



Covid-19 pandemic – Suppression vs Mitigation. What is this all about?

By Adrian Pinington FIA for

COVID-19 Actuaries Response Group – Learn. Share. Educate. Influence.

Summary

Suppression strategies seek to reduce the spread of this epidemic by aggressive identification of infected individuals, with strict isolation of them. Innovative contact tracing and testing, has shown success in slowing the epidemic in countries like Singapore, China, Taiwan and South Korea. However, this leaves the population without immunity and susceptible to recurring outbreaks.

Mitigation strategies seek to manage spread of infection through a population by significantly reducing social interaction between and among population subgroups. Specific isolation measures are implemented for vulnerable subgroups expected to be most adversely affected by infection.

Success depends on:

- getting timing + level of reduced social interaction right so health services are not overwhelmed,
- high levels of compliance with social distancing,
- successful identification and isolation of vulnerable subgroups, and
- acquisition of long term immunity by those who have been infected

Introduction

Put simply the community of nations is responding to the COVID-19 pandemic by trying to implement a suppression strategy. The UK government initially proposed an alternative mitigation strategy never before tried in any recorded history, but has now moved – at least partially, to suppression. This article seeks to simplistically explain and dissect the two concepts. Both are rational, but both are risky and the stakes are high.

Suppression - Contain and isolate

This strategy is conceptually simple, and has almost achieved checkpoint one of a multi-stage marathon, at least for a few countries (such as China, Singapore, South Korea, Taiwan), but there are many stages ahead.



Stage one's objective is to constrain spread – forcing replication below 1. Conceptually it may help to think of a grid with many millions of cells in it. Picture the outbreak as clusters of cells on the grid that have changed colour to red (indicating infectious) and are able to infect adjacent cells changing them to red. The suppress action surrounds the infected cells with barriers – preventing movement and infection outside those barriers. Once the impenetrability of the barriers has been achieved the next step is to identify infectious cells within the contained zone and quarantine/isolate them so that they cannot infect other uninfected cells. Whilst the detection process is ongoing all cells within the barriers are prohibited from moving. Eventually the infection spread is arrested and after a period of time all cells within the barrier zone resolve to either recovered or dead.

Singapore (pop 5.6 M vs UK 65.2M)¹ started this process back in late January and as of 23 March is evidencing 509 cumulative cases after scores of thousands of tests and innovative contact tracing such as using mobile phone proximity history. Singapore's new daily cases chart was as follows:



Daily chart new cases taken from 22 January 2020²

For the first few weeks of the pathogen spread, it would appear to have been a successful strategy, but increasingly difficult to maintain.

Since contact tracing and isolation still leaves the general population susceptible and without immunity, total containment is likely to be hard to maintain with outbreaks flaring up as seems to be occurring.

The testing and isolation for stage 1 is only really achieved once new cases drop to zero and stay at that level for some three or so weeks.

Stage 2 is to prevent new imported cases – and ensure no new flare ups.

Stage 3 is to rapidly develop a vaccine so that population immunisation can start – this will take many months perhaps 12- 18 months assuming a safe vaccine can be developed. [Vaccine development should be possible as many people have already recovered, but safety needs to be assured].

Stage 4 is to produce vaccines and vaccinate the whole population rapidly.

Mitigation - Herd Immunity through timing of controlled exposure

The mitigation strategy initially proposed by UK authorities is a far more nuanced strategy than may be assumed on first reflection. The proposal is that from existing data we can identify the more vulnerable subsets of the population and get them to effectively self-isolate. If they are self-isolated then the virus would be allowed to spread among the more resilient segment of the population in a controlled way – replicating slightly above 1 - and catching those who need hospitalisation.

Hopefully resulting in a much smaller number than would have been the case were the vulnerable subsets not being isolated, and thus preventing medical resources from being overwhelmed.

Implementation would not preclude regional instances of broader isolation, such as envisioned in the suppression model. In time it is theorised that the number of immune individuals can grow to a high enough proportion such that when isolation of the “vulnerable subset” is relaxed, the probability of them coming into contact with an infected person is small and thus the rate of any transmission through the vulnerable/older population is much reduced – and is possibly unsustainable.

The following information from Italy reveals most adverse mortality experience amongst the aged and thus the potential opportunity to be grasped if we could somehow protect this subgroup:

23-Mar 2020³

Age	Deaths	Case fatality Rate	Confirmed cases
0 to 29	0	0	
30 to 39	14	0.3	4,667
40 to 49	46	0.6	7,667
50 to 59	191	1.6	11,938
60 to 69	606	5.4	11,222
70 to 79	1960	16	12,250
80 to 89	2221	23.7	9,371
90+ to	503	23.7	2,122
not rep	1	0.3	333

The challenge with this strategy lies in its novelty and it received early criticism from several experts and senior people (even within the WHO). To be successful the following need to happen:

- successful identification of people the most vulnerable people
- very high compliance to isolate the vulnerable and aged – potentially for several months
- sustained support from the designated resilient segment – many of whom may get sick, but not be tested
- co-operation from parents who will be anxious for their children.

Once embarked upon there may be no chance to turn back and indeed it may already be too late, not just for the UK, but for many European countries. For countries with less resources this is likely the only route forward.

There are risks such as:

- immunity may be temporary as the virus evolves
- mis-timing exposures could still result in health system being overwhelmed
- keeping the vulnerable safe (e.g. carers unknowingly carrying the virus into a care home)
- unknown prevalence required to impart herd immunity

There are some desirable dynamics associated with the strategy:

- if the population can remain largely at work it will keep the economy going – if only limping
- reporting can change from the distressing infection/mortality prevalence to the more hopeful antibody/recovery prevalence – sociologically more hopeful
- the emerging future has sociologically attractive elements of shared responsibility, actively doing something - working, isolation compliance to avoid overwhelming health services
- innovative ways to manage spread may be strengthened – such as work from home, shift working to reduce on site numbers, delivery services and other social distancing techniques
- possibility of lower reliance on development and distribution of a successful vaccine.

Conclusion

Policies to suppress the virus (i.e. lowering replication number below 1) are seen to be effective in delaying the spread of the virus in the short-run, but slow-down the build-up of immunity. The population thus remains vulnerable to new outbreaks in the medium term, although not a problem if vaccination is soon available. Crucially the strategy also buys time to expand health system resources.

Policies to mitigate/contain the virus (i.e. lowering replication number BUT NOT below 1) are much less effective in flattening the curve. This may well have strong repercussion in the short-run because of limited health system capacity, but allows population immunity to build up faster and so the population may become less vulnerable in the medium term.

Practically the UK has tried to move to a suppression strategy, but limitations of testing capacity mean that a mixture of suppression and mitigation is actually being applied. Each country will need to make its own decisions and hopefully we will be able to learn quickly from each other, unfortunately with the data arising from many individual tragedies.

References

1. Approximated from *Human Mortality Database*. University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany). Available at www.mortality.org or www.humanmortality.de
2. Tableau Public based on Johns Hopkins University dataset https://public.tableau.com/profile/covid.19.data.resource.hub#!/vizhome/COVID-19Cases_15840488375320/COVID-19Cases
3. Epicentro Istituto Superiore di Sanità (https://www.epicentro.iss.it/coronavirus/bollettino/Infografica_24marzo%20ENG.pdf)