Wendy Olsen Models and Ethics in Handling the COVID-1919 Pandemic: Models Enable Strategic Reasoned Public Actions

Abstract

As a specialist in 'mathematical models' in sociology and social science generally, I want to explore the implied ethical stance, if any, when authors use statistical or mathematical models of COVID-1919 impact. I critically review the statistical and algebraic models of SARS-Cov-2, which include models of how it spreads as well as models of impact. 'Models', being brief representations of an open system, can support strategic thinking and socially-grounded collective action. Part of the process of creating, using and reading/thinking about a model is *retroduction*. We then have dialogues in public as well as in private about strategies for action. Each model is not perfect but the dialogue is a good one to be having at a certain point in time. Due to abstraction and the limitations of both algebra and statistics, the models had many limitations yet are of great use at the social level. I conclude with some reflections on wider issues of public policy. Lessons learnt include that a citizen's basic income would offer security during an epidemic; limiting passenger travel would be very important if a test-trace-treat policy were followed in each locality; the damaging role of key neoliberal assumptions; and finally, that lockdown showed that a simpler life can be fulfilling- a theme commonly promoted by green and sustainable-economy campaigners.

Introduction

As a specialist in 'mathematical models' in sociology and social science generally, I explore in this paper the implied ethical stance, if any, of authors who use statistical or mathematical models to gauge COVID-1919 impact. I critically review the statistical and algebraic models of SARS-Cov-2, which include models of how it spreads as well as models of impact. 'Models', being brief representations of an open system, can support strategic thinking and socially-grounded collective action (Olsen, 2019a). Part of the process of creating, using and reading/thinking about a model is *retroduction*. When we do retroduction – which is not the same as induction or deduction - we mentally or dialogically ask why the data look a certain way. After finding the answers, re-theorise the situation as a supporting groundwork for future action. The "dialogical" part is important: we have dialogues in public as well as in private about what are the best strategies for action. Already, by implication, it might be the case that each model is not perfect, but the dialogue is the best one we can be having at a certain point in time. You may not like imperfect modelling. Some authors want to use only 'true' assumptions in their models.

Due to abstraction and the limitations of both algebra and statistics, the models had many limitations yet are of great use at the social level.

This paper begins with the ethics of *strategic agency*. That means concerted thought and action among reflective practitioners. Then I explain how I responded to several modelling approaches; and lastly, I offer key policy implications of my analysis for the United Kingdom. The UK politics is dominated at the top by neoliberally-committed politicians, but my

response is not neoliberal. Because neoliberal thinking has been a barrier to good social-policy in the UK, I conclude with some non-neoliberal policy implications.

The Ethics of Strategic Agency 1) Introducing the situation.

Most of the models reported on here were built rapidly to respond to news about a crisis and most of the models come from a neoliberal-elite dominated part of the world – the UK or India. Events in China since December 2019 made experts worry about the new virus, SARS-CoV-2. The news was filtering into the UK and India during January-February 2020. UK's neoliberal leaders were mainly focused on encouraging maximum market expansion. Many multiple narratives challenge neoliberal thinking in both UK and India. I will report mainly on the UK epidemic models with a few mentions of models focused on India. The news of the pandemic risk seeped into our campaign groups and into Radical Statistics.

The Ethics of Strategic Agency 2) Ethical conceptual frameworks To respond to this situation, we apply ethics as a continuation of our past positionings and strategies. Ethics is not just ethical 'thinking' or 'theory'. People's public ethics rely on one of three options in general. They relation (a). principles, or (b). pragmatism, or (c). a relational humanist orientation with structure and agency interacting. This latter (c.) integrates agency and knowledge about structures, so that people acting as agents can 'know' and debate knowledge as well as action. The knowledge is not taken for granted. I prefer this complex approach which supports the human endeavour of widening our knowledge. We recognise that knowing means not just theories about well-being and suffering through historical time, but also knowing practically how to improve things. According to this approach, when we know about suffering, people feel urges to act to reduce it. It is an intrinsic part of being human to be a reflective practitioner of good social policy. When we are well, and not suffering, nor hearing about others suffering, we tend to act to actualise our underlying capabilities.

The 'capabilities theory' in international development studies summarises this approach, focusing on agency, structural barriers to well-being, and reflective practitioners. It moves beyond the idea of 'quality of life'. Instead of merely aiming to raise *average* quality of life, or *average* earnings, the structure-agency approach also respects people's human needs and the need for relational health. We need personal and social reflection on the good life, and suffering, and then work out how to move continually toward a balance of these two.

I am not convinced by the other two options – principles alone, and pragmatics alone. The principled approaches to ethics are epitomised by Rawls' approach, where you make a choice of an idealised best political system based on a hypothetical situation of not knowing where you will sit in that system. Such principled approaches sometimes get called 'deontological'. This idealist method often implies that a god's-eye view is possible. The reality is that situated standpoints are informed differently, and no god's-eye view is real, only a pretence. Social situations are diverse so there is no way for principled approaches to reach ideal perfect points of view. The competing idea of a situated standpoint is important. Each actor in the scene, known in sociology as 'agents', has different information, memories, relationships and assets. The agents have to converse to work out

a way forward. Conversations and dialogues are normal, and they are real, thus, we can get evidence about them. No ideal solutions are reached, so the role of principles is rather less than in the Rawlsian framework (or other idealistic frameworks, such as utilitarian, or deep-ecological or other).

