Go Suppress Yourself | A Chronicle

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By

In December 2019, reports emerged of a pneumonia of unknown origin in the city of Wuhan, China. A week into 2020, a novel pathogen was identified— "severe acute respiratory syndrome coronavirus 2" (SARS-CoV-2), a new coronavirus. The novel virus is highly similar in structure and sequence to the first SARS coronavirus (2003). After entering the body, typically through the mucus membrane, the novel coronavirus binds, just like the first SARS, to angiotensin converting enzyme 2 (ACE2), an enzyme attached to the membranes of cells in the lungs, arteries, heart, kidney, and intestines. It appears to especially target lung cells (both type I and type II pneumocytes).[1] Unlike the first SARS virus, SARS-CoV-2 has a cleavage site for a proprotein convertase called furin, which may account for the increased likelihood of the virus binding to enzymes on the cell membranes in key organs, attacking and killing these cells. The attack on these organs, in particular the lungs, causes, in some people, an illness now known as Coronavirus Disease 2019 – COVID-19. Once it became clear that the virus was human-to-human transmissible, and that it was spreading quickly, Chinese authorities locked in the city of Wuhan and the province of Hubei, before Chinese Lunar New Year celebrations began. By the middle of March, a pandemic was announced by the only authority authorized to make such a speech act: the WHO.

There are many different narratives and analyses that can proceed from this starting point. Our analysis concerns one specific question: how did a set of policies, which include the closure of all educational institutions, the closure of "non-essential" endeavors, not only businesses but all kinds of work and research, including some clinical trials and other medical services, as well as the closure of borders, became the self-evident and obligatory response to the pandemic in the vast majority of countries worldwide, since early March 2020?

How did broad blanket closures and the cessation of movement of people and things, "social distancing" and "lockdown" measures, become the necessary solution to this pandemic?

These policies have as their obvious corollary, let us note, inter alia: state intervention into the economy in ways that were inconceivable for most governments just weeks prior; the suspension of constitutional freedoms,

in countries where those freedoms exist, and the signing into law of emergency powers, in places where signing things into law matters; as well as the destruction of millions of livelihoods worldwide. In what follows we provide a narrative of what happened as well as some conceptual orientation to aid analysis in discerning how a broad policy of lockdown, with its extreme social, political and economic effects, was rapidly integrated and accepted by broad swaths of the majority of states worldwide, with little dissent.

1. Four strategies: An Overview

Since January 2020, four strategies have been mobilized in response to the pandemic. These are broad strategies of intervention that can be distinguished at least schematically from a range of tactics and techniques which accompany them, such as physical distancing, regular and correct handwashing, mask-wearing, and border controls. We distinguish these four strategies for schematic purposes and recall that that they are used in combinations:

> (A) containment of transmission of the virus at the level of individuals, through testing, case isolation and contact tracing. The aim of this strategy is to stop clusters from breaking out.

> (B) containment of transmission of the virus to a specific territory within a country, through quarantine. The aim of this strategy is to keep infections from spreading out to adjacent areas within the country.

> (C) suppression of transmission of the virus, within a given territory, realized principally through "lockdown": an obligation to stay inside, close all "non-essential" places of education, work and leisure. The aim is to spare critical care capacity in hospitals from being overwhelmed.

> (D) mitigation of the transmission of the virus, aims to protect vulnerable groups from spread of the virus through the population. In order to slow the spread of the virus, some physical distancing and partial closures of some places of education, work and leisure are put in place.

Strategies A and D target individuals or populations, independently of their location, whereas strategies B and C target first and foremost territories.

These four types of strategy differ in terms of how they target and take up the *danger* of Sars-CoV-2. We note that following Niklas Luhmann, and his reading of Frank Knight's *Risk, Uncertainty, and Profit*(1921), it is useful to distinguish dangers from risks.[2] Dangers are empirical things (facts, circumstances, elements, forces), however, they exist in the world in a scientifically under-examined, indeterminate, state. Strictly speaking, dangers are veridictionally under-determined, which is to say that they lack conceptualization, time series, justified comparisons, and so on, so that knowledge can move from the knowable to the known, and such that the knower might be able to make a warranted judgment about the supposedly known. It is only once dangers, understood as in principle knowable, enter into a grid of knowledge, and only once these dangers can be taken up in a calculable series, that they then technically become risks. Dangers, unlike risks, cannot yet be scientifically assessed.

The four strategies mobilized so far during this pandemic are not pragmatically exclusive, they can and are being mixed and matched in various combinations. There is however, as we will explore, an overriding style of response, whose normativity needs to be explored.

A. The first strategy of containment through contact tracing and case isolation is an exemplary modern technique of public health: unlike quarantine, it focuses on cases (individuals) in networks (contacts), rather than a specified territory or area of a territory. The aim of this strategy is to prevent the onward spread of a pathogen, by finding all cases and the network of contacts of those cases. Insofar as it requires intense surveillance and isolation of individuals it should be regarded as a contemporary iteration of disciplinary technique. South Korea, Singapore, Hong Kong and Taiwan are today's exemplars, although in Taiwan's case as well as in Singapore's case their low case numbers also depend on having restricted travel to and from China.

