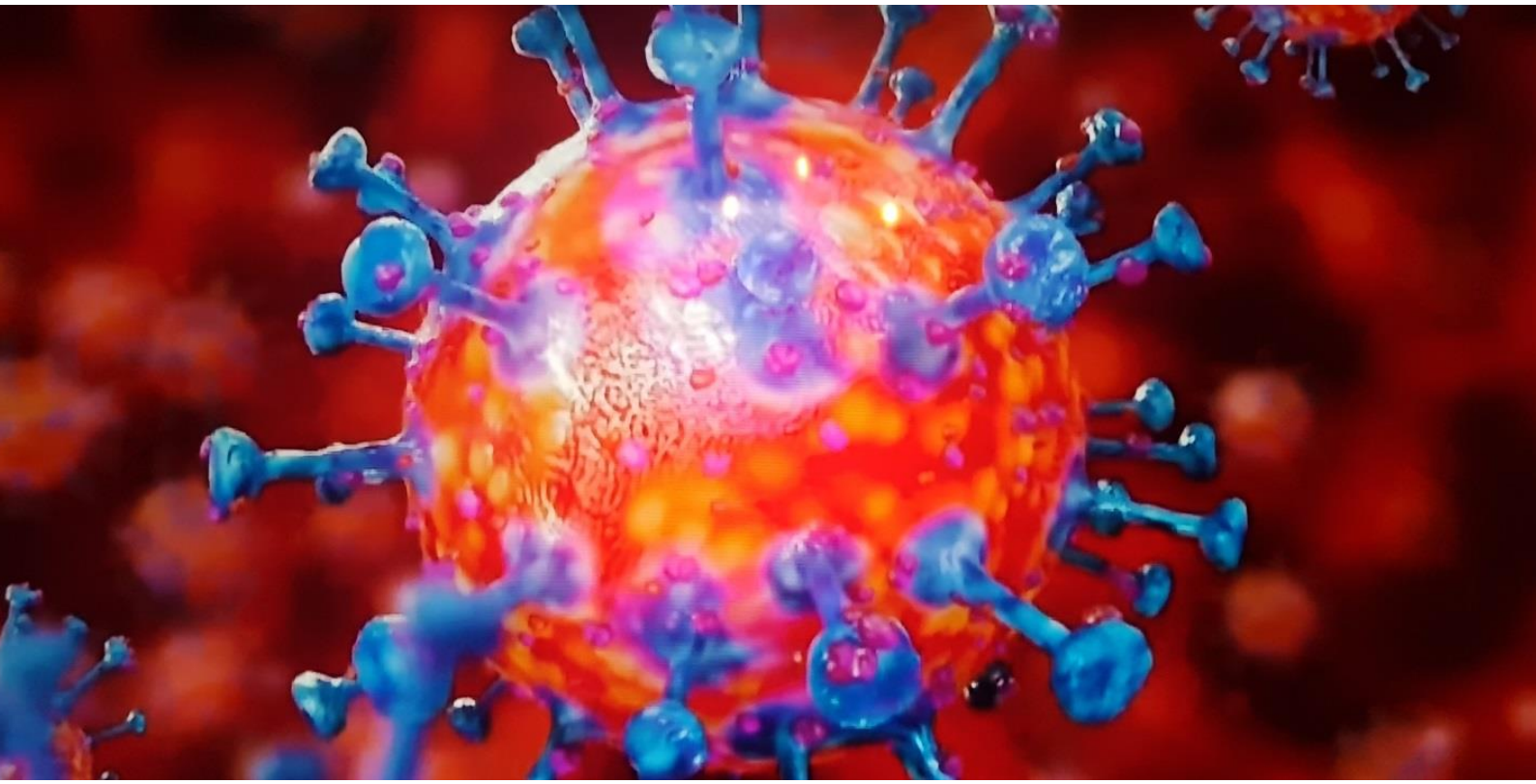
Covid-19 comprehensive explainer: science, response, lessons & God

By Dr Mamnun Khan

www.beingbritishmuslims.com

16 April 2020



In the name of God the Most Gracious, Most Merciful

Being British Muslims is a project that seeks to: (1) produce insights into how faith can become more meaningful and relevant in today's world; and (2) inform public debate and understanding of the multifarious crossroads, imaginings and challenges currently making and remaking British Muslim identity.

This is an independent, non-partisan, non-sectarian and non-affiliated project based on the book *Being British Muslims: Beyond Ethnocentric Religion and Identity Politics*, www.beingbritishmuslims.com, @UKMuslims2050. This paper is not funded by any person, group or organisation.

This paper is dedicated to my father Haji Faizur Rahman Khan (1944-2019). I pray that God accepts this work, counts it among the good deeds of my father, who taught me morals, and makes it a source of benefit for those who read it.

I am very grateful to Shaykh Mohammed Nizami (www.nizami.co.uk) and Shaykh Arnold Yasin Mol (Leiden University, https://leidenuniv.academia.edu/ArnoldMol and the Institute for the Revival of Traditional Islamic Sciences (IRTIS) https://www.irtis.org.uk/) for their feedback on the paper before publication. All errors, omissions, oversights are mine and for any feedback please contact me through the web form on the website above or directly at mamnunkhan123@gmail.com.

I have an undergraduate degree in Biochemistry from Imperial College London, and a PhD in Molecular Immunology from Cambridge University. In recent years, I have advised a number of UK organisations on projects and strategy, as well as founding grassroots initiatives. My passion is to bring critical insight and thought leadership in advocating contextualised Islam and making the British Muslim experience God-centred. In my professional capacity I have a background in corporate management at a FTSE 100 company and over 14 years of experience in business improvement, management and strategy.

Picture of virus on the front page is taken from the BBC.

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1. Introduction and purpose of paper

We are living in unprecedented times. Never since World War Two (when most of us weren't around) have we seen the level of shutdown to society, and social, cultural and economic life. Yet this is what we're now living through, at least for the next few months. Unfortunately, it will not end at the end of this period. Much of the deep systemic shock that has entered into society locally and globally in response to the public health emergency will likely remain with us for some time to come. The role of Government has drastically expanded, businesses have stopped trading, we have cut down on social freedoms, some of us are losing loved ones unexpectedly, and as individuals we're now looking to Government to enact and co-ordinate top-down control measures and mandates on what we can or can't do.

Unfortunately, there is no "getting away" from it. Every country in the world has been impacted in one way or another and each is taking similar measures, albeit at varying levels of intensity and phase of the cycle. This is a truly global event; even compared to World Wars we've never seen something like this in modern times. Some countries are in a highly acute phase where public healthcare has been overrun by the sheer volume of people needing hospitalisation, while others appear to have come out of this better than perhaps feared at the beginning. Yet, this is not a human conflict. Nor is it a natural disaster. It is in fact a pandemic—a global disease—called "Coronavirus disease 2019" (Covid-19 for short) caused by a new virus that has both high transmission and ability to wreak pathological damage to our bodies. Viruses being miniscule particles we can't "see" them without the aid of specialised electron microscopes that, for example, use high-voltage beams of electrons to capture images (we have a few cryo-electron microscopes in the UK), though of course we can detect viruses and fight them in many ways.

Given such tumultuous changes to our lives, how do we make sense of it all, how do we go forward in combating it and what lessons can we learn for a better world? The likely challenges and opportunities in society are so vast, even if only in the short to medium term, but they require robust thinking-through, evaluation and framing of arguments that inspires action across multiple levels of society. These are questions that a sincere believer might ask. For whom, in the space of a few months, "God has flipped the world with a single strand of RNA."[1] This act of God, as it were, was to most people, believers and non-believers, previously only the stuff of fiction in movies like Contagion. Yet it is real.

This paper was written as a briefing paper to provide believers of the Islamic faith:

- A holistic account of the most pertinent aspects of Covid-19
- Greater thought leadership and religiously-inspired thinking to prepare the intellectual foundations of future generations of British Muslims

This paper also seeks to provide non-Muslims who are interested an insight into systems thinking as an output of religiously-inspired thinking.

[1] Quote from Mohamed Ghilan.

In this paper we will explore these considerations:

1. Provide key facts and the most up-to-date understanding of Covid-19.
2. Review the rationale behind the UK's strategy to date.
3. Review some of the deep systemic shocks from Covid-19.
4. Briefly outline the potential for Covid-19 as a great corrector to modern society.
5. Outline exit scenarios for how the outbreak might come to an end.
6. Assess the early responses to Covid-19 in the UK's Muslim communities.
7. Look at what lessons we can take to steer an increasingly complex world.
8. Provide some helpful advice on spending time at home with children.
9. Provide commentary on re-introducing a systems account of the nature of *fitna* (test)
10. We will end with a look at theological debates around the nature of causation.

2. Facts about Covid-19 (also called "SARS-CoV-2" / "2019-nCoV" / "Coronavirus")

Virus strain

- Covid-19 stands for "Coronavirus disease 2019" is caused by a virus called "SARS-CoV-2" (also called "HCoV-19" or "2019-nCoV" or "novel Coronavirus") that came into existence in late 2019 belonging to the Coronavirus (*Coronaviridae*) family of viruses which includes SARS ("Severe Acute Respiratory Syndrome" coronavirus).[2] In this paper I will refer to the disease that currently blights the world as "Covid-19" but when speaking about the virus *per se* I will call it by its most widely used scientific name "SARS-CoV-2." Some scientists have suggested that the name of the virus should be "HCoV-19" for "Human Coronavirus 2019."[3]

- The Coronavirus family of viruses includes six members, all of which infect humans. Four of them (OC43, HKU1, NL63, and 229E) have been infecting humans for more than a century, causing a third of common colds.[4]

- The other two are MERS ("Middle Eastern Respiratory Syndrome", also called "MERS-CoV," outbreak in Saudi Arabia in 2012) and SARS, of which the virus that causes Covid-19 belongs to the SARS sub-family which has 2 sub-variants:

    1. SARS-CoV (also called SARS-classic): first epidemic in 2002-2003, originating in Southern China
    2. SARS-Cov-2: this is the virus which is causing disease Covid-19

- SARS-CoV-2 shares only 79.5% of its genetic sequence with SARS-CoV, and approximately 50% with MERS-CoV.[5,6]

- It is more common for patients infected with MERS-CoV to require intensive care compared to those reported with SARS-CoV-2 (50-89% vs 20-30%, respectively) and also the mortality rate for MERS-CoV is 36% whereas for SARS-CoV (the SARS virus in the 2002 epidemic) is around 10%.[7]

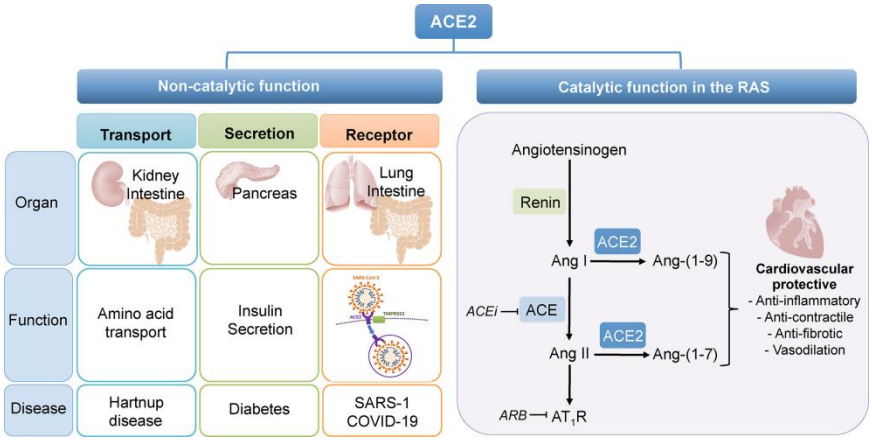
SARS-CoV-2: structure, mechanism and mutation

- The structure of SARS-CoV-2 is like a "spiky ball" with a lipid outer layer dotted with spikes of proteins (known as "surface spike receptors") that recognise and "stick" to other proteins. Those other proteins that it sticks to includes a protein called ACE2[8] (angiotensin converter enzyme 2), which is found on the surface of many different types of cells in our body, including, and crucially, airway epithelial cells of the nose and lung[9] (which are primary targets of SARS-CoV-2). SARS-CoV-2 is thought to "bind" to ACE2 much better than SARS-classic. Upon contact or "binding," these spikes then split allowing the virus to

[2] Erika Sifuentes-Rodríguez and Deborah Palacios-Reyes, *COVID-19: The outbreak caused by a new coronavirus*, Bol Med Hosp Infant Mex. 2020;77(2):47-53, 17 February 2020, http://www.bmhim.com/frame_esp.php?id=124.
[3] Shibo Jiang et. al., *A distinct name is needed for the new coronavirus*, Volume 395, ISSUE 10228, P949, March 21, 2020.
[4] Ed Young, *Why the Coronavirus Has Been So Successful*, https://www.theatlantic.com/science/archive/2020/03/biography-new-coronavirus/608338/, 20 March 2020.
[5] Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. *A novel coronavirus from patients with pneumonia in China, 2019*. N Engl J Med. 2020;382:727-33.
[6] Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. *Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding*. Lancet. 2020;395:565-574.
[7] Emmie de Wit et. al., *SARS and MERS: recent insights into emerging coronaviruses*, Nat Rev Microbiol. 2016; 14(8): 523–534.
[8] ACE2 is a protein that helps regulate blood pressure and is found in many cells.
[9] Wan Y *et. al.*, *Receptor recognition by novel coronavirus from Wuhan: An analysis based on decade-long structural studies of SARS*. J Virology. 2020; (published online Jan 29.) DOI:10.1128/JVI.00127-20.

enter into the host cell to establish the infection. The splitting of the spikes is crucial for viral entry into cells and starting off the infection.