Another recently popular mode of thinking, pragmatics, argues that taking an action is just choosing the best from among known options. Choosing whether to do some new qualitative research in India, for example, based on the paucity of quantitatively good-quality survey data for public use, would be a pragmatic decision. It is the opposite end of a spectrum from principles-ethics; and weak in giving advice upon which to base a decision.

In common with B. Flyvbjerg (2011), and others, I prefer to think that the agents in a situation are conversing about what to do next and they draw upon many resources when discussing COVID-1919, e.g., data, medical knowledge, memories, norms, standpoints and values. Pragmatics does not help us much in working out how to weave our way through all this complexity.

The structure-and-agency approach with standpoints is a richer approach to how we operate. When I say 'statistical modelling' I mean people and corporate agents working to improve society and avoid harm using a model as part of the evidence base whilst also critiquing the model and data to move forward for the next round.

The people and situations are structured – they have institutionalised practices such as peer review for example – and we are not limited by that structure but are informed by it. Thus, the *MedRxiv* and *BioRxiv* journals, which produce preprints, became more important this year for a wide audience. The careful audience might treat with caution the material published prior to peer review.

It is ethical to use material prior to peer review in view of the many lives which are/were at risk by delaying positive policy action.

I read the models of SARS-CoV2 and COVID-1919 impact as a way of engaging in dialogue with experts who, after many past epidemics, were determined to avoid letting history repeat itself. I wanted to avoid more suffering. In human capabilities theory, we stress the improvement of human lives with a global scope as well as locally situated standpoints for knowledge. In capabilities theory, respect for all agents means that there is a role for translating models from scientific expert to lay language. There is always also a role for asking for new, better data. Capabilities theory has been adopted by the SDG campaign, DFID, and other key actors in world development. Capabilities theory supplants the older Gross Domestic Product focus which was commonly used to guide economic development policy. Capabilities theory is consistent with RadStat's remit as it takes a transdisciplinary approach, not restricted either to biological or economic aspects of a pandemic.

Models of the Epidemic's Effects. Three kinds of models emerged for the transmission of the virus. All of them highlighted the 'cases of COVID-19-19' and the 'deaths from COVID-19-19',

showing this ultimate focus on human wellbeing. The case fatality ratio (CFR) is the ratio of deaths to cases, and has been exhaustively estimated (Verity, et al., 2020). The *Lancet* editorial of 15 February 2020, first published on 24 January 2020 by Wang *et al.*, stated

that the CFR was 2.9% in the Wuhan epidemic (as shown in a table), and that for the first 41 cases the rate was 15%, ie 6 out of 41 people with COVID-1919 died. The CFR and rates of cases per capita are parameters in models. It is growing in popularity to realise that we can also model the *impact* of COVID-1919 based on models of the spread of the disease (Pellis, et al., 2020).

Figure 1 illustrates Alison Hill's model of the spread of disease. Like many other people – experts and lay people alike – I used Hill's model to create my own forecasts (see Figure 3). By Mid-March it looked like an Intensive Care Crisis would occur in the UK. Government – another strategic agent – used similar models to underpin its decision to expand bed capacities in a number of hospital sites, including new field hospitals.

This model adapts a traditional epidemiological model to allow for social parameters. Figure 1 illustrates the Susceptibility – Exposure - Infection – Recovery model (SEIR).

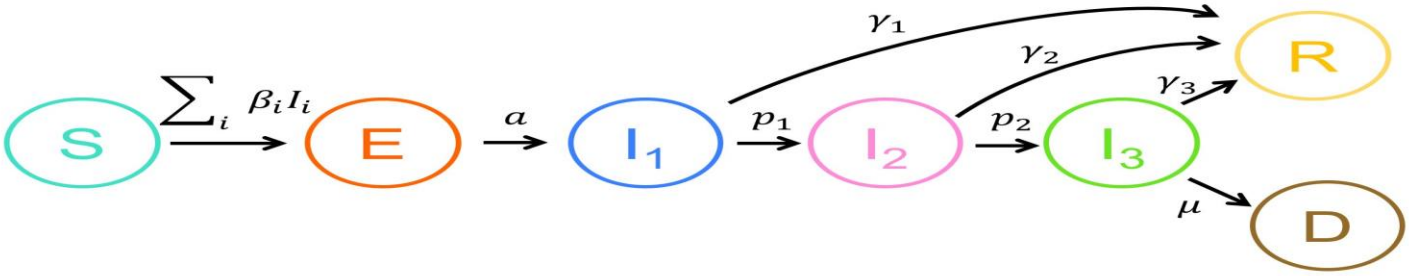


Figure 1: Hill (2020) Tweeted a SEIR Model in Seven Compartments

Key: S=Susceptible. E=Exposed. I=Infected. I1 mild, I2 severe, I3 critical cases. R=Recovered. D=Died.

Source: Hill, a tweet dated March 2020.