B. The second strategy of containment is the archetype of the pre-modern disciplinary rationality: a grid is imposed on a territory, all movement is strictly controlled within the grid. It is how the plague was addressed, for example, through quarantine, and should be qualified, following Michel Foucault, as a juridico-disciplinary technique. The only country which has succeeded in imposing this type of measure is China, in Hubei, to spare the rest of the country. Italy, in Lombardy, tried first to imitate China, but failed because people fled the north of the country. Since it was no longer possible to contain the transmission to a specific territory, Italy therefore used strategy C, "suppression", and extended a form of lockdown to the whole country. Strategy C was subsequently adopted, in varying forms and degrees, by the majority of countries in the world.

C. Suppression is what we consider as original and unexpected in its sweep and scale across states. The logic of suppression is being employed not only to stop the pathogen spreading to other individuals or other areas, but to stop one very specific feared effect of the spread of the pathogen: overwhelming the capacity of hospitals to treat patients. Like quarantine it can be conceived broadly as disciplinary, but with the following attenuation: quarantine and case isolation is purely disciplinary to the degree that it is a norm imposed from the outside; you cannot leave an area due to blockades, you must stay at home if you are sick or have been told you have been in contact with anyone sick. A state conducts containment, in either form, in order to protect others from those contained: it is imposed.

Suppression*,* however, is also underpinned by self-imposed limitation, in the name of one, and only one, public good, to wit: hospitals' capacity to treat those who are ill. You must suppress yourself, not principally because of the danger to an individual becoming sick, or of making another sick, but because of the net effect of the virus spreading on ICU capacity, a public good and capacity that will have been invested in by states to vastly different degrees. The concern about hospital capacity, the infrastructure of ICUs and critical care infrastructure to cope is the finality / purpose to which this strategy is oriented and organized. Again, what is important is that we are dealing with the concern about capacity, rather the actual effect of / on capacity.

We will discuss in more detail the measures taken up in a suppression strategy, as well as the fourth kind of strategy, mitigation. At this stage what is of note is the variation in how "self-limitation" / suppression is made normative: France's militarized lockdown is different from that being implemented in the UK, or in Germany, or in San Francisco, or in India, even if the interventions in these places share broad features: closing schools and closure of all educational institutions, closure of bars, restaurants, all non-essential businesses, closure of cultural institutions, and so on. Although such a strategy may appear to be a disciplinary measure, the variations in norms, and the zeal/willingness to impose measures in different contexts, changes what "lockdown", or "confinement", signifies in different places. Germany and France are curious companion cases: broadly similar policy policed to highly divergent degrees — France intensely, Germany less intensely. Within neighboring counties in northern California, cell phone data showed that San Francisco, with close to zero policing and no punitive measures had very rapidly integrated the norm of "staying at home" whilst Sonoma had done so to a lesser degree.

Suppression, it is important to point out, has to be continued until either: (a) there is sufficient capacity in the hospitals, and public acceptance, to

allow more people to get sick or (b) until a vaccine is available. The economic, social, psychological, and health corollaries are flagrant.[3]

D. Mitigation as a fourth strategy aims to allow the virus to circulate whilst still trying to slow its transmission and to reduce deaths. The rationality behind such mitigation is to foreshadow being able to treat this danger as risk. The strategy, whilst protecting the most vulnerable, aims to adjust life to a normal distribution of infection among less-vulnerable age groups, to slowly allow the spread of the virus until a threshold has been passed after which sufficient immunity exists within the population such that the virus cannot effectively pass from one person to another. It is not a risk strategy because it lacks the case series necessary to determine the risk profile of engaging in such an endeavor. Only Sweden has explicitly said it seeks to allow the virus to spread slowly amongst the population, recommending public health measures, including partial closures, but not lockdown.[4] What is also important to note is that this strategy does not depend per se on the baseline ICU / critical care capacity. Sweden's capacity is below that of Germany, and they still decided against hard suppression of the virus. At the same time, they also set up a military field hospital (like in other places e.g. London's Excel center) just in case.[5]

If the key externality or limitation of suppression is that it multiplies the negative effects on the economy, leaving millions jobless and will exacerbate already flagrantly destructive inequality, effects which will lead to increases in death amongst those who are vulnerable economically and medically, the externality of the mitigation strategy is whether only slowing and not trying stop transmission will produce an unacceptable number of deaths directly from COVID-19, deaths which target disproportionately those who are vulnerable medically and socio-economically.

It is important to note: at this stage, no strategy has a verificational basis. Verification will only take place post facto.

Hence, the question was one of ethos: How do we want to live our lives? How did different states, with their varying health infrastructures, varying political ideologies, and bureaucratic capacities, orient themselves to this danger? On what basis? With which ramifications? How will different classes within societies with varying obligations, injunctions, vulnerabilities, both in terms of access to healthcare and the basic means for survival in an emergency situation, accept, or refuse, state policy? Very simply, how will people both live with this virus, and future novel viruses, in the coming months and years, and how will we live together?