- ACE2 is mostly found on the membrane of cells (though there is a soluble form too) and has many functions that are either enzymatic (catalytic) or non-enzymatic (non-catalytic) – see below diagram. In relation to Covid-19, the most relevant function of ACE2 is that it acts to regulate the levels of angiotensin 2 (Ang II) by converting Ang I into "Ang-(1-9)," and by converting Ang II into "Ang-(1-7)," which is tissue-protective.[10] It isn't proven if SARS-CoV-2 binding to ACE2 destroys ACE2 function but it's very likely to (my speculation), and if that is the case then an infection by SARS-CoV-2 virus would also be taking out an important regulator of anti-inflammation and blood pressure in our tissues, with potential pathological consequences.[11]



- Interestingly, the splitting process can be hugely sped up by protease enzymes (these are enzymes that cut proteins) which are quite ubiquitously found in many tissues in our body. One important protease that's been identified is TMPRSS2. There are still many unknowns about the underlying biology of the SARS-CoV-2-ACE2_TMPOSS2 system.

- Viruses are the smallest "life forms" known. The size of a virion, which is a single virus particle, tends to be about 20 to 400 nanometres in diameter[12] (remember 1 nanometre is 0.000000001 of a meter). By contrast, the smallest bacteria are about 400 nanometres in size. I have put "life forms" in quotation because there is a big debate as to whether viruses are classical life forms, because unlike other life forms (like bacteria, fish, mammals etc.) they replicate only in the living cells of animals, plants and bacteria. As viruses need other living cells to replicate, different viruses need different host cell types and host species. This is why, normally, a virus that infects, say, rabbits will unlikely infect humans. And a virus that infects humans through the respiratory tract (like SARS-CoV-2) will not infect through the

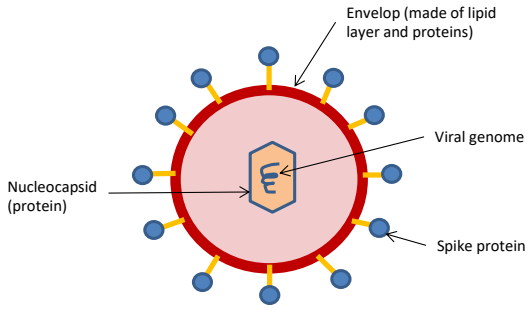
[10] Rhian Touyz *et. al., ACE2 the Janus-faced protein – from cardiovascular protection to severe acute respiratory syndrome-coronavirus and COVID-19*, Clin Sci (Lond) (2020) 134 (7): 747–750. https://portlandpress.com/clinsci/article/134/7/747/222585/ACE2-the-Janus-faced-protein-from-cardiovascular

[11] Look out for guidance on medication for anyone taking ACE blockers to regulate blood pressure, because ACE results in an upregulation of ACE2, and so if you have more ACE2 you may be more susceptible to Covid-19 as the virus is more readily able to get into epithelial cells. Currently the medical advice is not to change, but this may or may not change in the future as more evidence come to light – see: *Position Statement of the ESC Council on Hypertension on ACE-Inhibitors and Angiotensin Receptor Blockers*, available at https://www.escardio.org/Councils/Council-on-Hypertension-(CHT)/News/position-statement-of-the-esc-council-on-hypertension-on-ace-inhibitors-and-ang Accessed 14/3/2020. See also: *Statement of the European Society of Hypertension on hypertension, Renin Angiotensin System blockers and COVID-19*, available at https://www.eshonline.org/spotlights/esh-statement-on-covid-19/. And, see: Lei Fang *et. al.*, *Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection?*, The Lancet, 11 march 2020, https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30116-8/fulltext

[12] See: https://courses.lumenlearning.com/boundless-microbiology/chapter/overview-of-viruses/

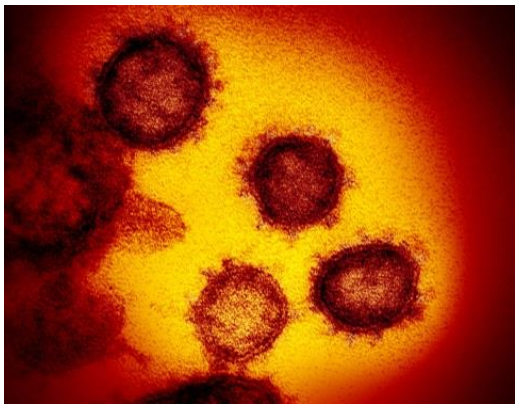
skin because there are different cell types containing different molecules on the surface of cells of the skin and respiratory tract respectively.

Diagram of a virus particle showing its important elements

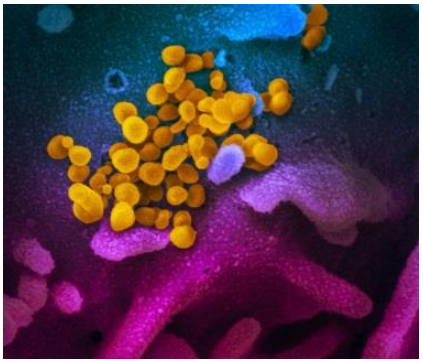


What SARS-CoV-2 viruses look like in (a) transmission and (b) scanning electron microscope[13]

(a)



(b)



- That said, it seems we don't have much luck with SARS-CoV-2 as there's been reports of zoo animals infected by a zoo keeper who tested positive for Covid-19, showing that the virus can transmit from human to tiger,[14] and other animals[15] (e.g. cats, ferrets, dogs have all been seen). However, there's been no documented case as yet of humans catching the virus from infected animals such as dogs, cats or ferrets. SARS-CoV-2 was originally a Coronavirus that infected bats, but it mutated and somehow "jumped species" and now infects humans. It's unclear exactly where this new Coronavirus "jumped species" other than circumstantial evidence pointing to the wet market of Huanan Seafood Market in the district of Wuhan in China. Due to the high mutation rate it is possible for viruses to "jump species" and the chance of that happening increase with close unregulated contact with animals as happened in the live wet markets in China, enabling SARS-Cov-2 to do a species jump. They are called "wet markets" because there is a lot of slush from melting ice, water and animal blood amidst the complex of stalls.

- It's worth saying that the wet markets in mainland China are particularly problematic because they have many different kinds of animals – some wild, some domesticated but not necessarily native to that part of Asia. The stress of captivity in these markets weakens the animals' immune systems and creates an environment where viruses from different species can mingle, swap bits of their genetic code and spread from one species to another, according to biologist Dr Kevin Olival of EcoHealth

[13] Jacinta Bowler, https://www.sciencealert.com/this-is-what-the-covid-19-virus-looks-like-under-electron-microscopes
[14] A Malayan tiger at The Bronx Zoo, in New York City, tested positive for Covid-19, 6 March 2020.
[15] David Grimm, *Should pets be tested for coronavirus?*, 32 March 2020, https://www.sciencemag.org/news/2020/03/should-pets-be-tested-coronavirus

Alliance.[16,17] When that happens, as with SARS-CoV (in 2002) and SAR-CoV-2 a new strain of an animal virus "jumps species" to infect humans.

- Viruses like SARS-CoV-2 are made of a single (positive) strand of RNA (ribonucleic acid). This is the genetic code that contains all the code necessary for the virus to replicate.[18] The length of the genome is between 26 to 32 kb, and is thought to be the largest RNA virus known to date. The genome of SARS-CoV-2 is 96% identical to a bat coronavirus, suggesting that it originated in bats before being able to infect humans in the wet market of Wuhan.[19] Exactly how the outbreak happened (including the likelihood of other outbreak locations) and the possibility of different strains early on are not yet clear, though there is some evidence hinting that there could have been at least two early strains in China with one being more dangerous than the other.[20] But one thing that is clear is that it is a very rare event for a virus originating in bats to have the traits to so effectively infect human cells from its very origin. Previous Coronavirus outbreaks (which were not as infective) happened through natural selection of Coronaviruses in a non-human host first (for SARS it was bats to civets and for MERS it was bats to camels) before then jumping to humans.[21]

- Over 100-plus mutations have been documented for SARS-CoV-2 (to date of publication), but none of them have risen to dominance, suggesting that none is especially important, and so the mutation rate of SARS-CoV-2 appears to be relatively stable. But that's not to say that there are subtly different pathological abilities of different strands (the data isn't yet available). Because viruses multiply so rapidly, they are of course always mutating. The average mutation rate of RNA viruses is estimated to be around one mutation per genome per round of replication. When a person is infected with SARS-CoV-2, it replicates and every time it replicates genetic mutations occur. Some viruses have a million times higher mutations rate than their hosts.[22] That's because, while mutations are happening during cell division in, say, humans, we have multiple mechanisms that detect and take protective action when things going badly wrong (e.g. we have DNA polymerase proofreading and repair mechanisms and proteolysis etc.).

- RNA viruses have a higher rate of mutation than DNA viruses because they encode their own protein machinery (enzymes known as RNA polymerase) needed to replicate their genomes in the host cell. These RNA polymerase enzymes are generally thought to be quite basic "pieces of biological equipment" (compared to human RNA polymerase enzymes) because they lack, for example, proofreading and editing capability and are more likely to make copying errors than DNA polymerases (used in DNA viruses) and, therefore, often make mistakes during transcription (transcription is the process that makes more copies of the RNA genetic code; RNA encodes proteins which are the basic building blocks of viruses). For this reason, mutations in RNA viruses occur more frequently than in DNA viruses. However, the latest research on Coronaviruses seems to suggest that they actually have some proofreading capability,[23] which might explain the relatively stable mutation rate.

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[16] https://www.ecohealthalliance.org/personnel/dr-kevin-j-olival.

[17] Taken from Jason Beaubien, *Why They're Called 'Wet Markets' — And What Health Risks They Might Pose* https://www.wamc.org/post/why-theyre-called-wet-markets-and-what-health-risks-they-might-pose

[18] See: Andrew White et. al., *RNA virus replication, transcription and recombination*, RNA Biol. 2011 Mar-Apr; 8(2): 182–183, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3127097/.

[19] Zhou, P., Yang, X., Wang, X. et al. *A pneumonia outbreak associated with a new coronavirus of probable bat origin.* Nature 579, 270–273 (2020). https://doi.org/10.1038/s41586-020-2012-7.

[20] Jessica Hamzelou, *Coronavirus: Are there two strains and is one more deadly?* https://www.newscientist.com/article/2236544-coronavirus-are-there-two-strains-and-is-one-more-deadly/#ixzz6Hi1gayC4, March 5 2020.

[21] *COVID-19 coronavirus epidemic has a natural origin*, https://www.sciencedaily.com/releases/2020/03/200317175442.htm, Scripps Research Institute, March 17 2020.

[22] Duffy S (2018) *Why are RNA virus mutation rates so damn high?* PLoS Biol 16(8): e3000003, 13 August 2018, https://doi.org/10.1371/journal.pbio.3000003.

[23] Smith EC, Denison MR (2013) *Coronaviruses as DNA Wannabes: A New Model for the Regulation of RNA Virus Replication Fidelity*. PLoS Pathog 9(12): e1003760, 5 December 2013, https://doi.org/10.1371/journal.ppat.1003760

- Nevertheless, many of these genetic differences in SARS-CoV-2 won't affect the production of proteins, and so won't change the way the virus works, or the symptoms it causes. However, because there is a selection process and the rates of mutation and infection are so high, we can't completely rule out the outbreak of new strains that do actually work in different ways. While this is unlikely (as evidenced to date and given that we know Coronaviruses have proofreading during transcription that edits out genetic errors), understanding mutations has important implications for vaccine development. This is why many scientists are actively sequencing the genome of SARS-CoV-2 across different locations to track mutations as well as to generate effective vaccine leads.