We see the summation sign which indicates a range of agents who can be exposed: children, adults, old people living in a variety of home types. This summation of exposure rates allows a disaggregation of an overall parameter. The disaggregation allows social groups, geographic differentiation, and change over time in the parameter. Next ***a*** is the rate of infection of those exposed. This parameter proved highly disputed, because the rate of infection (detected) is low for groups with good immune systems. In the Diamond Princess cruise ship, for example, children rarely were recorded as 'getting' COVID-1919. Suppose they were exposed, their immune systems attacked and overcame the SARS-COV2 virus, and the result was no fever, and no case detection. Infection (I), then, is actually going to mean 'Recorded Infection'. In medical systems, infection often refers to the arrival at a set of symptoms which 'mean' the person has that disease. Thus, having 'COVID-1919' means being with fever OR cough OR one more symptom [for example].

At one stage in the UK, I was defined by the NHS has having a high fever AND a high cough. Small changes in wording gave a whole new measurement approach during the crisis. To a

realist these are not just wordings or narratives, because they can also pinpoint ontological differences. One definition is: **I = Having COVID-1919 disease sufficient for detection.**

Another is: Having COVID-1919 disease sufficient for the immune system to respond [regardless of detection capability]. The first definition refers to both the subject and the medic. The second refers only to the subject, the person having been exposed. These are fundamental differences which matter a lot to the discourse around how we measure COVID-1919, what rights to being tested do people have and what we mean by a data 'trend'. In the present case, the bold definition is the one that tended to dominate in public discussions.

Among experts, the SEIR model got a lot of close attention, leading to explorations of the time trend elements and how to model them. Figure 2 illustrates some options for modelling panel data.

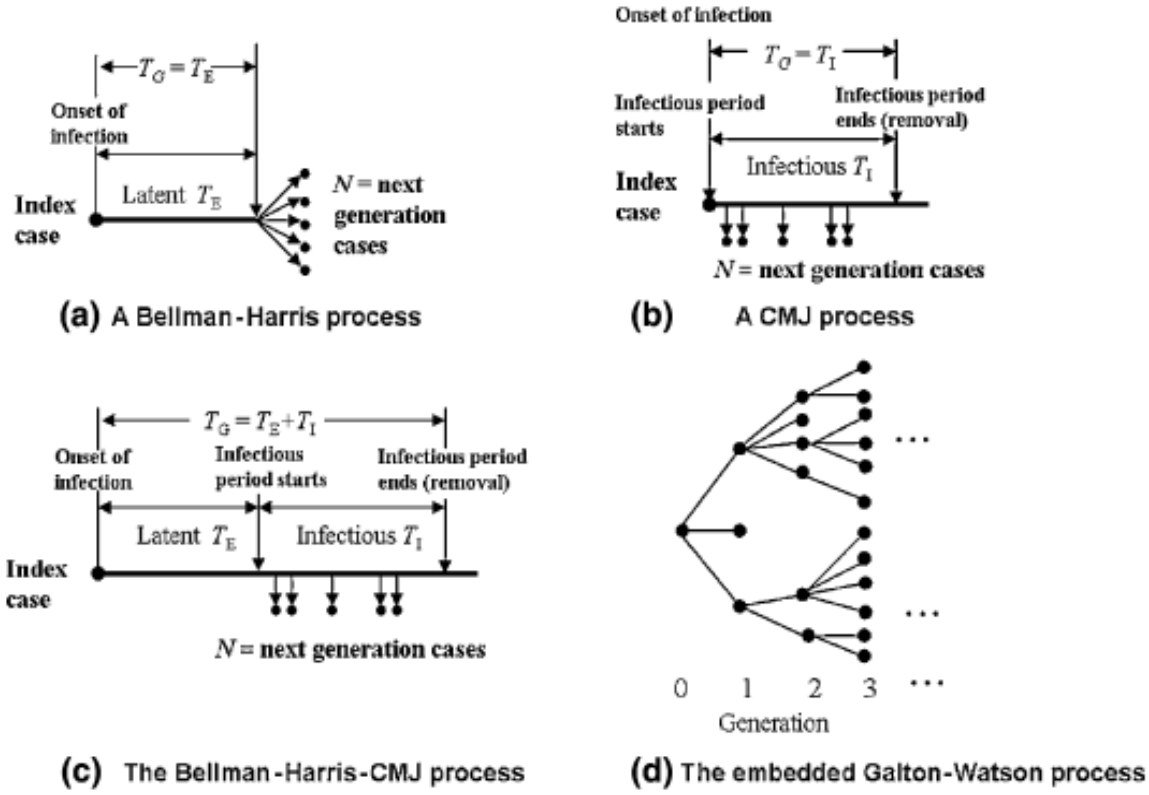


Figure 2: How the Transmission Process Can Be Modelled Longitudinally

Applications of the concept of branching processes in India led to concern that living in joint families would lead to high rates of transmission (Singh and Adhikari, 2020). Hill et al. (2010) also showed decisively that social networks matter very much to the way that a virus is passed around. Verity, et al. (2020) showed that the cruise ship 'Diamond Princess' data gave best insight to the biological processes of exposure and infection, since there the high testing levels enabled asymptomatic and early cases with latent virus presence to be included in the case rate (page 3). Transmission is the overarching term for exposure. and infection. Attack rates are the rate of spread of virus from person to person – without