STRATEGY	CONDUCT OF CONDUCT	TECHNIQUE	AIM	CASE EXEMPLAR	PROBLEM / EXTERNALITY
Containment I	Modern Discipline	Case isolation, and contact tracing, high degree of testing	Stop clusters from breaking out	Singapore S. Korea	Undetected infections
Containment II	Pre-Modern Discipline	Quarantine	Keep infections within one region to spare rest of country	Wuhan Lombardy (until 8.3.2020)	Undetected infections Economic / Sustainability Second wave
Suppression (Lockdown)	Couter-Modern Discipline & Self-Discipline	shutdown of schools and non-essential work; enforced distancing	Stop transmission across whole territory Protect health system from collapse	Italy France India	Economic/ Sustainability Second wave Mass deaths due to global economic depression
Mitigation	Modern Regulation	Partial closures, some distancing	Ensure slow transmission through population	Sweden	Mass deaths If the Infection Fatality Rate is > 0.5

Table 1. Four strategies

2. What happened: January 20th– March 15th

On January 20th, the Chinese authorities, by way of contact tracing and case isolation work, deduced and announced that Sars-Co-V-2 is human to human transmissible, less than a week after the acting head of WHO's emerging diseases unit had said that it looked like there was "no sustained human-to-human transmission." Several countries in East Asia, such as in Hong Kong, Singapore and South Korea, initially implemented classic measures of case isolation and contact tracing. It is important to note, however, that South Korea and Hong Kong also closed schools early on. Hong Kong enacted the measure in early February, at the same time as it obligated most people to work from home. While South Korea has been lauded an exemplar of the contact tracing model, it is worth noting that until mid-April most businesses were mandating work from home and schools "resumed" on April 16[th]only in a distance learning mode. As such, the South Korean strategy can hardly be qualified as "avoiding lockdown."

Singapore by contrast had avoided lockdown until early April, keeping workplaces and schools open, thus pursuing a "pure" case containmentstrategy. However, on April 6 the city-state decided to go full press for suppression, closing schools and "most workplaces" due to a cluster outbreak in a migrant workers encampment. This rare glitch in the highly efficient technocracy, required a reaffirmation of control over the

territory, which they claimed initially would be short term. However, due to the large number of migrant workers, and crowded living conditions, the cluster has been difficult to contain and the city-state extended the lockdown into June.[6]

Thus, broadly speaking, once containment through case isolation has come to appear unfeasible as a means of controlling transmission, each country has to make a judgment about how best to proceed: case isolation + suppression, perhaps via quarantine, or else moving from efforts at case isolation to mitigation.

China as we know decided on a policy that combined the quarantining of the province of Hubei with especially tough measures in Wuhan, making use of a suppression strategy within the province, eventually centralizing all cases in purpose-built field hospitals. What is critical to recall is that the combination of the three strategies in China was ultimately oriented to the overarching challenge of stopping the spread of the disease out of Wuhan to the rest of the country.

On January 23rd, China imposed a "locked city" policy on Wuhan and other cities in Hubei province in an effort to contain the center of an outbreak, prior to Chinese lunar new year celebrations, a time when vast numbers of people move across the country, and specifically through Wuhan, a transport hub.

At the same time, in addition to a strategy of containment through quarantine, the authorities also imposed a suppression strategy: orders within quarantined cities that people should stay at home, a policy that would become more restrictive, going as far as closing not only "non-essential" businesses but also factories, in the hope of suppressing transmission of the virus from person to person. What is crucial to note, and must be highlighted, is that quarantine and suppression only work as long as the measures are kept in place, or until a vaccine is available.

On 25th January 2020 Hong Kong declared a state of emergency. Schools were closed, civil servants were asked to work from home, and many companies soon followed. Hong Kong did not close borders however, imposing vigorous surveillance instead. They had learned from experience with the first SARS outbreak in 2003 that closing borders does little, and only makes global responses to emergencies more difficult.

Two days later, Gabriel M Leung, an internationally-recognized expert on the epidemiology of novel viral epidemics, and Dean of Medicine at the University of Hong Kong, predicted along with his colleagues that actual case numbers in China were likely 10 times higher than case reports from and suggested that:

> "it might still be possible to secure containment of the spread of infection such that initial imported seeding cases or even early local transmission does not lead to a large epidemic in locations outside Wuhan. To possibly succeed, *substantial, even draconian measures that limit population mobility should be seriously and immediately considered* [emphasis added]."[7]

Leung and colleagues estimated the basic reproduction number of the virus as 2.68, meaning that any person who has the virus will transmit on average to 2.68 other people, in line with an early estimate from Imperial College London.[8] As the Imperial College team, led by Neil Ferguson indicated in a January 25th report, there is, for epidemiologists like Leung and Ferguson, a logical necessity which stems from the basic reproduction number:

> "This implies that *control measures need to block well over 60% of transmission to be effective in controlling the outbreak* [emphasis added]. It is likely, based on the experience of SARS and MERS-CoV, that the number of secondary cases caused by a case of 2019-nCoV is highly variable – with many cases causing no secondary infections, and a few causing many. Whether transmission is continuing at the same rate currently depends on the effectiveness of current control measures implemented in China and the extent to which the populations of affected areas have adopted risk-reducing behaviors. In the absence of antiviral drugs or vaccines, control relies upon the prompt detection and isolation of symptomatic cases. It is unclear at the current time whether this outbreak can be contained within China; uncertainties include the severity spectrum of the disease caused by this virus and whether cases with relatively mild symptoms are able to transmit the virus efficiently. Identification and testing of potential cases need to be as extensive as is permitted by healthcare and diagnostic testing capacity – including the identification, testing and isolation of suspected cases with only mild to moderate disease (e.g. influenza-like illness), when logistically feasible." [9]

Surveying the events since January, and the appropriateness and character of the control measures put in place, Leung and colleagues have taken up the event as an occasion to underscore the position of China in global health leadership:

> "The public health lockdown, initially heavily criticised as typical of China's authoritarianism, has in one form or another become an international norm. Containment or suppression is a de facto

strategy, whether by choice or necessity, based on the success of countries that rapidly 'controlled' the outbreak. However, the degree of political repression in some national strategies is still blurred."[10]

"Blurred" authoritarianism is considered an externality of an obligation to "control the outbreak" where control means, de facto for these epidemiologists, suppression. The Chinese authorities were clearly taking serious and extreme measures to contain and suppress the spread of the virus, efforts which were lauded by the WHO.