Disease pathology of Covid-19

- Covid-19 symptoms are typically fever and a dry continuous cough. Some people also have aches in the body and muscles, and in severe cases it causes pneumonia (irritation and swelling of the lung). In other cases gastrointestinal symptoms can also be seen. Runny nose or sniffles, or a sore throat are not common. The incubation period from exposure to onset of symptoms is between 3 to 10 days.

- Most people show symptoms around 3-6 days (we'll take an average of 5 days in this paper). Most respiratory viruses tend to infect either the upper or lower airways, and in particular airway epithelial cells. In general, an upper-respiratory infection spreads more easily, but tends to be milder, while a lower-respiratory infection is harder to transmit, but is more severe. SARS-CoV-2 infects both upper and lower airways, which is why it's so much more dangerous than other viruses that attach the respiratory tract. SARS-CoV-2 can also be detected in faeces, blood and urine samples.

- A big proportion of people who get infected by SARS-CoV-2 do not show symptoms (known as "asymptomatic"). This means that whilst the virus has infected them their body's immune defences have been able to neutralise the virus and therefore the virus hasn't had the opportunity to grow to sufficient load to inflict damage to the body and produce symptoms like coughing and fever. Studies by Japanese scientists on the Diamond Princess cruise ship found that 18% of all people infected (by 20 February) on the ship had no symptoms. This was in a controlled environment with a much older demographic than in the wider population, suggesting that the asymptomatic rate (i.e. those who don't show any symptoms) will be vastly higher in the wider population. In fact, at least one other study in the wider population found that 31% of people infected were asymptomatic.

- The reason why some people's immune system can fight off the virus without symptoms while others can't is down to a complex set of factors, including those listed below:

    - Genetics (some people will just have a better immune system from birth)
    - Acquired immunity through exposure to antigens (including other vaccinations) over time
    - Age-related degradation of immunity and lung capacity
    - Viral load and immune system trade-off
    - General health (non-immuno compromised)
    - Many factors such as the relationship between viral load and disease progression remain unclear and so is our understanding of how different factors can affect viral load or antibody response or other immune systems cells, or how we can modulate the most effective immune response. We also don't yet understand why children seem to have much milder disease than adults.

- Once someone is infected, the virus replicates in the body by taking over the cell, forcing the cell to make copies of the virus (this is what is meant by "replicate"), which damages normal cell functions and sometimes kills it. The cells' machinery (that's all the things in our cells that make life possible) is

effectively hijacked and used to replicate the virus instead of the cell doing its normal function. The newly-made viruses then breakout of the host cell and get "released" (also called "shedding") as it were to find new cells to infect and propagate.

- The total amount of the virus in a person is known as "viral load." The latest research suggests that for Covid-19 the viral load in an infected person is highest at the beginning of the infection, peaking during the first week of illness then gradually declining over the second week.[24] We get ill and start showing symptoms like coughing (and fever – which is caused by the body's response to the infection, see next point) when a virus has established an infection in enough cells such that our body's normal functioning changes, which in the case of Covid-19 is that we start coughing, our lungs get irritating and hot, and we get a fever. Left untreated or without the immune system fighting back, more and more cells are damaged, leading to progressively more of the air sacs in the lungs (alveoli) collapsing, and hence more severe breathing difficulties (pneumonia) eventually requiring respiratory support.

    - It's worth noting that data on viral loads in a person's body isn't clear. A study has shown that there are equal amounts of viral RNA in a person's body between people who were symptomatic and asymptomatic,[25] whilst another study has shown that some patients with milder Covid-19 have lower levels of viral RNA than those with more severe symptoms.[26] Note that the samples size of the studies isn't big enough to conclude, but at this stage it is reasonable to assert that viral load is an important factor in disease prognosis.

- Of course, the body's immune system (made of cells continuously recirculating in the blood system) does fight back and attacks the virus causing inflammation (this is what irritates the lungs) and fever. The fever is a response of the body to kill off the virus (viruses die at higher body temperatures). Immune cells start secreting a plethora of cytokines (soluble chemicals) to kick start the immune response. Initially it's chemicals like Interferon-gamma (INF- γ) that are non-specific/blunt defences to try to block viruses from replicating and also causing inflammation in the lungs (site of infection). The inflammation is the result of blood vessels dilating to allow for more immune cells to enter the site of infection. Other cells then enter the site of infection (process known as chemotaxis), including B lymphocyte cells (also called "B cells" for short). B cells then produce antibodies (known as IgG and IgM) against the SARS-CoV-2 internal nucleoprotein and the surface spike receptor binding domain to neutralise its activity, preventing it from binding and therefore entering yet more cells. Eventually by day 10 the viral load starts dropping as the virus is stopped in its track from replicating, especially deeper into the lungs. At this point we get better and our alveoli cells start repairing. The good news is that most people have healthy immune systems and are able to eliminate the infection.

- However, in extreme cases, the immune system goes into overdrive, causing more damage than the actual virus. This is a general problem of immune intolerance where cytotoxic T lymphocytes over react and the immune response becomes dysregulated. When this happens, for example, blood vessels going into the lungs become too leaky, so no longer are they open enough to allow the right amount of immune cells to reach the site of an infection, but they become too leaky, causing the lungs to fill up with more fluid. Now the patient is into secondary complications like pneumonia and those with underlying problems like cardiovascular diseases are at particular risk.

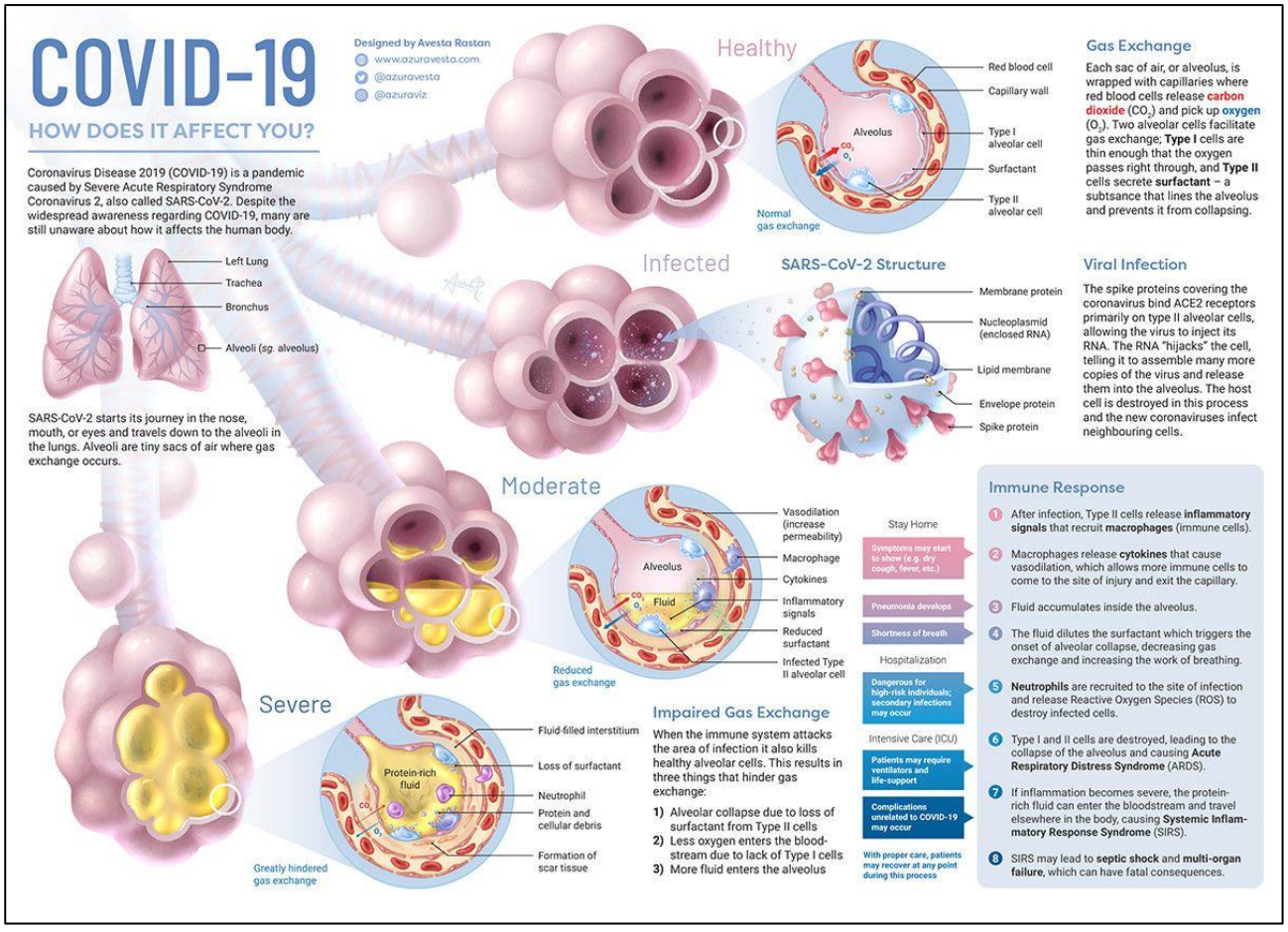
- These damaging overreactions are cause by "cytokine storms." Cytokines are chemicals produced by cytotoxic T lymphocyte cells (or "T cells" for short) to fight the virus as part of the body's immune response to Covid-19 but overproduce them. It isn't clear why T cells go crazy like this. Among the

[24] Yu Chen and Lanjuan Li, *SARS-CoV-2: virus dynamics and host response*, The Lancet Infectious Diseases, 23 March 2020.
[25] L. Zou *et al.*, *SARS-CoV-2 Viral Load in Upper Respiratory Specimens of Infected Patients*, N. Engl. J. Med. http://doi.org/ggmzsp, 2020.
[26] Y. Liu *et al.*, *Viral dynamics in mild and severe cases of COVID-19*, Lancet Infect. Dis. http://doi.org/dqrr, 2020.

cytokines found in infected lungs of Covid-19 patients are: IL-1, IL-2, IL4, IL-6, IL-10, IL-12, IL-13, IL-17, GCSF, MCSF, IP-10, MCP-1, MIP-1α, HGF, IFN-γ y TNF-α). Their over-production progressively causes more and more inflammation of the lungs, and with that pneumonia worsens and we get severe acute respiratory issues. This could lead to septic shock, systemic inflammation and multi-organ failure. It is thought that this kind of overreaction to the virus was historically responsible for many of the deaths during the 1918 flu pandemic, H5N1 bird flu outbreaks, and the 2003 SARS outbreak. And they're behind the most severe cases of Covid-19.

- Older patients with conditions such and pulmonary disease, heart disease, kidney disease, diabetes and hypertension have been associated with higher mortality rates of 5%-8%[27] at the time of writing, due partly to being unable to deploy an effective immune response and partly due to the secondary effects of the virus on other organs, causing failure.

- The below picture taken from the World Economic Forum provides a good pictorial summary of what happens between healthy, infected, mild and severe cases of Covid-19.



[27] Based on Imperial College data modelling using China outbreak, which adjusted for differences in the denominator populations to obtain estimates that could be applied across populations.

Transmission of SARS-CoV-2

- Most transmission is likely to be caused by either: (1) asymptomatic people as they go about their lives without knowing that they have been infected and make contact with others yet to be infected; and (2) by people who in the first 5 days of being infected and only later do they develop the symptoms. It is thought that on average one person will infect at least another 2-3 people (most models of viral spread assume 2.5 people). This is known as the effective reproduction number, R_t, of the infection, which is a "fundamental epidemiological quantity representing the average number of infections, at time t, per infected case over the course of their infection." In other words, the average number of people infected by a single infectious person. If R_t is maintained at less than 1, the incidence of new infections decreases, ultimately resulting in control of the epidemic. If R_t is greater than 1, then infections will increase (dependent on how much greater than 1 the reproduction number is) until the epidemic peaks and eventually declines due to acquisition of herd immunity.[28] The rate at which infections will grow will be much higher than the rate of decline.