declaring whether infection occurs. The latent period is a time when the person holds virus particles on or in their body whilst not showing symptoms of the COVID-1919 disease. The latent period length became a key variable. This parameter is in turn potentially differentiated by social group, body type, genetic features and immune response. The models show that there can be interactions of the various underlying structural features. In Hill's Model (Figure 1), the three infection stages all interact to influence the rate of recovery from a detectable case of COVID-1919. Treatment, hospitalisation, ventilation, intensive care unit (ICU) lengths of stay, and medicine could all increase the recovery rate. Pellis, et al. (2020) illustrate the inclusion of a longitudinal model of transmission with an SEIR model of infection and recovery, using UK data. Their work supports the conclusion that the concept of biologically exponential spread at the early stage of the virus is appropriate, but that data for other countries cannot well inform the forecasting of when the peak of the exponential curve of cases will be reached, nor how rapidly a decline in new case rates will occur. Pellis *et al.* (2020) also illustrates both the appropriate use of global or overseas parameters to fit into one country's model, and at the same time the unfortunate nomothetic parameterization in trying to set up a model for 15 European countries. Their conclusion is "although existing data has its limitations, the evidence for fast exponential growth in the absence of intervention is overwhelming" (page 3 and Supplement Figure S3). They do not discuss the obvious possibility that countries not included in this study could have a very different medical, social-health-behavioural or genetic structure – and that these differences could be relevant.

The normative overlay on this model is clearly that recovery is good, while the rest of the underlying mechanisms are complexly interpreted. One may want to get the disease and fight it off, so that one might become immune. This complex normative possibility raised much discussion: would it be better to expose >50% of the population so that they could become immune? Or would a country prefer to wait till a vaccine could be found – the decision rests in part upon the disease symptoms and severe impacts, in part on costs of case, and in part on the future vision of the possibility of finding a vaccine and being able to produce it (or buy it).

Neoliberals tended to imagine it would be easy to eventually produce or buy a vaccine. Humanists tended toward wanting to avoid the agony of the disease itself and the worry and potentially lost lives arising from vulnerable people getting the disease. Thus, the undertone of the model is that the norms are complex and a mature discussion is needed (Olsen, 2007).

The duration of hospital stays and the percent of hospital cases that are in intensive care are crucial to the recovery rates. Cases arriving at hospital were predicted to exceed the beds available. Capacity in UK hospitals was raised, but ICU beds are expensive, and expanding the supply of new ICU beds can be slow. Hill's model and a modified model by Greg Dropkin (2020) which also incorporated primarily a Susceptibility, Infection, and Recovery (SIR) model were, in the end, based mainly on guessing the parameters for the population overall, not broken into groups.

Aswi *et al.* (2020) showed that the correlated geographically-contiguous spread of a different disease, Dengue Fever, meant that a spatial autoregression model would help in forecasting a virus spread pattern. Aswi, *et al.,* also showed how a Bayesian Markov Chain Monte Carlo estimation method could make large models tractable without requiring a single maximum-likelihood function to encapsulate all the equations at once. (Aswi, et al., supplemental document, 2020, has a sample programme. Rajendrakumar, *et al.*, 2020, illustrates these Bayesian methods.)

An SEIR variant model by Tomas Pueyo (2020) became popular with over 40 million views (*ibid.*). Pueyo stressed that lockdown brings the rise in cases down over time, but the epidemic will re-surge. Pueyo's work helps the readers think about cycles of rising and declining case rates, while Hill and Dropkin were focused mainly on the stage at the beginning, known as the exponential growth stage (Dropkin, 2020). The problem is still that exponential growth is the pattern to which the virus reverts if lockdown- or transport-limiting measures are relaxed.

Hill tweeted about her model on Twitter, and a campaign group was created as a Twitter feed, @COVID-19ActNow: "COVID-19 Act Now is a tool to help leaders and communities understand how the pandemic will affect regions across the country" (URL https://twitter.com/COVID-19ActNow/ and hashtag #COVID-19actnow; Note- hashtags bring together people with similar interests, while twitter handles are an input mechanism which help the producer of tweets to generate a stream of small statements that can also be recovered for re-assessment.) @COVID-19ActNow was sociological activism with a bio-social information base. Hill had introduced what factors could cause the epidemic's impact to be reduced.

Separately, Neher et al. provided another similar model with worrying findings for the UK (2020). (URl https://smw.ch/article/doi/smw.2020.20224, 16 March 2020). Again, a compartment model of the stages of the disease without social disaggregation by social group was used. However, age group differentials in susceptibility were allowed for.

These SEIR models with social data underlying a mixture of bio-, med- and social parameters are not based on pragmatics. In Hill's model for example, the March/April 2020 campaign slogan appears at the top of the campaign webpage: "Stay home, save lives. Staying home has saved at least 43,000 lives and counting. Click the map below to see COVID-19 projections for your region and what you can do to stop it." (URL https:// COVID-19actnow.org/, accessed 30 April 2020). Under pragmatics, there would not be such a concerted, focused campaign with clear messaging. A more diverse range of strategies would have been tolerated. The map of USA below the slogan suggests a geographic focus. By contrast the UK government schemas have been UK-focused and have tolerated a diversity of localised strategies. Scotland for example has different COVID-1919 management to the rest of the UK: Northern Ireland, Wales and England. Care homes have a different approach to personal protective equipment to the National Health Service. A great degree of toleration and diversity, probably based in part on pragmatics and in part on neoliberal models of markets solving problems, underlies the UK approach.