By mid-February, the Chinese authorities issued an extension of the order to shut down all non-essential companies, including manufacturing plants, in Hubei until at least March 11. The lockdown was getting more restrictive: old forms of political control reared their ugly head: "red guards" using physical violence against norm breakers.[11] The WHO affirmed both the containment strategy and Chinese success: "China has bought the world time. We don't know how much time" the WHO stated. On March 3rd, the WHO announced a case fatality rate (CFR) of 3.4%. CFR is the ratio between confirmed deaths and confirmed cases. As Our World in Data makes clear, "During an outbreak of a pandemic the CFR is a poor measure of the mortality risk of the disease" since the true numbers for both infections and deaths due to infection are indeterminate. The WHO confirmed that "containment" (unspecified) should still be the preferred strategy. Tedros Adhanom Ghebreyesus, the WHO director, made the explicit point at the March 3 press conference that SARS-CoV-2 seems to be less transmissible than the flu, and more deadly, and that the Chinese containment strategy was working.

The WHO announcement in early March about the legitimacy of containment followed the worrying events in Lombardy in northern Italy, where a number of cases were not treated as possible SARS-CoV-2, and were not tested because of a lack of links with China, producing a situation that required the quarantine of ten cities. Italy closed schools and universities on March 4th in order to contain the virus in the northern part of the country, with crowd control measures put in place. By March 8th, the government approved a decree to lock down Lombardy and 14 other provinces in Veneto, Emilia-Romagna, Piedmont and Marche, encompassing more than 16 million people. It was a spectacular failure. News of the quarantine leaked and thousands fled the north of the country. The order was thus extended to the entire country on March 9th, producing a "suppression" situation, as a de facto solution to the problem of failed quarantine.

A pandemic was announced by the WHO on March 11, 2020.

1. January 23, 2020 | Locked-in city policy - Wuhan/Hubei
2. January 25, 2020 | Hong Kong announces state of emergency, school closures
3. January 31, 2020 | Dr. Leung (Hong Kong) estimates r0=2.68, draconian measures should be considered to contain the spread
4. February, 2020 | Increasingly draconian measures in China / WHO praises China.
5. March 3, 2020 | WHO announces Case Fatality Rate of 3.4
6. March 4, 2020 | Cases in China begin to plateau
7. March 8-9, 2020 | Italian situation is drastic: several nothern provinces quarantined; when this doesn't work, entire country is locked down
8. March 11, 2020 | WHO announces pandemic

Table 2. Key events leading up to announcement of pandemic

3. From Pandemic Preparedness towards Global Suppression

Other countries, the vast majority of countries, went straight to suppression (at the scale of the whole country) after the pandemic was announced, after realizing that containment strategies would be futile. Faced with the medical, ethical, and political obligation to "do something," we find it difficult to comprehend how suppression, which involves extreme and significant curtailments on movement, the ability to work, and significant health and mental health impacts, was established as normative, in so many countries, so quickly and, seemingly with little dissent.

The remainder of our text is an effort not to explain, because we cannot, but at least lay out the elements of a possible understanding for the normative establishment of suppression as the necessary and obligatory response.

We should underscore that severe community restrictions and blanket "social distancing measures" were considered unfeasible and unproven by several expert groups in 2007.[12] As recently as 2019, the WHO's advice on "Non-pharmaceutical public health measures for mitigating the risk and impact of epidemic and pandemic influenza" stated that there is "low" evidence for the impact of workplace closures, and "very low" evidence for school closures, suggesting that these measures should be *considered* only for extraordinarily severe pandemics. "Severe" means a rating of 4 or 5 on the pandemic severity index, with infection fatality rate of 1% or more.

To begin to answer the question of how a suppression strategy could become normative some background is necessary.

Prior to 2005, measures beyond classical containment to stop the spread

of an infectious disease in the absence of effective vaccines or treatment were not considered seriously, meaning the tools in play were (i) effective isolation of symptomatic individuals and (ii) tracing and quarantining of the contacts of symptomatic cases. These policies are still today considered the gold standard, and countries which are able to do them are praised.

In the case of SARS (2003), these policies worked well because of the virus's low infectiousness prior to clinical symptoms.

> "SARS-CoV was contained in human populations in 2003 largely by aggressive use of traditional public health interventions (case finding and isolation, quarantine of close contacts, and enhanced infection control measures in settings where care was provided to persons with SARS, especially in healthcare facilities and homes). These measures also contained a smaller SARS outbreak in 2004 that originated from a laboratory-acquired infection. Measures to decrease the interval between onset of symptoms and isolation were effective in containing community transmission. The independent effectiveness of general community measures to increase social distance (in addition to contact tracing and quarantine) and improve hygiene and wearing masks in public places requires further evaluation."[13]

After the SARS outbreak "pandemic preparedness" became a global issue, a point indicated by the simple observation that during 2005, the number of countries with a pandemic preparedness plan rose from under 50 to 120 in six months. As Carlo Caduff has explored in detail, pandemic preparedness became normative.[14] The preparedness projects for the most part, however, dealt with prevention and containment. Very little attention was paid until now to the norms for governing a pandemic once containment is longer possible.