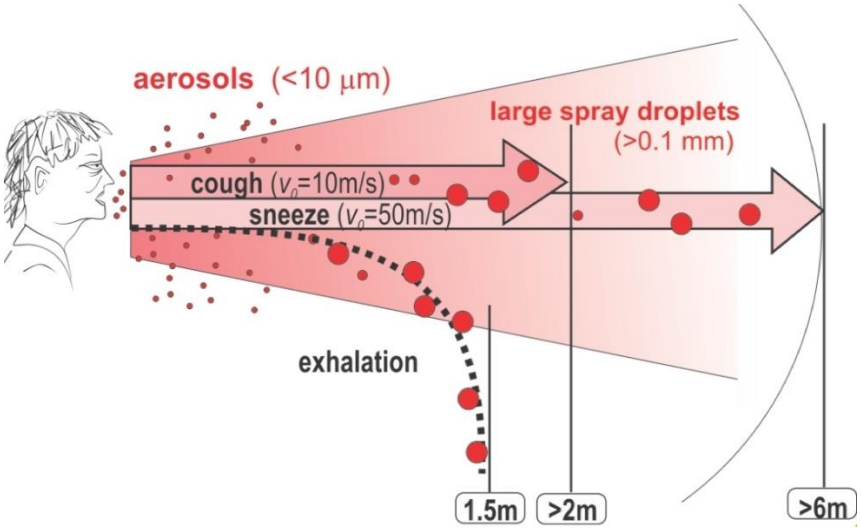
- Recent studies have shown that SARS-CoV-2 virus survives for no more than a day on cardboard and soft surfaces like clothes, and about two to three days on hard surfaces like steel and plastic. The virus thrives most inside human bodies, and in particular the respiratory tract. Like all viruses exposure to UV light over time can destabilise the virus (i.e. kill it off), and in a lab environment it has been shown that no infectious virus remained after 30 minutes at 56° Celsius. And just five minutes at 70° C was enough to inactivate the pathogen.[29] However the reality is that we will not reach such high temperatures.

- As mentioned earlier, the amount of viral particles needed for a viable infectious dose isn't clear. The reason why this is important is that entry of, say, a single viral particle is extremely unlikely to be infective, but millions of virus particles on the surfaces of objects that then finds its way onto our lips through hand touching would be more than sufficient. Especially if the immune system is overwhelmed too quickly it will mean it takes longer to clear up the virus, and therefore the virus has more time to cause damage to the lungs.

- Air-borne transmission can also occur, particularly through coughing and sneezing. Both of these contain water droplets of various sizes that can then travel some distance and get inhaled by others (possibly up to 6 meters, though most droplets sink to the floor by 2 meters), or land on surfaces that others touch with their hands before touching their eyes, nose or mouth from where the virus can infect the second person. Of course there needs to be sufficient number of viral particles (infectious dose) to start the infection process which isn't known properly yet and may well differ depending who is being infected.

[28] This definition is taken from Seth Flaxman *et. al.*, *Estimating the number of infections and the impact of non-pharmaceutical interventions on COVID-19 in 11 European countries*, https://www.imperial.ac.uk/media/imperial-college/medicine/mrc-gida/2020-03-30-COVID19-Report-13.pdf

[29] https://www.sciencenews.org/article/coronavirus-warm-weather-will-not-slow-covid-19-transmission



According to Sui Huang, droplets larger than aerosols, when exhaled (at velocity of <1m/s), evaporate or fall to the ground less than 1.5 m away. When expelled at high velocity through coughing or sneezing, especially larger droplets (> 0.1 mm), can be carried by the jet more than 2m or 6m, respectively, away.

- The data is not conclusive on whether or not it should be compulsory to wear a mask when outside especially while also observing social distancing rules and the type of mask it should be. However, given that transmission can occur from inhaling airborne droplets, intuition suggests that even some sort of face mask, whether a scarf or a surgical mask, could offer some useful protection.[30, 31] Health officials in densely populated countries such as India and Bangladesh heavily promote wearing face masks, and increasingly in Western countries such as Canada and the US the official recommendation is to wear a face mask.

- Most studies and arguments have been theoretical, and when one considers other factors such as viral load necessary for infection, hand washing and generally keeping a comfortable distance from people, the decision to wear a face mask will come down to individual preference and risk appetite. Though knowing that by wearing a face mask of sorts (as complimentary measure to social distancing) one is maximising precaution may have at the very least a positive mental health effect for some people. However, given that what masks mean and how we should react to them is not standard, some people may consider a mask to mean: "ok, I'm safe" and they slack off on social distancing, while others may consider it reminder that they need to stand back.

Treatments to Covid-19

- A vaccine against SARS-CoV-2 is perhaps the best long term proactive treatment. Given that none of the 100-plus mutations have not (as yet) risen to dominance, it is good news for vaccine development and effectiveness. Any vaccine will need to target features that are found in SARS-CoV-2 that are not in high mutation areas in order to be effective. There are over 100 different attempts (using a variety of methods) to create a vaccine ongoing around the world, including a few in the UK. However, a vaccine created conventionally will take 12 to 18 months to develop (that's May/June next year at the earliest) and then some more time will be needed to mass produce and administer across the UK and the world. By that time most of the damage will have been done by the current outbreak of Covid-19.

[30] Sui Huang, *Covid-19: why we should all wear masks there is new scientific rationale*, 27 March 2020, https://medium.com/@Cancerwarrior/covid-19-why-we-should-all-wear-masks-there-is-new-scientific-rationale-280e08ceee71

[31] *Using face masks in the community - Reducing COVID-19 transmission from potentially asymptomatic or pre-symptomatic people through the use of face masks*, 8 April 2020, https://www.ecdc.europa.eu/en/publications-data/using-face-masks-community-reducing-covid-19-transmission

- Normally it takes years to develop a vaccine, so a vaccine against SARS-CoV-2 will likely break records for the shortest time to develop a vaccine. Vaccine's take time to develop because they needs to be proved to illicit the right immune response that leads to the production of antibodies and memory B lymphocytes (or "B cells" for short). Otherwise they are of little use in giving people immunity.

- To realise the full benefit of vaccines a big enough population need to be immunised to reduce the overall outbreak of Covid-19 (or any viral disease). What that means is that the more the number of people are immunised the less opportunity for a virus has to infect someone who doesn't have immunity. This phenomenon is called "herd immunity," and it has allowed once-devastating diseases such as smallpox, measles, diptheria, tetanus etc. to be eliminated in the UK, without needing to vaccinate every individual.[32, 33] The proportion of the population that need to be immunised is thought to be 70%, but the % will vary depending on how transmissible a virus is. For Covid-19, this is thought to be about 60-70%.

- In the absence of a viable vaccine and drugs that are proven to specifically work against Covid-19, medics are using a treatment strategy of:

  - Supportive care using oxygen treatment to help the lungs while giving time for the body's immune system to fight the virus
  - Providing ventilation using more specialist breathing equipment for patients in more distress so that the lungs are support while the body's immune system clears the virus
  - Where possible, the above is supplemented by a combination of broad-spectrum antibiotics, anti-virals, corticosteroids and convalescent plasma. Note that not all of these are being tried in the UK in unison and treatment remains at the professional discretion of medics on a case by case basis

- Clinical trials are underway with drugs that try to stop the dysregulated immune response in Covid-19 which causes the deepening pneumonia and subsequent severe acute respiratory syndrome. Examples of drugs that are in clinical trials in different parts of the world are below (taken from a science review paper).[34] There are over 60 drugs being investigated by researchers across the world which are in different stages of testing. If clinical trials prove successful, these drugs will be readily administered, and will help treat and especially prevent acute cases of Covid-19. Most if not all of the drugs that are being trialled are already known and used against other infections, and often they're ones that have been used against other viral infections including SARS-Cov (usually because there isn't anything out there more specific).[35] Some putative drugs that show good results *in vitro* are likely to be fast-tracked into trials for Covid-19, such as Ivermectin which is already approved by the US Federal Drug Agency (FDA) for parasitic infections, and therefore has a potential for repurposing.[36] List of drugs in clinical trials:

[32] https://www.publichealth.org/public-awareness/understanding-vaccines/vaccines-work/.
[33] https://www.historyofvaccines.org/timeline/all
[34] Yang Yang et; al., *Traditional Chinese Medicine in the Treatment of Patients Infected with 2019-New Coronavirus (SARS-CoV-2): A Review and Perspective*, *Int J Biol Sci* 2020; 16(10):1708-1717. doi:10.7150/ijbs.45538, https://www.ijbs.com/v16p1708.htm.
[35] See Stockman et al., *SARS: systematic review of treatment effects*. PLoS Med. 2006; 3: e343.
[36] Leon Caly et. al., *The FDA-approved Drug Ivermectin inhibits the replication of SARS-CoV-2 in vitro*, https://www.sciencedirect.com/science/article/pii/S0166354220302011.

Type of treatment	Therapeutic agent or device
Oxygen therapy	Nasal cannula Non-invasive mechanical ventilation Invasive mechanical ventilation ECMO (extracorporeal membrane oxygenation)
Antibiotics combination	Amoxicillin Azithromycin Fluoroquinolones
Antivirals	Lopinavir/ ritonavir Ribavirin Favipiravir (T-705) Remdesivir Oseltamivir Chloroquine Hydroxychloroquine Interferon
Corticosteroids	Methylprednisolone
Convalescent plasma	Convalescent plasma

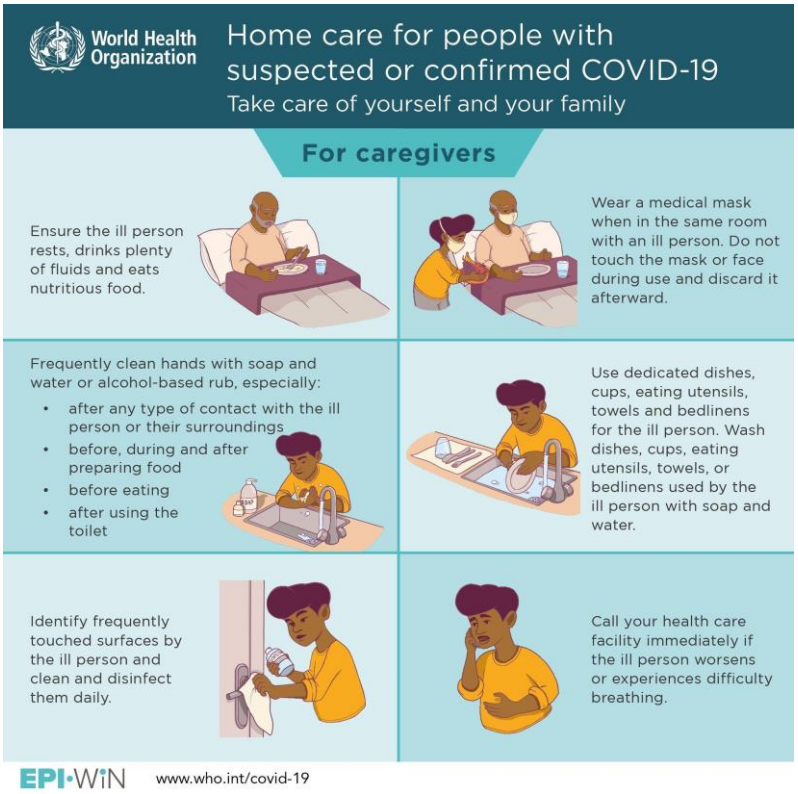
- Clinical trials[37] are necessary to prove the efficacy of the drugs before they can become standard treatment options in the NHS. Only after passing clinical trials are licences granted by the Medicines and Healthcare products Regulatory Agency (MHRA) and the European Medicines Agency (EMA), and be made available for wider use. Part of the challenge here is that licences need to confirm the health condition a drug should be used for and the recommended dosage, but the pathogenesis of Covid-19 (i.e. when people go from no symptoms to pneumonia) is not straightforward because patients often have other medical conditions which can complicate what treatments can be given, to avoid becoming at greater risk of the unintended consequences of these drugs. It is the job of clinical trials to try to work out all of this.[38]

- Herbal and traditional medicine trials are also underway. One particularly interesting one for Muslims is a trial with honey against Covid-19 in Egypt. Honey being a traditional medicine in Arab countries and advocated by the Prophet, as well as known to have anti-viral properties and helps with alleviating symptoms of cough. There is also a huge number of Traditional Chinese Medicine trials which are underway in China (see paper by Yang Yang *et. al.*), but these are unlikely to be adopted in the UK, especially if the trials don't confirm to rigorous standards of modern medicine.