Alternatively, an exponential trend model can be used in the very short term. The earliest part of epidemics is often dominated by biological universal facts rather than social

differentiation. A particular example is a study by Deasy *et al.* (2020). Deasy *et al* looked at mortality rates and hospitalisation rates per 'case' using data for UK regions which, unfortunately, were based on a very restricted testing regime. Deasy *et al.* (2020) showed that beds in hospital ICU in the UK were getting very full by the end of March or early April. Worrying – but the upward-trend forecasts were based on a model that could not go downward. This model with an obvious flaw in its algebra nevertheless usefully brought into the frame the age-group differences in hospitalisation and ICU use rates. It also considered regional differences within England in the mortality rate (ranging from 0.82% of the known cases in London region to 1.41% in the Southwest NUTS1 region, page 4; the mortality rate here is a measure of the case fatality rate at sub-national levels, CFR). The Deasy *et al.* research paper enabled further research to be commissioned by the UK government about hospitalisation.

Ironically, such moves in a fast-changing scene show the value of modelling exercises which have obvious weaknesses. We can say, as experts with an overview, that positive normative value is attachable to the exercise whilst a critical reading and a sense of its biasedness is also required.

Here is an example. The case fatality rate, estimated at 1.1% of cases for China by Russell et al. (2020: 2), is widely perceived as having a biological basis. Verity et al. (2020 Supplement) saw the CFR fundamentally as a biological fact as shown in their use of Wuhan, China, and cruise ship data to generate "robust" (pg 1: read worldwide and nomothetic) estimates. The main reason these authors argue in favour of country-specific CFR is that the age-structure of populations differ – a key biological parameter. However, from my reading of the literature, the CFR also responds to hospital treatments, personal behaviours, prevalence of pre-existing conditions, and socio-economic status via mediators like TB, lung disease, diabetes, BMI and heart disease. The CFR reflects social, economic, and political, not just biological, causal mechanisms.

A third model type uses agent-based modelling to make a forward trajectory for the parameters corresponding to each social group. This disaggregation and re-aggregation is then combined with the standard compartmentalised analysis of those susceptible, infected and recovered (SEIR) (Ferguson, et al., 2020, and Flaxman, et al., 2020). This particular model became known as the Ferguson Imperial College Model.

Ferguson, et al. (March 16, 2020) showed that their combination of the SEIR model with parameter changes over time invoking elements of shutting shops and factories, lockdownof schools and homes, and social distancing, including care-home restrictions and over-70s isolation for 12 weeks, would lead to an initial improvement followed by a second wave of viral infections. Ferguson's model was superior in noting social types, social-networking patterns, and social groups. For example, they note "Transmission events occur through contacts made between susceptible and infectious individuals in either the household, workplace, school or randomly in the community, with the latter depending on spatial distance between contacts. Per-capita contacts within schools were assumed to be double those elsewhere in order to reproduce the attack rates in children observed in past influenza

pandemics" (Ferguson, et al., 2020: 4), and a wide range of information was brought into play to make the combined SEIR-Agent-Based model.

A simplified summary was presented at URL https://www.nature.com/articles/d41586-0201003-6 (Adam, 2 April, corrected 3 April, 2020). Adaptations were made to allow for people being more or less contiguous at each point in time. Ferguson's ICL model is a contagion model. However, as published, it is weak in its coverage of the lockdown impact.