In all of the anthropological and social scientific work on pandemic preparedness, the key object was the imaginary and the rationality of preparedness and the use of "sentinel devices" for surveillance, detection, and containment.[15] What we have today come to call "lockdown" did not figure in government planning. It did not however emerge from the head of Zeus. It came from a very small number of modelling groups, principally those of Neil Ferguson and Elizabeth Halloran who collaborated and published together. [16]

A systematic search year by year between 2000 and 2010 using the search terms "nonpharmaceutical interventions + pandemic" and "targeted layered containment + pandemic" shows that prior to 2005 no consideration had been given by epidemiological and public health experts

to pandemic interventions consisting of large-scale extended closures of workplaces/schools. These groups were, as far we have been able to find, the first to make serious research based propositions about what would come to be called today "lockdown."

In January 2006 the WHO recommended interventions for pandemic influenza stated that isolation of patients and quarantine of contacts, accompanied by antiviral therapy are appropriate for the initial "pandemic alert" phase, when containment is still possible, but that once a pandemic has taken hold

> "the focus shifts to delaying spread and reducing effects through population-based measures. Ill persons should remain home when they first become symptomatic, but forced isolation and quarantine are ineffective and impractical. If the pandemic is severe, social distancing measures such as school closures *should be considered* [emphasis added]." [17]

What does such consideration consist in?

From roughly 2005-2006 the serious consideration of what we can call "suppression" or social shutdown began to take hold, in stark contrast to a prior normative position summarized in the following way, in 2006, by public health veterans Henderson and O'Toole:

> "Experience has shown that communities faced with epidemics or other adverse events respond best and with the least anxiety when the normal social functioning of the community is least disrupted. Strong political and public health leadership to provide reassurance and to ensure that needed medical care services are provided are critical elements. If either is seen to be less than optimal, a manageable epidemic could move toward catastrophe." [18]

We think that a shift began in roughly 2005 based on the research of the Ferguson and Halloran groups. These publication indicate, minimally, one space of reflection, in which large scale suppression of daily activities went from being unadvisable, and not in the public imaginary due to the range of interconnected effects such policy would have, to being considered as not only possible but logically necessary to avert a simulated catastrophic outcome.

The modelling of suppression measures through non-pharmaceutical interventions seems to have begun precisely at the time circa 2005, after

H5N1 outbreaks. This modelling could be considered the flipside to work on preparedness that aimed at targeted interventions, containing an outbreak as it emerged or being able to respond quickly to an outbreak through stockpiled vaccines.[19]

The key question was what would be the effect of different non-pharmaceutical interventions in an epidemic for which there was no vaccine and no prospect for a vaccine for a year or two.

As previously stated, one of the principal players who has been working on modelling suppression as a possible strategy for pandemics since 2005 is Neil Ferguson. Sars-CoV-2 was his chance to put his prefabricated model to the test, and he did not miss a beat.

4. Who is Neil Ferguson?

Neil Ferguson was a theoretical physicist who, after deciding he was "not smart enough" for physics, as told to the *Financial Times* by his doctoral advisor John Wheater, decided to use his modelling skills to tackle real world problems. [20]

> "He was soon working for one of the top scientists in the field, Roy Anderson, who took his team of infectious disease experts from Oxford to Imperial College in late 2000. Within months they were called in to help UK officials grappling with a devastating foot-and-mouth disease outbreak that would prove to be a turning point in Prof Ferguson's career. As the Daily Telegraph reported at the time, it was "the first time that epidemiologists have modelled a major epidemic as it unfolds, then intervened to change its course". "It was really Neil's innovative thinking on the computational side of it that made that possible," says Deirdre Hollingsworth, an Oxford university epidemiologist who worked with Prof Ferguson at Imperial. In recognition of the role his work played in helping to contain the outbreak, the father of one was awarded an Order of the British Empire in 2002."[21]

The accolades continued to arrive. His research group at Imperial College London has several distinctions: It is a WHO Collaborating Centre for Infectious Disease Modelling, an MRC Centre for Global Infectious Disease Analysis and the Abdul Latif Jameel Institute for Disease and Emergency Analytics (J-IDEA). He is also a Dean.

Prior to working on a model of transmissions and deaths for the new coronavirus, Ferguson had worked on the Ebola pandemic (2016), MERS (2012), and swine flu (2009) in addition to foot and mouth disease (2001).

What the *Financial Times* paean to Ferguson doesn't include, regarding the foot and mouth story, and his subsequent OBE for his work, is that his mathematical model triggered a mass culling of the animals, an "aggressive approach" judged later (2007) to have been unnecessary, as reported in *Science* and *Nature.*[22]

His penchant for dramatic estimates also led him in 2005 to being quoted in the *Guardian*[23] regarding the H5N1 (bird flu) outbreaks, as saying that:

> "Around 40 million people died in 1918 Spanish flu outbreak. There are six times more people on the planet now so you could scale it up to around 200 million people, probably."

You could. Probably.