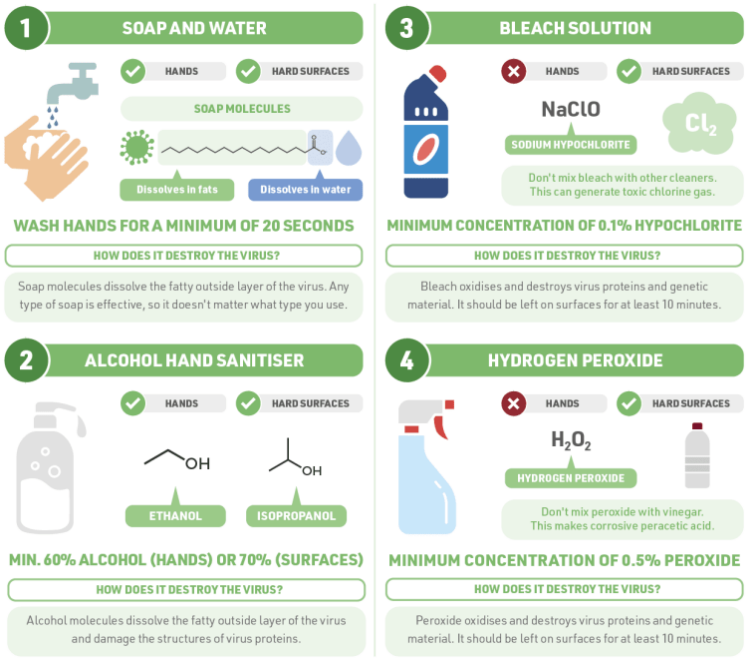
- Plasma therapy trials are also likely to begin very soon. Plasma is the fluid part of the blood (55%) that carries red blood cells and all the other components of blood, including immune cells. Its primary function is to transport nutrients, hormones, proteins, antibodies etc. to the rest of the body. Individuals who have recovered from Covid-19 can donate blood from which the plasma can be isolated to give to those suffering from Covid-19.

- The following guideline for treating people at home has been provided by the WHO:

[37] See: https://www.nhs.uk/conditions/clinical-trials/.
[38] See: Carrie Arnold, *Coronavirus treatment: What drugs could work and when can we get them?* New Scientist, https://www.newscientist.com/article/mg24532760-900-coronavirus-treatment-what-drugs-could-work-and-when-can-we-get-them/#ixzz6Ipt6eGoD, 1 April 2020.



- There are 4 ways to destroy SARS-Cov-2 viruses (created by Andy Burnham):



Testing

- Testing is at the centre of the WHO's recommendations for countries to control the pandemic.

- The original testing for Covid-19 was done through a technique known as qRT-PCR (quantitative real time polymerase chain reaction). This is a standard technique that's been around for decades to detect

the presence of specific pieces of DNA or RNA sequences in a sample of cell extracts. Since the RNA sequence of SARS-CoV-2 is known we can detect it using qRT-PCR. These reactions require machines (known generally as "PCR machines") which take time to complete (hence the tests aren't instantaneous, but take 1 -2 days) and care is needed to ensure that the identity of samples doesn't get mixed-up. The last thing people need is what happened in Wales where some NHS workers were given the wrong Covid-19 results.[39] Nevertheless, most of the testing has been done in this way so far, and will continue to be done this way until the other tests come out (examples further down).

    - However, it's worth bearing in mind that there may be differences in the ability to detect low levels of the virus in samples depending on the primer probe sets used for the PCR reaction (apologies if this is somewhat gobbledygook to some of you reading – my intention is to inform). Normally, PCR primer probe sets are optimised over time, but the pandemic nature of Covid-19 has meant that there hasn't so far been so much time about optimising detection methods and techniques as the focus has been about firefighting to stop the pandemic.

    - Also worth noting that there are limitations in the number of PCR machines that can be scrambled to scale up testing – even if all the PCR machines from University departments and commercial research labs were procured, the throughput may still struggle to go beyond 100,000 tests per day. This is because, it's not just the PCR machines that are needed, but all the raw materials for PCR reactions as well as the need for machines for automatically extracting RNA, all of which are limiting factors on the throughput achievable.

- Antibody testing has also been developed. However, the antibody testing from China is considered not robust enough (meaning they are not reliable to the degree we would want diagnostics to be). The UK Government has thus given a challenge to the UK's pharmaceutical industry to produce a reliable antibody test. The same is happening in other countries, particularly in the US.

- Testing has been poor in the UK, due to a lack of forward planning in Government and the civil service particular due a weak UK-based diagnostics manufacturing industry making it harder to get started. However, the UK Government's plan[40] is now to:

    - Rapidly increase NHS swab testing for those with a medical need and the most critical workers
    - Deploy commercial swab testing for critical workers in the NHS and social care
    - Deploy mass antibody testing to help know if people have developed an immunity
    - Surveillance testing to learn more about the disease to help develop tests and treatment
    - Deploy national diagnostics capability for mass-testing capacity and a completely new scale

  All of this will take some time to scale and work out the implementation logistics and keeping track of monitoring, and there will be efficacy questions, but that is all to be expected. The crucial thing is the Government has now got its act together on testing and has a good plan to work towards delivering.

- The Government has also asked industry to take a leading role in testing for Covid-19, setting out the following asks:

    1. Provide additional testing consumables that are in short supply, such as swabs, tubes and components for kits
    2. Increase lab testing capacity donated by universities, research institutes and private companies

[39] *Coronavirus: NHS staff with Covid-19 given wrong test results*, 7 April 2020, https://www.bbc.co.uk/news/uk-wales-politics-52205495.
[40] See: https://www.gov.uk/government/publications/coronavirus-covid-19-scaling-up-testing-programmes/coronavirus-covid-19-scaling-up-our-testing-programmes

3. Develop new technology to diagnose Covid-19 quicker and new methods of safely delivering tests widely across the UK
4. Support development of reliable antibody testing with end-to-end solutions or solving specific challenges in the supply chain

- The UK Government is considering a greater role of technology in tracking case sand helping with social distancing particular with easing lockdown measures, such as:

    - Contact tracing apps (most likely part of the NHS app) will aim to track and contain infections by using bluetooth data to measure proximity between mobiles. When someone tests positive for Covid-19, other devices that have been nearby will be informed. For this to be successful widespread testing needs to be done and a large proportion of people will need to be using the app, as well as avoid issues to do with stigma and privacy.

    - Immunity passports have also been mentioned as a possible means to help people return to normal work. These could be produced in a privacy-friendly way by communicating only the verification of immunity. However, they could also be tied by a central database or register, similar to the idea of national ID card system.

Immune response

I will keep this section as brief as possible in the interest of keeping things simple, because as you can imagine immunology (the study of the immune system) is a vast subject that has thousands of scientists researching for decades to understand how our body's immune system works and to develop treatments and therapies to treat diseases.

The immune system is the body's highly adaptive defence system that acts to protect infectious disease by invading pathogenic microorganisms or neoplastic and malignant abnormalities. In order to do this, the immune system uses two major components termed innate and adaptive immunity, whose interaction and co-operation together leads to a more effective defence than either alone. Innate immunity comprises anatomical, physiological, phagocytic an inflammatory barriers and is not specific to a particular pathogen. By contrast, adaptive immunity involves three major steps:

1. The ability to recognise and discriminate in a highly specific manner between self and non-self-antigens.

    - When we normally speak of "antigen" we mean it in the sense that it is part of foreign entity/body (bacteria, virus etc.) that also induces an immune response in our bodies, especially the production of antibodies. However, the immune system also displays antigens from our own body in a manner to ensure that cells of the immune system recognise antigens that are specific to our bodies as "self" as opposed to antigens from invading bodies/pathogens like bacteria and viruses etc. as "non-self" and thus enable the immune system to be tolerant to our body and intolerant to foreign bodies.

2. Regulates the response to the foreign antigen, which includes directing the appropriate network of interactions and assemblages of cells if the immune system and the magnitude of the ensuing response.

3. Provides memory (by learning the antigenic determinants) which may be life-long so that in a subsequent encounter with the same antigen the immune systems recalls the appropriate response and magnitude of delivery to rapidly eliminate the infection.

Adaptive immunity is further subdivided into cell mediated and humoral based on the type of immune response. Cell mediated responses are carried out by T cells which have varied killing mechanisms and functions in the immune response.

T cells are a heterogeneous group of lymphocytes that includes CD4 T helper cells, CD8 T helper cells and $_{\delta\gamma}$T cells. T cells contain the T cell receptor (TCR) which binds antigens. The antigens T cells bind are presented by peptide-MHC (major histocompatibility complex) complexes on antigen presenting cells (dendritic cells/DCs, macrophages and B cells). These antigen presenting cells also secrete cytokines to stimulate and cause CD4 T helper cells to differentiate Type 1 (Th1) T helper cells and Type 2 (Th2) helper cells. In turn Th1 and Th2 cells secrete different profiles of cytokines (soluble chemicals) such as interleukin-1 (IL2), and interferon g (INFg), whereas Th2 cells secrete IL-4, IL-5, IL-6 and IL-10. Further types of T cells are CD8 T cells, which function to kill cells that have become infected or are malignant. For this reason they are also known as cytotoxic T cells (CTLs). They recognise viral peptides associated with MHC class 1 molecules.

The other branch of adaptive immunity is mediated by antibodies which are produced and secreted by B cells. Antibodies are initially expressed as a B cell receptor (BCR) and each B cell has a different B cell receptor that recognises a single antigen. Unlike other genes, the genes encoding the proteins that make up the B cell receptor are allowed to undergo hyper-mutation which means B cells can generate millions of different B cell receptors that can recognise a potentially infinite range of diverse antigens. However, B cell receptors need to bind to their specific antigen which is presented to B cells by antigen presenting cells (DCs, macrophages) before they trigger a response. B cells that successfully bind to an antigen and receive the right kind of cytokines (from T cells for example that are also at the site of infection), become "stimulated" to divide and expand their numbers. The resulting B cells now have a slightly different B cells receptor, which, if all goes well, and through selective pressure will better bind to the antigen on the invading pathogen.

These clonally expanded B cells also then secrete antibodies. Antibodies possess no toxic or anti-microbial properties of their own but cause different effector mechanisms:

- They neutralise antigen e.g. in the response to SARS-CoV-2 the antibody binds to its spike receptors making it unable to bind to and enter epithelial cells of the lungs
- They cause agglutination of antigens into immune complexes for ingestion by phagocytes, macrophages and neutrophils (these are cells that basically gobble up bad things and can be found in puss for example)
- They activate Complement (this is a sophisticated defence mechanism that assembles what is known as the membrane attack complex which directly kills bacteria (mainly) and pathogens in the body)
- They activate Natural Killer (NK) cells and cytotoxic T cells to go and kill invading pathogens
- They trigger release of all kinds of chemicals e.g. hydrogen peroxide from basophils and eosinophils to kill the invading pathogen

Basically B cells are at the centre of mediating all the wider ammunition to kill pathogens.

Long term immunity

The assumption at this stage is that if someone has been properly infected, they should go on to develop immunity against SARS-CoV-2. We know this because after recovering from infection by SARS-Cov-2, many people have high levels of antibodies against the virus. And so, people should go on to create memory B cells for SARS-CoV-2, and therefore long term immunity. Long-term immunity means that a second infection by SARS-CoV-2 will be dealt with much more quickly and without symptoms, which is what a good

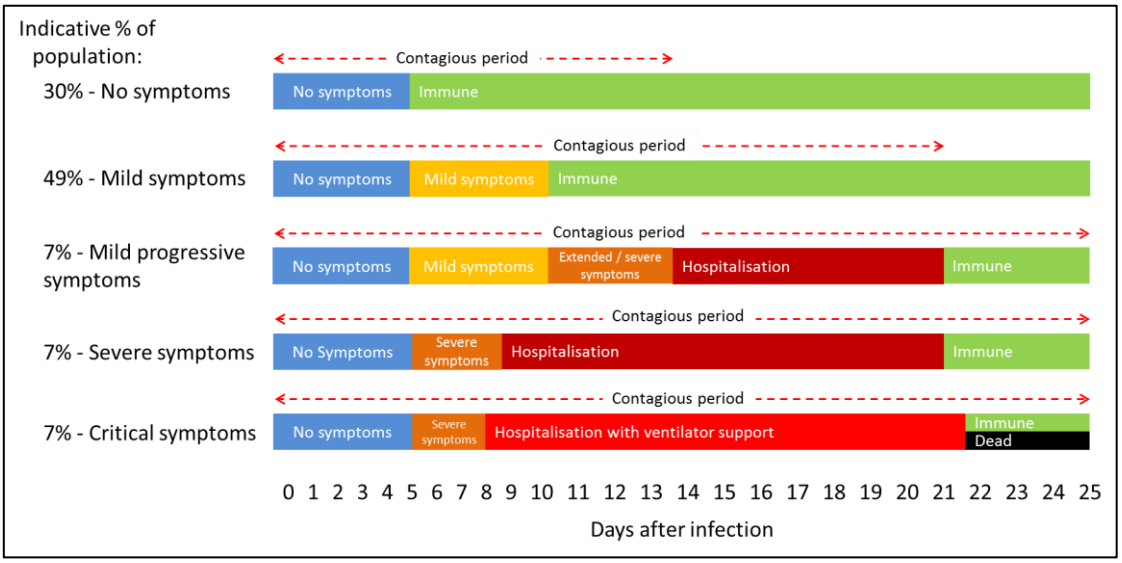
vaccine also tries to achieve. This is based on how our immune system is known to work. However, there are some nuances:

- For immunity to develop there needs to be an immune response in our bodies involving B cells. Thus is why vaccines need time to be created because they need to be thoroughly tested to check if they generate effective memory B cells in our bodies.