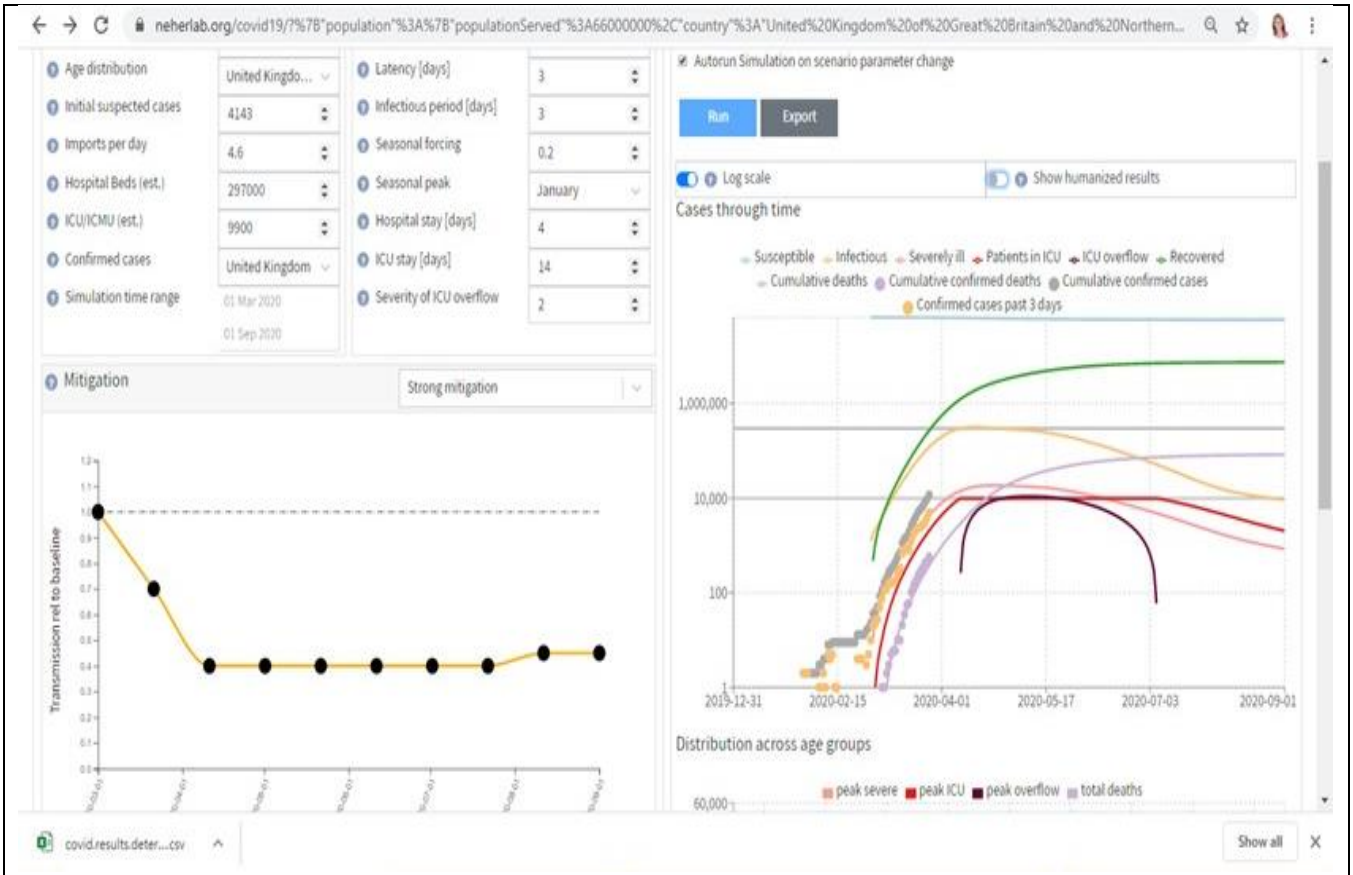
With so many parameters, any of the above models could be tweaked, leading to a lower or higher overall case fatality rate. Criticisms arose because there was a worry that subjective or political factors were entering into the scientific modelling. Extrapolations for the UK 1b based purely on Chinese data were especially worrying. For example social networking patterns in the UK might be different, so the transmission rates might be different (see comparison of rates for countries in the contact-tracing literature, Kretzschmar et al., 2020; and Singh and Adhikari, 2020, covering India, China and Italy). Extrapolations in India at an early stage were inconclusive (Gupta and Pal, 2020).

Ultimately, one could doubt whether we can know about the future if each epidemic is unique. Each virus is unique. Each country's policies are unique. Yet in modelling, we often summarise the ideographic detail to make an important abstract point. An abstract or overarching model in turn must be somewhat approximate. That does not make it wrong; just abstract. Models can still be useful. Furthermore, as data arrives, we can change and improve the parameter settings. A key method is to substitute local for regional, and local or social-group data for global parameter estimates, when appropriate. It was useful for Singh and Adhikari to show how strongly India's joint families differ from the family social networks of Italy (2020).

I also have doubts about the wisdom of individualistic, atomistic agent-based modelling in general. It invokes methodological individualism. No ethics of the family were applied. The agent-based mathematics has some serious breaches of realism in the assumptions of the model: it is not a relational model. Still, this is a form of abstraction. (It is an example of reductionism.)

The models of the three kinds: SEIR, Extrapolation, and Agent-based models, all had common steep slopes upward for infected people during Spring 2020. I applied a mental pattern known as Model Averaging. With the best information as inputs, model averaging is a good use of information (Raftery, 1999). With poor information, the result will be poor. Society tends to take the averaged model results as true, or a best guess. It is still not a god's-eye view, and we await further insertions to the debates.

My use of the Hill model showed much UK higher death estimates than Ferguson's ICL model for April to Dec. 2020. Figure 3 shows my reasoning, which was that the virus is infective from day 3, not from day 5. I estimated 70K deaths for the UK. I still believe that is a likely outcome. The preprint reports by Dropkin, Hill and Pueyo convinced me that a long lockdown is advisable. Neher's model took account of seasonality of flu viruses but was still worrying (2020). The latency period is a key parameter and may differ from time to time, and from group to group.



Lockdown makes cases drop.	Parameters are at top.	Figure has lines for forecasts.	Dots match lines, dots=real data.
The upside-down U curve is a count of cases which need ICU but exceed capacity.			

Figure 3: Forecast by Wendy Olsen Using Alison Hill's Model, 28 March, 2020 for UK
Note: the original figure did not have the notes now shown underneath it. It could be traced back to the model, and it had commentaries attached. Source: Olsen (1 April, 2020).

I created Figure 3 and disseminated it on 28.3.2020 using Facebook, Linked-In, and the Radical Statistics listserv email list. On the left in Figure 3, the lockdown's lowering of transmission rates is shown as a scalar parametric guess. On the right, the outcomes were plotted for each compartment of SEIR. According to this forecast, ICU cases would exceed ICU beds in the UK on about the 1st of April 2020 (an event which did not happen). The overflow is shown as a forecast in an inverted U curve shape.

A feeling of voicelessness, of being disrespected, of alienation, fury and fear arose. No testing was done in streets or care homes! The WHO strategy was not applied.

The various models followed the rapid uptick of cases. They modelled a plateau resulting from human immune systems working. This plateau had not yet been reached. Explaining the data patterns became important. The role of travellers' social contacts was the total focus of the UK Government for many weeks. Mistakenly, they left out of the early policies

the person-to-person transmission. Far too late, the UK government set up broad restrictions on social contact. Using Figure 4, I disseminated these ideas and issues via Facebook and Twitter.