4.1. The model

Ferguson's J-IDEA team appear to have started work on the new coronavirus epidemic in January 2020; the first "tweet" released by the team on the subject is from January 17th. You can watch a series of videos (February 5th, February 20th, February 28th, and last one on March 11th) made by the team about its work, published on their Imperial college web site and on their You Tube channel. Interviews are sometimes conducted with ominous music playing in the background. In these videos, Ferguson is interviewed by a member of his group: the message of the first video is delivered by a very soft spoken Ferguson and stresses the importance of mathematical modelling for policy making as well as underscoring a number of uncertainties that these models inevitably carry with them. Uncertainties explored by Ferguson concern, essentially, the transmissibility of the disease. The lethality of the disease is also uncertain, but appears less so than the transmissibility of the disease, and Ferguson estimates, on February 5th, that the fatality rate is between 0,5% and 2%. Said another way, on the Pandemic Severity index of levels 1-5, what he said is that he estimates that it is not a level 1, but cannot say whether it is 2, 3,4,or 5.

On February 14th, Ferguson is interviewed on Channel 4 NEWS (UK). Introduced as "the global expert" by the interviewer, he explains that one thing he doesn't know is how many people infected by the virus will actually die, however he advances his "best estimates": "maybe one percent of people infected might die"; in his group's paper that will later inform UK, US and French policies, the number chosen/calculated is 0,9%. The interviewer draws out the implication: "So we are speaking of 400,000 people in the UK. It's not an absurd number?" "No, it's not an absurd number," replies Ferguson, who then pauses. After this short silence, the

interviewer asks "So do you think we are overreacting?" Ferguson calmly replies that he "would rather been accused of overreacting than underreacting" and ends the interview on a bleak note delivered in his usual dead pan manner: "And this virus is probably the one which concerns me the most of everything I've worked on." A (catch)phrase he repeats at subsequent interviews.

On March 11th, the day the WHO declared a pandemic, Ferguson, looking more tired than usual, made his last appearance on J-IDEA TV. He reported that the virus had now spread to most European countries and delineates two possible strategies to face the threat. The first one "that the Chinese did" and "that the WHO is recommending" is a "suppression strategy." Such a strategy would consist in suppressing all transmission. It would have to be kept in place for 12 to 18 months (until there is a vaccine) carrying with it enormous "feasibility issues" and a "clearly huge economic and social issue". The second option is a "mitigation strategy": it would aim to control the epidemic until populations develop herd immunity, yet it carries a "very high health burden" he suggested.

These two strategies and their consequences were presented to French president Emmanuel Macron and his advisors on March 12th (according to *Le Monde*[24]), a few hours before Macron was to appear on TV, an appearance in which he explained his decision to close schools because, "according to scientists … children and the youngest are the ones who propagates the disease the most" –a claim (increasingly disconfirmed) based on analogical reasoning that this coronavirus transmits "like" the flu. Macron then addressed the French a second time, on March 16th, explaining his decision to implement a general lockdown ("*confinement*") in France.

Meanwhile, in the evening of Sunday, March 15th the White House received Ferguson's report and, as reported by *The New York Times*, his predictions drove policy change in the US — in particular, the recommendation that primary and secondary schools be closed and that gatherings of more than 10 people be avoided[25].

At around the same time in the UK, the government had put forward a mitigation strategy roughly equivalent to the one Sweden is carrying out today. On Monday, March 16th Ferguson met personally with Prime Minister Boris Johnson and, on the March 23rd, the UK made a U-turn announcing a stay at home order and closing schools.

Ferguson's report was made public on the March 16th as a pre-print paper (not peer reviewed). The article opens with a scary and unwarranted claim and a fantastical point of comparison: "Whilst our understanding of infectious diseases and their prevention is now very different compared to

in 1918, most of the countries across the world face the same challenge today with COVID-19, *a virus with comparable lethality to H1N1 influenza in 1918*" [emphasis added]. The paper then forecasts 500,000 deaths from COVID-19 in the UK and 2 million deaths in the US if these governments *were to do nothing*.

As Ferguson previously explained on J-IDEA TV, his center's media platform, two broad types of strategy, suppression and mitigation, can be used to reduce these numbers. The aim of the paper is to examine predictions of the different results of these two strategies concerning two key outcomes: number of ICU beds required, and deaths from COVID-19. Before examining the results it is important to bear in mind that the 2 million deaths in the US from Covid-19 and the 500,000 in the UK projected by the Imperial Model are based on two estimated numbers: an Infection Fatality Rate (IFR) of 0,9% and on a basic reproduction number (R0) —that measure the transmission of the disease—of between 2 to 2.6.

The model assumes an R0 between 2 and 2.6 based on a very early analysis from January 29[th]published in the *New England Journal of Medicine* of 425 patients with confirmed novel coronavirus infected pneumonia. Another study published around the same time as the Imperial paper has estimated a much higher R0 of 5.2 in Wuhan City, which means that according to the latter the virus would be much more contagious, and therefore, according to the current CFRs, much less lethal, than what the Imperial model estimates.[26]

The IFR is a blind spot that will remain unknown as long as there is no effective testing available to know how many people are/have been infected by SARS-CoV-2. As of today (10[th]May), the CEBM (Center for Evidence Based Medicine at Oxford) polling data from all over the world estimates a global IFR (with all the caveats pertaining thereto) between 0.1% and 0.41%[27]. The only estimate of the lethal potential of SARS-CoV-2 that we currently have is the Case Fatality Rate (CFR), which is the ratio of the number of deaths divided by the number of *confirmed cases* of disease—a ratio that varies massively from country to country depending on who is tested and for what reasons. In the Imperial College model, the IFR is estimated based on a study which projected the IFR in China to be 0.66%. Note that another study[28] published at around the same time, using data from the passengers of the Diamond Princess estimated the IFR for China to be 0.5. The Imperial College is estimating a higher IFR, and therefore a higher lethality, for the UK than those two studies, including the study that drove their own estimation.