- As individuals we have different genetic make-up which means our bodies will elicit subtly different immune responses e.g. we will have different levels of chemicals like interleukins or different levels of lymphocytes at the time of infection etc. We will also have different levels of fitness based on how rested we are or how well we sleep etc. which are all factors known to affect the strength of our body's immune system. Overall, this will mean that the profile of our immune response may not be the same between individuals.

- In some recovered patients, antibodies against SARS-CoV-2 are present at very low levels, and in some cases are undetectable. A study found that 30% of those infected by SARS=CoV-2, many of whom were under the age of 40 never developed high levels of SARS-CoV-2 antibodies, suggesting that other immune responses may have helped rid them of their infections.[41] More research is needed on this, but if true the 30% that get infected by SARS-CoV-2 may not have antibody immunity but nevertheless other cells of the immune system may be able to deal with it. Remember the immune system has lots of redundancy.

I have drawn a graphical view showing disease progression by the different cohorts of people experiencing different severity of symptoms. This is a highly summarised view which IS ABSOLUTELY NOT APPROPRIATE FOR USE IN INDIVIDUAL CASES. The % reflect a view that I have guesstimated based on data from various sources showing the relative proportion of the UK's population who may fall into each category, but please bear in mind that it is a guesstimate and the reality may be a very different once we have more data and also depends on exposure to different age demographics. Please also remember that immunity isn't always guaranteed.

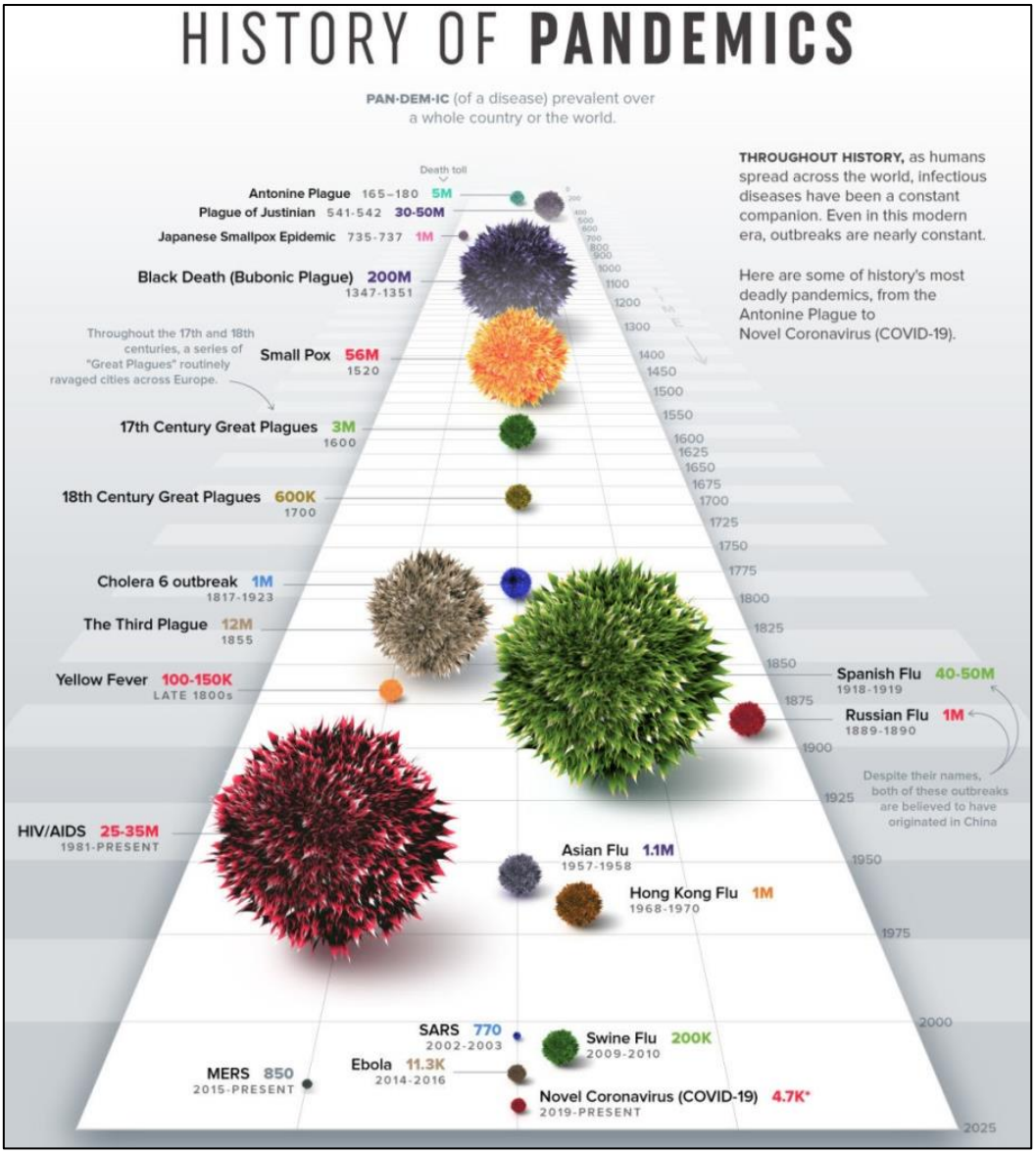


[41] Please note that the paper remains under review: F. Wu et al., *Neutralizing antibody responses to SARS-CoV-2 in a COVID-19 recovered patient cohort and their implications*, https://www.medrxiv.org/content/10.1101/2020.03.30.20047365v1, 2020.

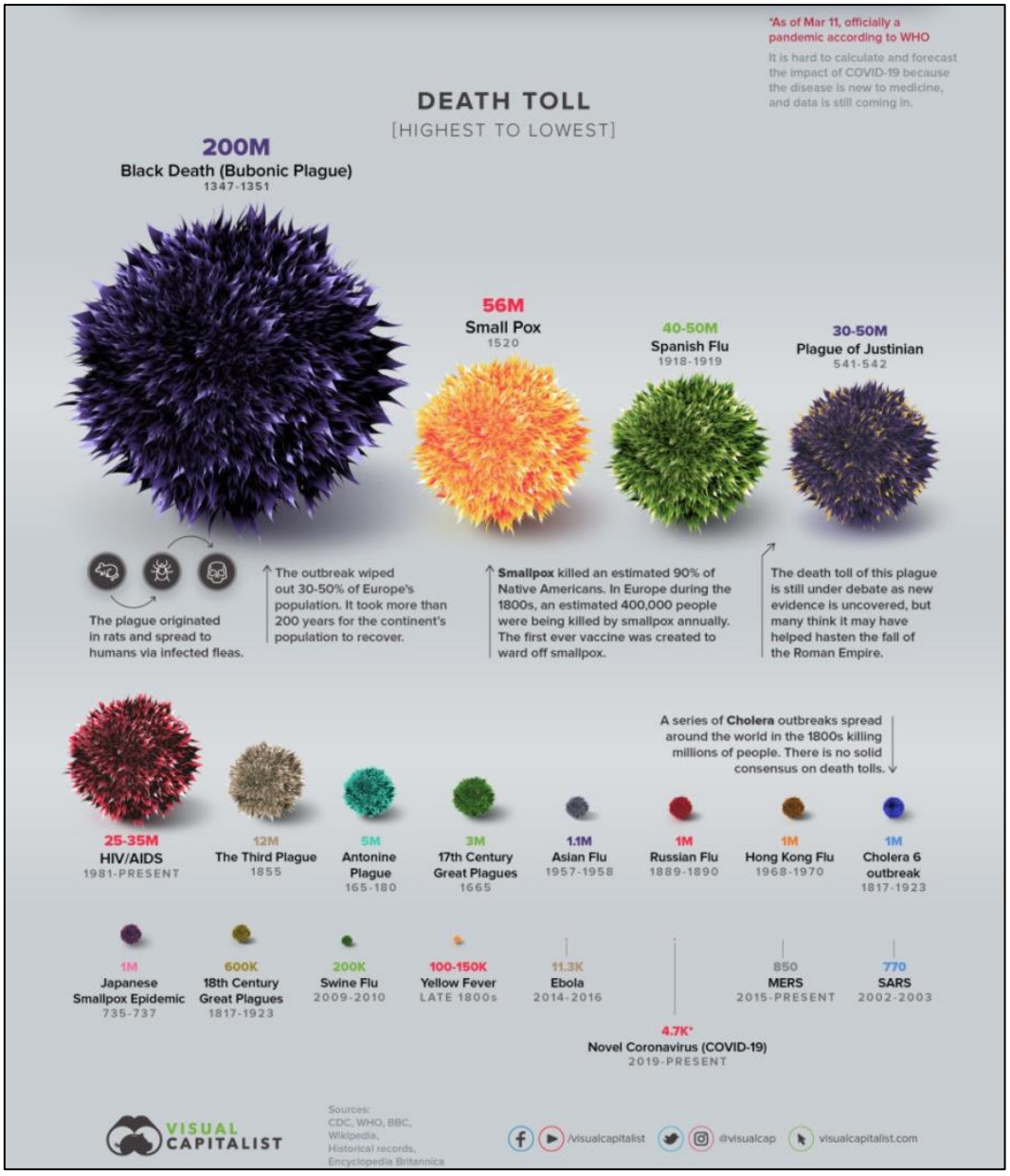
Pandemics in comparison

A pandemic is defined by the World Health organisation (WHO) as "an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people."[42] Covid-19 was declared a pandemic on 30 January 2020.

See history of pandemics, published by the World Economics Forum:[43]



[42] http://www9.who.int/bulletin/volumes/89/7/11-088815/en/
[43] https://www.weforum.org/agenda/2020/03/a-visual-history-of-pandemics/


*As of Mar 11, officially a pandemic according to WHO
It is hard to calculate and forecast the impact of COVID-19 because the disease is new to medicine, and data is still coming in.
DEATH TOLL
[HIGHEST TO LOWEST]
200M
Black Death (Bubonic Plague)
1347-1351
56M
Small Pox
1520
40-50M
Spanish Flu
1918-1919
30-50M
Plague of Justinian
541-542
The plague originated in rats and spread to humans via infected fleas.
The outbreak wiped out 30-50% of Europe's population. It took more than 200 years for the continent's population to recover.
Smallpox killed an estimated 90% of Native Americans. In Europe during the 1800s, an estimated 400,000 people were being killed by smallpox annually. The first ever vaccine was created to ward off smallpox.
The death toll of this plague is still under debate as new evidence is uncovered, but many think it may have helped hasten the fall of the Roman Empire.
A series of Cholera outbreaks spread around the world in the 1800s killing millions of people. There is no solid consensus on death tolls.
25-35M
HIV/AIDS
1981-PRESENT
12M
The Third Plague
1855
5M
Antonine Plague
165-180
3M
17th Century Great Plagues
1665
1.1M
Asian Flu
1957-1958
1M
Russian Flu
1889-1890
1M
Hong Kong Flu
1968-1970
1M
Cholera 6 outbreak
1817-1923
1M
Japanese Smallpox Epidemic
735-737
600K
18th Century Great Plagues
1817-1923
200K
Swine Flu
2009-2010
100-150K
Yellow Fever
LATE 1800s
11.3K
Ebola
2014-2016
4.7K*
Novel Coronavirus (COVID-19)
2019-PRESENT
850
MERS
2015-PRESENT
770
SARS
2002-2003
VISUAL CAPITALIST
Sources:
CDC, WHO, BBC, Wikipedia, Historical records, Encyclopedia Britannica
/visualcapitalist
@visualcap
visualcapitalist.com

3. The UK's strategy for public health emergency

Do nothing – was never an option

If left completely untreated, anything between 510,000 people could die in the UK by August 2020 (that's 1.8% of the UK's population). This is based on the disease modelling by Imperial College London working with the Government. A number of assumption that a significant portion of the population will be able to fight off the virus without being seriously affected and over time acquire "herd immunity," giving the overall population protection to SARS-CoV-2, and effectively from then on buffering transmission in large numbers to vulnerable groups. It also assumes that the virus does not mutate into anything more or less virulent or gain different medical effects, and in about 12-18 months' time a new vaccine will be available to bring the disease to a halt. However, before that, the vulnerable groups which will generally tend to be in the aged population include those with respiratory issues, cardiovascular problems, cancer patients, immunodeficiency, asthma sufferers, and patients with COPD etc. who will be at higher risk of death.