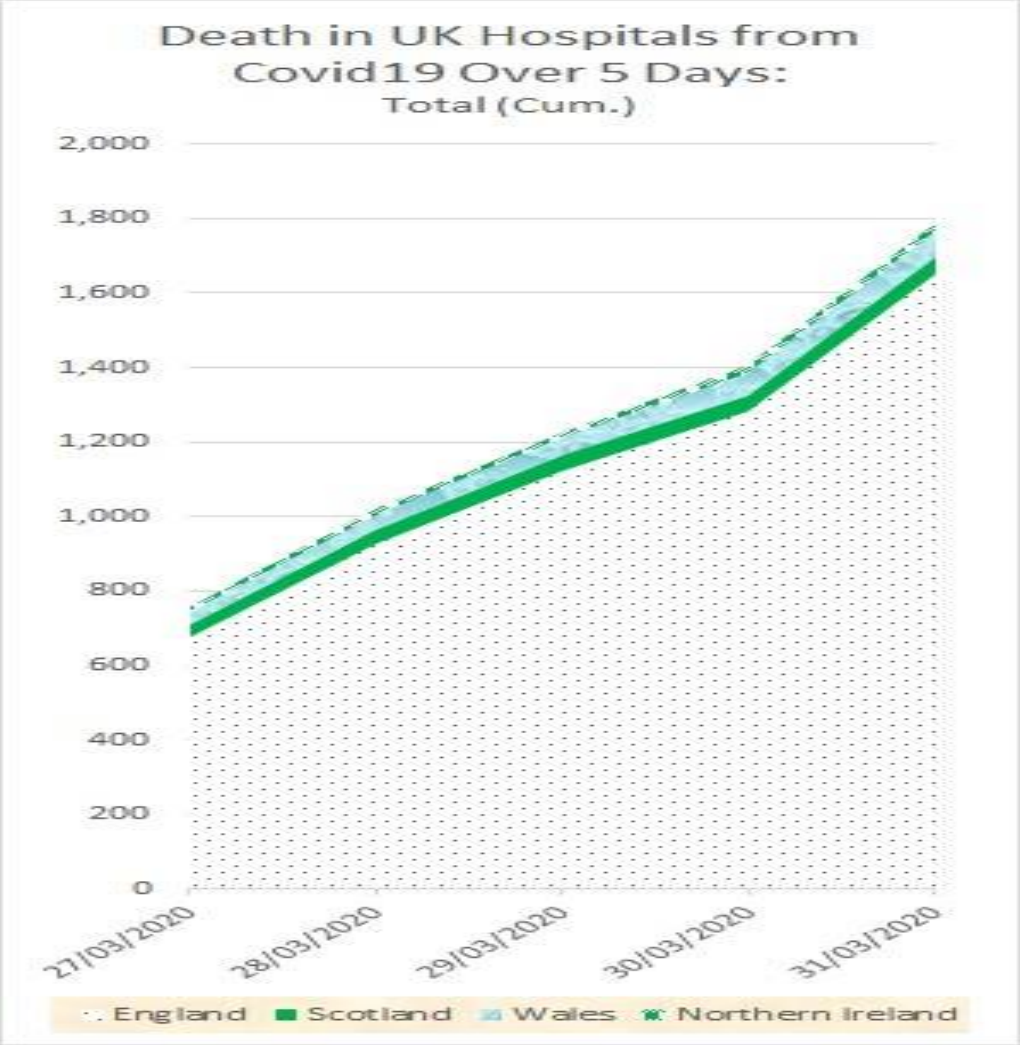


Figure 4: UK Deaths in Hospitals From 27-31 March 2020: An exponential trend depicted for lay audiences (Source: Author's figure based on PHE data on deaths in the UK from COVID-19-

https://twitter.com/Sandhyamma/status/1245676021438963718, sent 2 April 2020)

As a result of analysing the models, and the parameters, and retroducing what social mechanisms have increased or decreased each key parameter, I decided to identify and develop a structure-agency approach to four key policy areas.

Vision 1 and Possibilities 1: A Basic Income for All by 2020.

The UK Government acted decisively to expand the role of public finance in underpinning several sectors. Benefit rates for low-income and unemployed people were raised. Yet these are stigmatized. What was missing from the apparent principle of fairness is a sense of who the actors are that campaign for change. A variety of actors and notably campaign groups argue for an unconditional Citizen's Income or Basic Income instead of unemployment benefits.

Vision 2 and Possibilities 2: Traffic Stops at Your Local Authority Boundary!

The UK Government set up rules on individual behaviour (Stay at Home, for example). They contradicted their supposed "Free Market" "principles". Poor planning mechanisms existed because these had been neglected in the previous administrations under neoliberalism.

One thing we need now is to limit passenger traffic to local areas for a one-year period. Then the epidemic trajectories are local and very predictable. Test-trace-treat can work to protect vulnerable people. Yet the passenger traffic across the country got no public attention at all in the UK (as of 14 April 2020). Holiday travel was restricted during a 6 week lockdown but after that ends… it remains to be seen how passenger travel becomes a policy instrument.