To face the danger of having 500,000 deaths in the UK from Covid19 and 2 million deaths in the US, the Imperial College group compared two strategies: mitigation and suppression.

4.1.1 Suppression

A suppression strategy requires the use of a selection and combination of non-pharmaceutical interventions in order to reduce the reproduction number (R0, which measures the transmission of the virus from person to person) to *below* 1. The interventions considered are four: Case isolation in the home; voluntary home quarantine; social distancing of the entire population; closure of schools and universities. The goal of the strategy is to *eliminate* human to human transmission, the mean is to simply close everything down. The text states that successful examples of suppression strategies are the ones recently implemented by China and by South Korea. If these two countries have successfully reduced the transmission of the disease below 1 (at least for a while) they have not done so with the same tools nor with the same effects on social and economic life. As far as the UK, the US and France were concerned as of the March 16th, when the paper was made public it was too late to implement interventions such as the highly targeted ones used in South Korea, interventions which privileged case isolation, contact tracing and quarantining of individuals suspected of having come into contact with infected people. Thus the model here for a successful suppression is therefore the Chinese model: blanket shutdown.

Given the aim, it is unsurprising to find that the team's calculations show that the most effective suppression strategy in order to have ICU beds available and therefore to lower the number of deaths would be to use a combination of all the interventions: closing schools and universities, social distancing of the whole population, case isolation and home quarantine.

This result is based on one significant assumption: transmission in the household is equal to transmission in school/ work place, which is equal to transmission in the community (each counting for 1/3 of total transmission). This is a major assumption, as there are no data available on how SARS-CoV-2 impacts children and therefore if children while in schools transmit it more, or equally, as children who are homeschooled. Significantly, in the available document, the Imperial model does not test its model for other kinds of distribution of transmission between household, workplace/schools and schools—something that is usually done by biostatisticians, and that takes a lot of time to calculate.[29] As such the Imperial model is very rough. Let's note however that recent modelling studies of COVID-19 predict that school closures alone would prevent only 2–4% of deaths, much less than other social distancing interventions[30], and that a previous study published by Ferguson on influenza, for which transmission in schools is proven, concluded even in that case that school closure had little likelihood of showing benefit.

Lastly, one important aspect of a suppression strategy is that by reducing

human transmission to below one, it leaves population susceptibility to the virus intact. Therefore, it would need to be in place for at least 12 to 18 months, the hoped for, but not guaranteed timeframe to produce a vaccine.

4.1.2 Mitigation

Mitigation means, according to the Imperial model, to use intervention strategies to reduce the health impact of the disease but without seeking to interrupt transmission completely. The R in a mitigation strategy would be reduced, but not below 1. The model used for mitigation tests the same measures as the suppression model, looking at their effect on ICU occupancy and deaths, with the difference that in the model the R does not fall below 1.

One extra intervention is also tested in a mitigation strategy: social distancing only of people above 70 years old. The conclusion is that the most effective mitigation strategy is a combination of case isolation, home quarantine of cases and social distancing of people above 70 years old. Adding school closure to these three interventions appears to be detrimental with respect to the number of deaths, although the paper does not explain why that is so.

Mitigation, unlike suppression, will allow immunity to build in the population and the measures could be lifted after 3 to 4 months. Let's note that this strategy is actually being adopted today by Sweden, where elementary and middle schools (but not high school and universities) are still open, as well as work places, although reports from Sweden indicate many people and workplaces are voluntarily choosing to work from home, and physical distancing measures are being taken by large swathes of the population.

Such a strategy focuses on the elderly rather than the young: those particularly vulnerable to complications from infection, and the aged, should be protected, and cases isolated and quarantined. According to Swedish state epidemiologist Anders Tegnell herd immunity could be achieved at the end of May. However despite the ban to visit nursing homes on March 31st, over half of deaths in Sweden have come from the elderly in nursing homes: half people over 70 who died as of April 28th were nursing homes residents and another ¼ were receiving care at home according to the Swedish Board of Health and Welfare (reported by *France 24*[31]). Interviewed on the Daily Show, Anders Tegnell[32] admitted that this was a major error and that investigations were underway to try to understand the cause of the high death toll in nursing homes. By comparison, the same candid responsibility has not been shown in other places where a suppression strategy was put in place and where similar proportions of death in care homes were observed. For example, in

France half of the deaths from COVID-19 have been nursing homes residents, according to Santé Publique France[33]; in Italy, Spain, Ireland and Belgium similarly, according to *The Guardian*[34], half of deaths are taking place in nursing homes; in Massachusetts, according to its Department of Public Health, 1,429 COVID-19 deaths occurred in long term care facilities, out of a total of 2,556 deaths by April 24th[35].

The Imperial Model predicts that a successful mitigation strategy (social distancing of people over 70, case isolation, and home quarantine) would (still) result in an 8-fold higher peak demand on critical care beds over and above the available surge capacity in both the UK and the US. This number is based on the projected estimate of patients requiring invasive ventilation (which is only feasible in the ICU). Mitigation would only lower the number of deaths by 50% from the expected number, resulting therefore in 250,000 deaths from COVID-19 in the UK.