Do something – required a great balancing act of four competing realities

Clearly, the "do nothing" approach was never an option and no country in the world has taken that approach. It would be wholly unethical mismanagement of the NHS, tantamount to an unlawful negligence in public health policy. The challenge, then, was to propose an approach that was the best trade-off between four competing realities.

1. Since the virus is only transmitted by people-to-people contact (or through close distance airborne transmission), if people stopped moving and there is a complete lockdown with no people movement, the virus will not transmit and will die in the UK within 4 weeks.

2. Essential services such as healthcare would need to remain open regardless of any other measures to avoid a huge increase in unnecessary non-Covid-19 related deaths, including the provision of emergency surgeries, renal dialysis, cancer treatment, orthopaedic treatment etc. Similarly, the police service, law enforcement, food industry (production, distribution, retail) would have to remain operational to avoid deaths from lawlessness, starvation, particularly of the old, infirm and young children etc.

3. The capacity of healthcare is finite, meaning once capacity is reached people won't be able to get the treatment they need at point of need (which his enshrined in the Constitution of the NHS) and as a result may die. Capacity can be defined as: the sum of the numbers of:

    1. critical care beds (ICU)
    2. + the right doctors, nurses and support staff
    3. + the personal protective equipment (PPE)
    4. + the right medical equipment (e.g. ventilators) and medicines (anti-viral drugs etc.)
    5. + the right level of testing.

4. Human behavioural psychology and societal norms about trust dictate how quickly and effectively the public will comply to lockdown measures to limit Covid-19 transmission.

a. As human beings we're wired in complex ways, one of which as experiments have shown is that we might take more risks when confronted with bad news, such as news of death tolls.[44] News reports of a few deaths at the beginning created in many people a sense of apathy. Scepticism by some people was based on thinking that it was a problem in China or elsewhere and that despite what the media tells us "it can't be that bad if I personally don't know of anyone impacted."

b. It was well known amongst policy makers in Government that the protection motivation theory which deals with how people cope with and make decisions in times of harmful or stressful events in life would play a part in how people would respond to being asked to suddenly change their behaviour, especially in socially liberal societies.[45] Based on this theory, in order for an individual to adopt a healthy behaviour, they would need to believe that there is a severe threat that's likely to occur and that by adopting a healthy behaviour, they can effectively reduce the threat. Individuals would also need to be convinced that they are capable of engaging in the behaviour.

   France and Spain are good examples protection motivation theory, where the lockdown measures progressed arguably too quickly, and as trust in governments is low (similar to the UK) it meant that too many in public didn't adhere to the behaviour change they were required to accept. This forced Governments to bring stricter laws to enforce the measures. Conversely, if people did conform and the threat of deaths didn't materialise, it's also possible that people would've started flouting the lockdown measures leading to, at worst, a "crying wolf" syndrome.

c. A corollary argument to the protection motivation theory was put forward in a paper[46] which argued that, with the risk of a multiplicative viral epidemic still in its early stages and therefore the risk for an individual to catch the virus being very low, lower than other ailments, to think that it is therefore "irrational" to panic (react immediately and as a priority). But if individuals don't panic and act in an ultra-conservative manner, they will contribute to the spread of the virus and it will become a severe source of systemic harm. That is, hospitals would be inundated and the initial small risk would become amplified and impact system-wide.

The challenge for public healthcare experts, epidemiologists and politicians has been to come up with the best strategy that would produce the lowest number of deaths under these four competing realities. Since these realities are different in every country, the measures taken will be different. Countries will begin with similar trajectories in the number of infections and deaths but will then diverge based on the range of measures taken, their successful enforcement and compliance, and demographics.

Epidemiological modelling

The epidemiological modelling and measures were informed by the Scientific Advisory Group for Emergencies[47] (SAGE) and The MRC Centre for Global Infectious Disease Analysis at Imperial College London.[48]

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[44] Daivid Comerford and Simon McCabe, *Seeing a daily coronavirus death toll might actually make us take more risks*, 8 April 2020, https://theconversation.com/seeing-a-daily-coronavirus-death-toll-might-actually-make-us-take-more-risks-135510

[45] See: https://www.communicationtheory.org/protection-motivation-theory/

[46] Nassim Nicholas Taleb and Joseph Norman, *Ethics of Precaution: Individual versus Systemic Risk*, https://www.academia.edu/42223846/Ethics_of_Precaution_Individual_and_Systemic_Risk, 15 March 2020.

[47] https://www.gov.uk/government/groups/scientific-advisory-group-for-emergencies-sage, SAGE supports the UK cross-government decisions in the Cabinet Office Briefing Room (COBR).

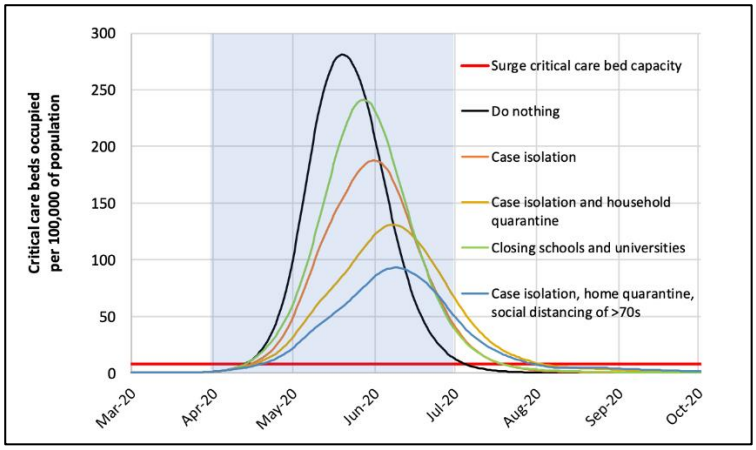
[48] https://www.imperial.ac.uk/mrc-global-infectious-disease-analysis/

Epidemiological modelling thus tells us that we need to have a combination of measures to deal with the pandemic in the UK[49, 50]:

1. Reducing or slowing the spread of infections (also known as suppression) so that peak healthcare demand is kept within capacity: hand-washing, social distancing the entire population, closing schools, self-isolation of suspected cases, limiting household-to-household contact, only going out for work and exercise etc. This slowing the spread of the infection will ultimately reverse the growth and infection to low numbers, and eventually kill off the virus's pandemic impact

2. Shielding those most at risk of severe disease from infection, including the 1.5 million immuno-compromised people identified, as well as the elderly

3. Increasing the capacity of hospital beds and in particular ICU (intensive care unit) beds so that those requiring hospitalisation can be offered care and without which they could die, and also to avoid overwhelming the NHS.



The above graph taken from Imperial College shows the impact of various social distances or lockdown measures on ICU bed requirements. The blue shading shows the 3-month lockdown as we approach the original critical care bed capacity. Since this graph was done, the critical care bed capacity has increased with the construction of NHS Nightingale at the ExCel Centre in East London giving an extra 4,000 beds, and at least 4 other Nightingale field hospitals are planned across the country at the University of the West of England in Bristol and the Harrogate Convention Centre in Harrogate (near York), the Central Complex in Manchester as well as the National Exhibition Centre in Birmingham, Glasgow and Belfast. Bed capacity has also been increased with the postponement of non-essential surgeries.

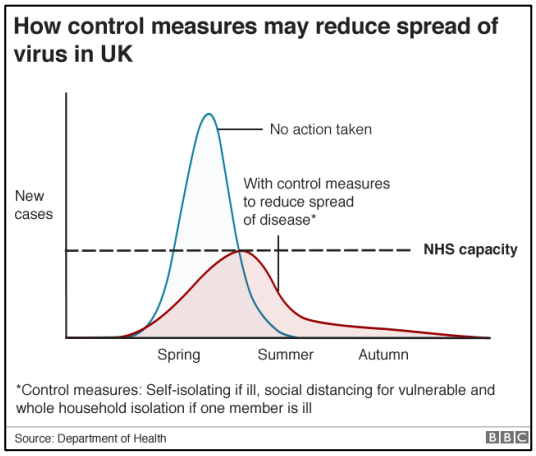
If the virus can be suppressed through school closures, reducing social contact, shielding vulnerable and self/household-isolation of those with symptoms and increased critical care capacity, then it is hoped that the number of deaths can be minimised to 20,000. So the "do something" approach is expected to save in theory anything between 490,000 lives by August, all things being equal. However, we know reality is different because:

- Some of the 480,000 will die anyway as part of the 600,000 people who die roughly in the UK every year (based on average in recent years) – most of them being elderly or with health issues who as it happens are already the main cohort vulnerable to Covid-19

[49] *Report 12 - The global impact of COVID-19 and strategies for mitigation and suppression*, https://www.imperial.ac.uk/mrc-global-infectious-disease-analysis/covid-19/report-12-global-impact-covid-19/, 26 March 2020.
[50] See also: *Why lockdowns can halt the spread of COVID-19*, https://www.weforum.org/agenda/2020/03/why-lockdowns-work-epidemics-coronavirus-covid19/, 21 March 2020.

- Some people will die indirectly as a result of delayed operations, appointments and treatments
- Others will die due to pre-existing health issues ("comorbidities") which may or may not become exacerbated due to Covid-19 infection

The graph below, taken from BBC online, is a more simplified version of the Imperial College graph showing the profile of reducing cases, dubbed "flattening the curve," to ensure adequate provision of healthcare for when people do fall ill.



Based on epidemiological modelling and other information gathered by Imperial College, the most likely to die/most at risk groups from Covid-19 are:

1. Aged population. Based on China[51] data (see table below), the proportion of infected individuals who will be hospitalised and die increases with age.

Age	Infection fatality rate	Hospitalisation rate
0–9	0·00161%	0·00%
10–19	0·00695%	0·0408%
20–29	0·0309%	1·04%
30–39	0·0844%	3·43%
40–49	0·161%	4.25%
50–59	0·595%	8·16%
60–69	1·93%	11·8%
70–79	4·28%	16·6%
≥80	7·80%	18·4%
Overall	0·657%	

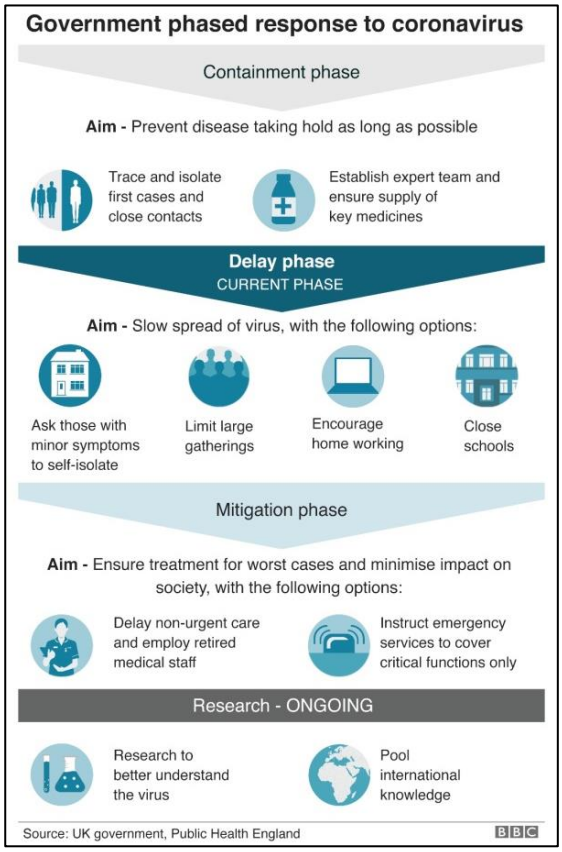
2. Population with depleted immune function for whatever reason – immune-compromised diseases, cardiovascular diseases, transplants, cancer, autoimmune diseases etc.

3. Since severe and critical cases of disease (defined as tachypnoea [≥30 breaths per min], oxygen saturation ≤93% at rest, or PaO2/FiO2 ratio <300 mm Hg) and critical (respiratory failure requiring mechanical ventilation, septic shock, or other organ dysfunction or failure that requires intensive care) would require intensive hospital care, the number of deaths would also be a function of not being able to get the right hospital treatment due to capacity constraints.

[51] R Verity, LC Okell, I Dorigatti *et. al.*, E*stimates of the severity of coronavirus disease 2019: a model-based analysis*. Lancet Infectious Diseases, 30-03-2020; in press. https://doi.org/10.1016/S1473-3099(20)30243-7.

Some of the above Imperial College modelling was published on 30 March but the general gist that the NHS demand can only be kept within manageable levels through an escalation of measures was already well-established as explained in an earlier report (published on 26 March) which led to a progression of the Government's lockdown measures on 23 March. The modelling was necessary to ascertain a better picture of fatality rates than earlier studies from around the world.