This campaign conclusion around casual travellers is not just short-term: neoliberal approaches are literally ignoring people's health and well-being! In the UK, we may need a holiday travel ban. India has been more draconian than the UK in the area of passenger travel. Their lock-down meant one could not bring the disease from an urban to a rural area. Social-network experts have modelled India's long-distance travel patterns which have effects upon the transmission of disease (Pujari and Shekatkar, 2020). Again this model is enabling public discussions of what is fair and what effects policy could/did/has had.

Vision 3 and Possibilities 3: Modelling for Public Health Can Be Nomothetic But Non-Neoliberal.

Many people worry about the neoliberal assumption that trade (imports) can fulfil any need, including the need for protective equipment or a vaccine. I am making this assumption explicit, whilst it has been implicit too often, and for too long, in both UK and India. This is a version of the nomothetic error of applying a grand idea within-country without validity. We could call it the **Neoliberal Nomothesis : Assume Supply Will Arise to Meet Demand!**

A main lesson of this paper is that it is an error to make a convenient global assumption without considering the matter carefully and looking at it empirically.

The word nomo- refers to laws, or lawlike when it is used as an adjective. Nomothetic analysis is the kind that assumes laws of motion, so biology could be nomothetic to some extent. But where transmission rates have a large social influence behind them, we should avoid large scale import of the concept of biological laws. Neither the past nor other countries will be a good guide to this year's events.

What is more helpful is to import a global parameter only if it will help a model to generate useful, reasonable forecasts. One example is the SEIR modelling for the Indian situation (Rajendrakumar, et al., 2020). In India, data on COVID-19is scarce, hospitalisation is rare, and a lockdown has been militantly policed, while no records are kept. Counting cases of COVID-19is carried out in part by journalists.

In Rajendrakumar et al.'s SEIR model, the parameters were described well, as shown below. This led to the implication that a single global parameter, *rho*= 0.028, was crucial to the whole exercise. Here, the idea of a global parameter was more valid than in some other contexts, as *rho* referred to the duration of a case from the onset of symptoms, through mild-severe-critical stages, and to the death outcome. This was estimated from WHO sources as 35 days. (1/35 is thus the parameter, rho= 0.028, Rajendrakumar, et al., 2020:

3). The equations otherwise brought to bear country-level Indian data. They illustrate how the differential equation approach is heavily dependent upon a range of aggregate parameters.

Eq. 1 $\frac{dS}{dt} = -\beta SI$

Eq. 2 $\frac{dI}{dt} = \beta SI - (1 - \alpha)\gamma I - \alpha\rho I$

Eq. 3 $\frac{dR}{dt} = (1 - \alpha)\gamma I$

Eq. 4 $\frac{dD}{dt} = \alpha\rho I$

Key: The four equations offer the daily rate of change of susceptible individuals S, infected people I, recovered people R, and people who have died D. The parameter α is the case fatality rate (deaths per detected case), β is the disease transmission rate, γ is the recovery rate, and ρ (*rho*) is the rate at which death occurs. The inverse of *rho* is the time to death, from start to finish, with COVID-19disease.

Estimating these differential equations and parameters through a hierarchical sequential Bayesian method, Rajendrakumar et al. (2020) achieved not only an exponential curve fitting through the data but also uncertainty intervals (predictive intervals) around that. Their paper did not model the Indian lockdown and it was pre-printed on 17 April 2020. They noted the 'urgent need' (page 4) for more local data from India to set parameters in relevant, ideographic ways. By using global parameter estimates, they stated, errors in the forecast could occur. 'Models are useful in identifying the transmission dynamics if parameter inputs are based on real world data in the early phase of the epidemic" (*ibid.*).

My vision is for each country to gather and release sufficient health data for health planners to be in a good position for forecasting the demand for health-service resources and personal protective equipment. The possibility of this is shown by countries like Taiwan and Singapore where excellent data are gathered to support public health.

Vision 4 and Possibilities 4: A Simpler Life Can Be Fulfilling.

The emergency has shown us that it is nonsense to base social policy on a mad race for higher cash incomes. Veblen wrote that a life focused on conspicuous consumption may be an elite life but it may not be a fulfilling life (Illich,1981; Lambert,1997). These authors show that a continual chase after self-respect is implied by commodity fetishism. Caradona (2014) advocates a simpler life. A postcolonial global needed (McEwan 2019). Economics should take the advice of Chang and Grabel (2014).

Questioning neoliberal narratives has begun again in earnest. It is not a coincidence that the models of virus impact were **not** neoliberal. The crisis can be managed. Human suffering can be reduced. Reaching into datasets to discover the causes of spread of disease is a collective, critical activity. It is very important to interrogate evidence. One should also not assume global parameters are true for the different parts of that whole. It is part of our relational being for us, as humans, to argue about which cause of suffering we want to shut down, and how.[1]

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Footnote 1: I am pleased that on the day of writing, 1.5.2020, the UK government has done a U-turn toward the test-trace-treat policy and promised to test all suspected cases of COVID-19-19. I have been advocating this for months and am glad to hear of the beginning of a UK attempt to track cases, as it may save many lives. The UK government has shown great sensitivity to the issue of recording COVID-19cases, stating on 2 March 2020 that the infected-case fatality rate (IFR) in the UK is not the same as its case fatality rate CFR (SPI-M, 2020). The IFR is the proportion of those infected by SARS-COV-2 who die, whilst the CFR is the proportion of those people with clinical symptoms of COVID-19who die.

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