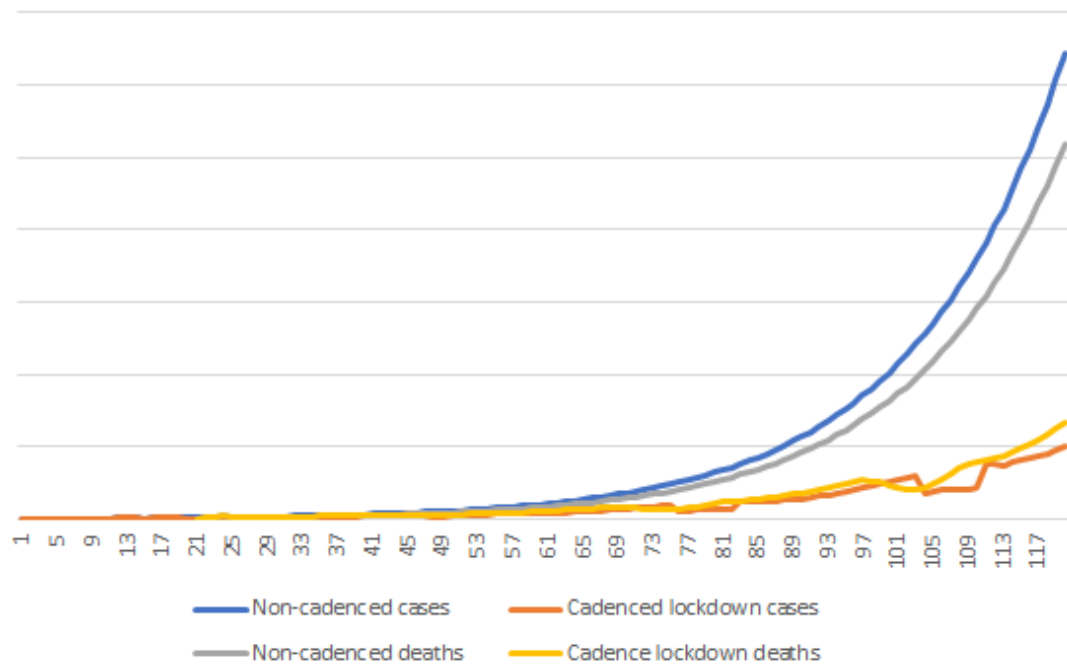
With a strong lockdown R of 0.9 and the lighter restrictions with an R of 1.3, the following results are obtained:



(Note the cases and deaths use different vertical scales.)

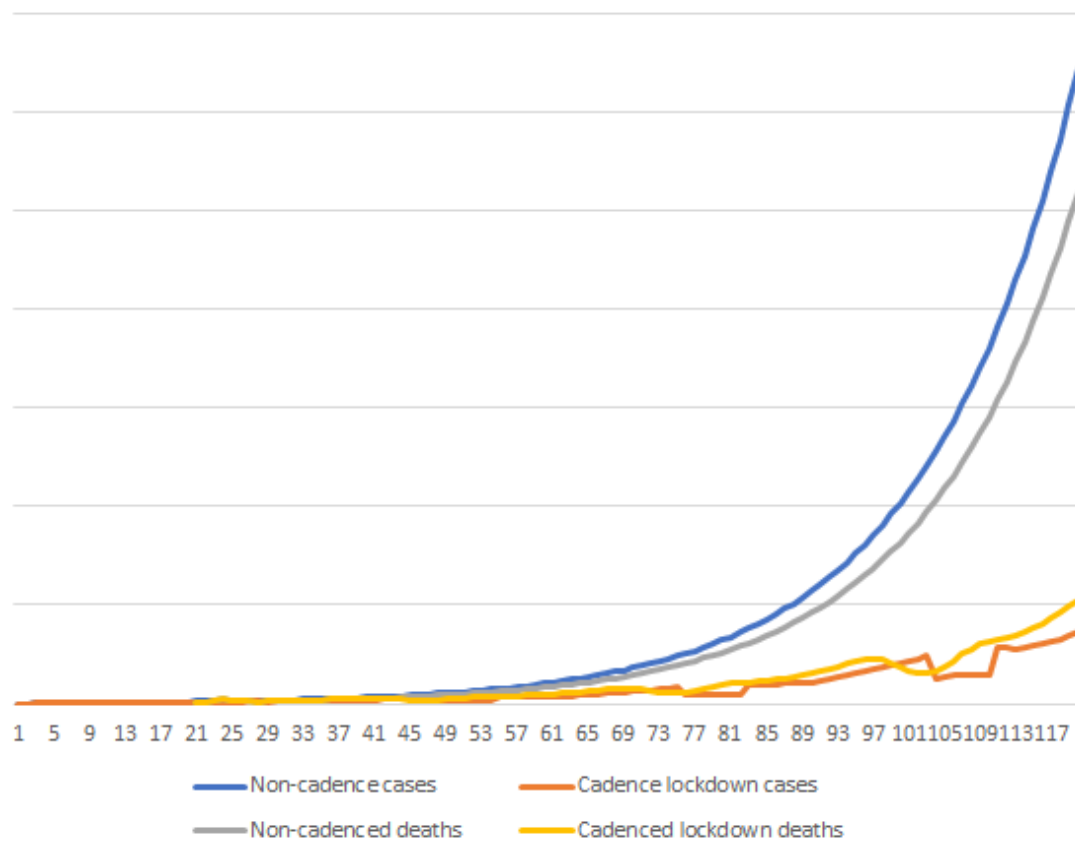
With an R of 1.6 for the lighter restrictions (keeping R for the strong lockdown at 0.9) the effects become even greater:

1-3-0.9-1.6



If the strong lockdown is more effective with an R of 0.8, we get:

1-3-0.8-1.6



(As an aside, an observer might notice that the peak deaths in the latter graph occurs at 21 days after lockdown despite the peak mortality after infection being set to 24 days. This phenomenon has been taken by some as evidence that the lockdowns were unnecessary because the deaths were decreasing anyway. These graphs show that that is a wrong and dangerous assumption.)

## **Conclusions and Recommendations**

There is much scope for more accurate modelling but hopefully this brief analysis and these few graphs are sufficient to illustrate that the potential for Cadence lockdowns is significant and worth exploring further. We encourage authorities to consider Cadence lockdown further.