The report therefore quickly dismisses mitigation strategy in favor of an aggressive suppression strategy. The conclusion of the paper is that only a suppression strategy going all out on control interventions would significantly allow the local health care system to absorb the demand in beds in the ICU and lower the number of deaths. The authors consider that it would be feasible to implement a suppression strategy with cycles between maximum and minimum social distancing and they imagine a maximum social distancing (lockdown type) in place for 5 months which would then be relaxed for one month, after which it is to be put back in place and so on indefinitely until an efficient vaccine is available.

5. Discernment

The conclusions of the paper by Ferguson and his colleagues require some consideration. First of all, the efficiency of a mitigation strategy is quickly dismissed by the authors in favor of an aggressive suppression strategy. It is not currently possible to challenge the mathematical model itself, mainly because to date and despite being requested multiple time the Imperial College has refused to give open access to the code of its model, choosing instead a few selected people who are "largely positive" about it. Nevertheless, the conclusion that a mitigation strategy protecting people above 70 would only reduce the number of death by half is a surprising result. The illness severity of SARS-CoV-2 infection depends on demographics, and at the time this paper was written it was already clear that COVID-19 mortality risk is highly concentrated in older age groups (particularly those aged 70+ or even 65+).

The surprising result that social distancing of those over 70 would still result in 250,000 deaths, half of the deaths that were predicted if nothing were done in the UK, makes us wonder if compartmental models are able

to capture demographically related heterogeneity in the course of the illness. If the answer is negative, why is this caveat not specified in the paper that informed pandemic policy all over the world?

In line with this concern, it will be crucial to see how Sweden is doing at the end of May. Sweden has applied a mitigation strategy that the Imperial Model has precisely rejected for being ineffective and causing excessive ICU bed occupancy and too many deaths. According to the Imperial paper such mitigation strategy in place for 3 months would have cost the UK 0.5% of its population (250,000 deaths). At the end of May, will Sweden have lost 0.5% of its population, that is 40,000 to 50,000 deaths from COVID19? How will deaths from COVID19 figure into overall excess mortality, which will include deaths that result from the strategy chosen?

A further problem is the actual implementation of a suppression model, which raises questions about i) its feasibility and ii) its effects on (social and economic) life.

One may have thought that asking people to stay at home, in theory for up to eighteen months, according to the model, would have raised dissent, debate and criticism given how extreme and unprecedented the solution is. The idea that this intervention might pose "feasibility issues" is touched on in the Imperial paper, it is also mentioned by Neil Ferguson on J-IDEA TV on March 11th, as well as in prior papers testing suppression models for influenza pandemic. [36] Very surprisingly the story will tell us that a suppression strategy was very much feasible, and imposed quickly by governments and individuals.

Beyond critiques concerned with limitations on freedom of movement, the closing of schools, and the broad disruption to lives, which has been rapidly integrated by the majority of people, a second issue concerns the specific health consequences of this strategy (so many resources being directed towards tackling the virus) as well as the obvious economic and social devastation brought by lockdowns.

The Imperial paper says that it "does not consider ethical or economic implications" but that suppression "carries with it enormous social and economic costs which may themselves have significant impact on health and well-being in the short and longer-term." or else that "The social and economic effects of the measures which are needed to achieve this policy goal [suppression] will be profound."

On 25th March, Neil Ferguson was interviewed by the UK Parliament to explain some of the key points of his influential report. Ferguson is asked at one point if his mathematical model takes into account one economic consequence, the expected fall in the GDP of 6.5% for the UK in 2020,

and its repercussion on health outcomes predicted to be worse than the ones of the coronavirus crisis itself. Understanding this question as using what he calls a "utilitarian argument," Ferguson explains that the excess deaths from COVID-19 will mostly ("in half to two third of cases") concern people in poor health conditions who would have probably died anyway by the end of the year, what public health discourse refers to, strangely, as "harvesting." Ferguson says that this [utilitarian argument] is a "very valid consideration". As we understand it, he is saying that it is valid to ask if prolonging the lives of two thirds of COVID patients by several months is worth the lives that will be taken by the long-term economic damage brought by the lockdown. However, he adds, the model is not driven by this kind of "utilitarian" consideration– nor does it consider any of the problems that will arise from lockdowns in actual practice. So be it. If this were a purely technical point, that they didn't or couldn't model that particular externality, that would be one thing. It is however tied up with a moral position about what should be done, the outcome of hospital/ICU capacity.

The model concentrates therefore on the capacity of the UK's NHS to "cope" with the demand for beds. What this study models is therefore an "ICU crisis" rather than a pandemic as an event per se about which a range of options could be *considered*. The model shows that under present conditions, the Sars-CoV-2 pandemic will bring about a too high demand for ICUs to cope with COVID patients, and hence to cope with any patients. The solution proposed for this diagnosis is intense lockdown that contains the virus as much as possible keeping as many patients as possible out of the ICU, such that ICUs will remain operational to care for both COVID patients and any other patients needing intensive care. Therefore, as Ferguson claims, it is possible to say that there are no utilitarian considerations in this model since it prescribes that everyone would be treated and treated equally (COVID and non-COVID).

The blindspot of Ferguson's modelling, and of his "philosophy" are the lives lost and destroyed from a one sided scientifically underdetermined, but affectively, ethically, and it must be said, psychologically, overdetermined obligation to "go suppress yourself."

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