# **OPTIMISING THE EFFICACY OF TIME-LIMITED INTERVENTIONS FOR EPIDEMIC CONTROL**

## **INTRODUCTION**

Non-Pharmaceutical Interventions (NPIs) have played an important role in the ongoing COVID-19 outbreak, with these measures reducing contact between individuals and breaking chains of transmission chains. NPIs also vary in terms of strength, variation and when they were introduced, ranign from population lockdown (stay at home orders), closure of schools and even just isolation upon symptooms and physical distancing between idnvidiausl.

While effective, serious retrospective discussion has been brought about to determine the effectivenees of these strategiges, with conversations regarding how these measures should have beenintroduced to reduce the number of deaths, and cases during the initial stages of the outbreak. While we note that the most obvious solution would to be intervene as early as strong and as long as possible, we highlight that this strategy is unsustainable, with lockdown measures providing a highlgiy effective approach at reducing cases, but with noted mental, physical and economical effects. It is for this reason that these interventions are considered time limited.

Due to the time limited nature of these interventions, researchers have discussed the concept of optimising outbreak intervention control, with the primary aim of reducing the peak number of cases and reduce the overall number of cases over the outbreak. These outcome emasreus are explored due to their epidemiological relevanece, with a recent precedent set during the recentcovid19 outbreak with the risk of nhs capacity being overwhelmed. This optimisation involves tweaking the characeteristics of NPIs to achieve the most optimal outcome, using dynamics epidemiological models. These studies also explore the concept of suboptimal strategies to minimise either outcome measure with parameter combinations which can be considered more realistic to achieve given the small room for error.

Interestingly borne out of the covid-19 strategy a number of different itnervention strategies have been proposed and implemented, this contrasts with the current thinking of an itnervention of a flat reduction inttransmission in many mathematical models. With ramping up being considered, or a pulsed intervention strategy as key examples. We note that the optimums and even suboptimum for each of these itnerventions sncearios should also be explored.

Therefore in this study we explore the following study questions in a amthetmical modelling framework in an attempt to better explore the optimsiation dynamics underliyng the itnrdocution of a strong NPI under difffernet intervention sncearios.

1. What is the impact of differing the magnitude of a SDM interventions on a COVID-19 outbreak?
2. What is the impact of differing the “trigger day” timing and length of SDMs on a COVID-19 outbreak?
3. What is the impact of these different interventions in the context of multiple, sequentially introduced SDM interventions?

In this paper, we explore the effect of differing SDM interventions, which differ with regards to how each strategy impacts the basic reproduction number (R0) over time. We also conduct a number of sensitivity analysis to explore the concept of an “optimal” parameter space, where the parameters best mitigate the peak and overall number of infections over the course of a simulated COVID-19 outbreak.