In any case, armed with some of this thinking (for which some data came later) the UK's strategy had 4 pillars: 1) containment, 2) delay, 3) mitigate and 4) research, as show below:



1) Containment had two elements:

I. In the early days of the outbreak people returning from China were quarantined for up to 14 days. However, there were significant gaps in this since the outbreak had spread to places beyond China such as Italy and Spain, and people arriving back to the UK from them weren't quarantined. Evidence in the US shows that people carried the virus to the US from Europe by mid-February. This aspect of containment was always going to be short lived and not easily scalable or controllable (most people were likely missed), which is why within a couple of weeks it was stood down.

II. Reducing contact-based spread by asking people to avoid unnecessary contact (e.g. handshaking) and crucially to wash their hands thoroughly with soap or hand wash or to use a hand sanitizer, and to dispose of tissue after sneezing and coughing etc. Campaigns were launched across TV, online and social media. This led to a sudden spike in demand for hand wash and bizarrely toilet roll which were early signs of anxiety-ridden stockpiling.

2) Delay phase is about reducing the speed of the spread of the virus. It is based on the assumption that the virus cannot be contained anymore and would now spread, but that the speed at which it would spread could be controlled by a number of measures.

- Shielding (began Monday 23 March) - this was the first of the delay measures announced, ordering 1.5 million vulnerable people not to go out of their homes at all to minimise the chance of transmission to them. Medicines would be delivered to this group by pharmacies and the local authority working with supermarkets would deliver food on their doorsteps. Vulnerable people were identified initially by NHS Digital and have been sent an official letter or text. At the time of writing the paper patients were also being identified by GPs who will be sending letters to those concerned. The vulnerable group comprised patients of:

    - Organ transplants
    - Those living with severe respiratory conditions (such as cystic fibrosis and severe chronic bronchitis (COPD) or severe asthma)
    - People with specific blood or bone marrow cancers
    - Anyone undergoing radiotherapy for any cancer
    - People taking drugs or antibody treatments for cancer or to suppress the immune system
    - Women who are pregnant with heart disease

    However, we can expect some people to be missed out of the list simply due to administrative errors, as has already been reported in examples of transplant recipients, lung disease patients and asthma sufferers etc.[52]

- Self-isolation for anyone displaying symptoms of Covid-19 for a minimum of 7 days.

- School closures - all schools closed on 23 March and only the children of "key workers" (involved in essential services e.g. NHS staff and a long list of others) were able to go to school.

    - There's been considerable discussion as to whether schools should have closed earlier or not at all. One study suggested that school closures would have minimal impact on the spread of Covid-19 and that it isn't worth it against the economic and social costs. This is based on the assumption that previous studies had shown that school closures are likely to have the greatest effect if (a) the virus has low transmissibility and (b) the attack rate is higher in children, both of which of course aren't the case with Covid-19. However, while school closure as a measure on its own is predicted to have a limited effectiveness in controlling Covid-19 transmission, experts like Prof Neil Ferguson of Imperial College London suggest that when combined with social distancing it plays an important role in severing remaining contacts between households and thus ensuring transmission declines - a view that I agree with.[53] Others have suggested that schools should have closed much sooner. However, given the behavioural risks of people becoming passive if the measures were too hard too soon, it is questionable whether schools being open an extra 1 or 2 weeks would have made much of a difference week versus the benefits of giving schools time to prepare.

    - There's also been growing concern as to whether enough vulnerable children are attending school raising the spectre of an increase in child sexual abuse. And school heads have interpreted "keyworkers" variously, with some insisting that both parents must be keyworkers.

- Lockdown of inter-household contact - this measure meant that people should only go out for essential work that could not be done from home, to get food or for exercise once day, and public gatherings were limited to 2 people.

[52] *Coronavirus: 'High risk' list misses off thousands of people*, 7 April 2020, https://www.bbc.co.uk/news/uk-england-52123446.
[53] See: https://www.theguardian.com/education/2020/apr/06/school-closures-have-little-impact-on-spread-of-coronavirus-study.

Failures in the UK's response to date

Whilst there are many things which the Government and the public got right and executed well, among which the creation of the field hospitals is an excellent example, I believe there have been many failures in the UK's response to Covid-19, too. Most of these are failures are by Government showing incompetence and poor strategizing, but there are also some failures by the public.

1. The Government seems to have given out a message of pursuing a strategy of "herd immunity" yet herd immunity has never been engineered in a pandemic situation without a viable vaccine, or indeed even effective drugs. And it took far too long (about 3 days) for the Government to clarify that the strategy wasn't one of "herd immunity." However, the ambiguity led many to become overly sceptical and distrust the Government's approach from the offset.

2. The Government failed to provide adequate personal protection equipment (PPE) to nurses, doctors, care workers and other hospital staff. Early focus on ventilators though necessary seems to have been at the expense of PPE, which was quite extraordinary given that Covid-19 was well known for its highly infectious transmission. At least some of the deaths of doctors, such as Dr Abdul Choudhury sadly died from contracting Covid-19 was most likely due to the lack of PPE and exposure to high levels of viral dosage, as he himself pointed to in a Facebook update a few days prior to death. The Government should have identified an extensive list of materials needed for the pandemic based on which they should have created a grand plan for procurement, distribution and resupply (and communicated it to the public) rather than drip feed tid-bits of announcements following questioning by journalists.

3. The Government failed to work out a comprehensive testing strategy, and it took about 3 weeks into March before a more well-thought-out strategy was drip-fed to the public over a few days. However, by then valuable time had been lost and the difficulties in scaling testing was by then further exacerbated by a deepening shortage of raw materials. The Government failed to realise: 1) the importance of testing to bring the pandemic under control as recommended by the WHO; and 2) the weakness of the UK's diagnostics industry meant that the UK wasn't in a good place to scale up production.

4. The Government failed to realise the risk of Covid-19 outbreak in elderly care homes, and consequently did not have a specific guidance for care homes, as well as prioritising testing and supply of adequate PPE. The epidemiological data was very clear from the beginning showing that age is a big risk factor and hence elderly care homes should have been a category of its own similar to the 1.5 million at risk group.

5. The Government repeatedly made misleading claims about the target testing throughput with different target numbers for the end of April claimed by Sir Patrick Valance who maintained 25,000 tests per day and Matt Hancock promising 100,000 tests per day. To make matters worse, leaked reports to Sky have shown that the Government initially rejected offers of help from smaller laboratories and pursued a centralised approach to testing. On 24 March Matt Hancock told a daily press briefing that the new "testing facility in Milton Keynes opens today and we are therefore on the ramp up of the testing numbers." Yet on 11 April the centre was only performing 1500 a day.[54]

6. The Government failed to report numbers with sufficient breakout, particularly around throughput of hospitalisation cases. This was a big miss to educate the public because the strategy of delay and mitigate was linked to hospital capacity, yet capacity wasn't factored into the daily reporting.

[54] Rowland Manthorpe, *Coronavirus: National coronavirus testing centre only conducting 1,500 tests a day*, 11 April 2020, https://news.sky.com/story/coronavirus-national-coronavirus-testing-centre-only-conducting-1500-tests-a-day-11971991.

7. The Government has so far failed to announce exit strategies and scenarios to give ordinary people and businesses a forward-looking view. Instead, the current approach of "wait and see if lockdown measures are working" fails to provide greater impetus to get the disease under control and clarity on the criteria for lifting the lockdown or how the gradual lifting of restrictions might look like etc.

8. The Government overall failed to be more proactive about the planning to combat Covid-19 despite knowing about the situation in Italy and China and WHO warning. What is striking is that some teams in the UK (e.g. the MRC Centre for Global Infectious Disease Analysis[55] and Abdul Latif Jameel Institute for Disease and Emergency Analytics[56] – both at Imperial College London) who were already working with the WHO many weeks before the pandemic took off in the UK. These groups and the Government/PHE should have kept in close contact and started planning.

9. The economic measures brought in failed to safeguard self-employed and recently employed workers, and needlessly caused anxiety for many families, especially as the policy announcement were made, albeit sometime later.

10. Government failed to have a rigorous pandemic planning and preparedness measures in place. Also, in national emergencies the Government should have spun up a website that acted as a hub where citizens could go to access all the information they needed across financial help, NHS/medical information etc.

11. The public's panic buying (and hoarding) of cleaning products and food is to be condemned, and conspiracy theories about 5G technology shouldn't have been allowed to proliferate by the public via WhatsApp and Facebook.

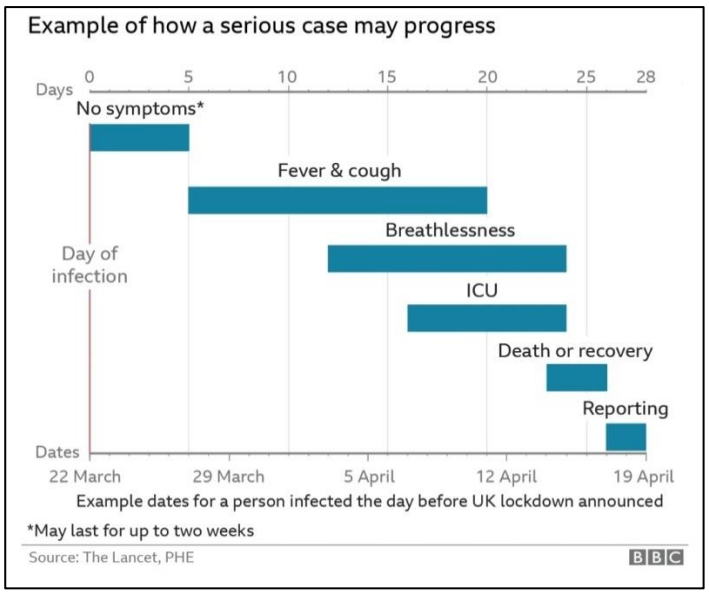
Making sense of death numbers and risk

There are so many different ways of reporting the number of Covid-19 deaths, and each has their own pros and cons. The point of the table below is to show that while we should keep an eye on absolute numbers of deaths we shouldn't be catastrophizing the UK situation by comparing the number of deaths between countries in an unnunaced way due to:

- Countries have differences in how they report deaths, e.g. differences between date the data was collected and the date the data was reported. Often the data isn't communicated transparently at a granular level so it's difficult to say when people actually died which can skew time-based comparisons.

- It takes weeks before infections show in the number of deaths. This means that deaths are not a leading indicator of how well the latest measures are doing at present. However, the tendency if to use deaths as the leading indicator when it can never be unless there weren't any measures in place, in which case the latest deaths would directly reflect current performance.

[55] https://www.imperial.ac.uk/mrc-global-infectious-disease-analysis
[56] https://www.imperial.ac.uk/jameel-institute/



- Countries have differences in what they consider to be a Covid-19 death. For example the UK hasn't yet included Covid-19 deaths in care homes and nor did France until the beginning of April.

- It isn't clear if countries are reporting the reason for deaths of people who die due to an underlying issue but just happened to be infected with Covid-19 but may or may not have had symptoms or exacerbated the underlying health issue. Some of this kind of reporting may come out in the Office of National Statistics (ONS) at some point in the future since it can use the reason for death on death certificates.

- Germany is an outlier with such low number of deaths despite having relative high numbers of those infected. The reasons have confounded experts so far, but I suspect it will be a combination of extensive testing and self-isolation, high levels of trust in public institutions and government, demographics, health care resources etc. they probably have optimised variables.

How overall Covid-19 deaths could be reported to allow for better comparisons between countries?	Why would we use this metric?
Deaths per million people by days after first death	This would correct for population size and indirectly measure the spread of the disease too. Population size is important because it provides insight into the performance of the health care system.
Deaths per million people by days after lockdown	Projected death rates will vary once the lockdown measures are instituted, so it is better to compare between countries post the point of lockdown which can then help track lockdown performance, especially given that the definition of lockdown is slightly different between countries.
Deaths as a proportion (and absolute numbers) of people hospitalised (plus absolute numbers)	This would give a view of the performance of how well our hospitals are doing to keep alive patients that require hospitalisation, and indirectly measure capacity and proficiency of the health care system to cope etc.
Deaths as a proportion (plus absolute numbers) of those testing positive (case fatality rate)	This will allow us to track the severity of those who get infected and therefore track the overall performance of self-isolation/medication as well as those who are hospitalised. As testing ramps up this metric may see large day-to-day moves, however at constant testing throughput it will be a more reliable metric.

4. Deep systemic shock to society from Covid-19

Public health emergency – the UK Government's response

- Information pertaining to the UK Government's response to Covid-19 can be found at: https://www.gov.uk/coronavirus,
- NHS advice for people can be found at: https://www.nhs.uk/conditions/coronavirus-covid-19/.
- You can track global number of infection cases and deaths, and sign up to the World Health Organisation's (WHO) Covid-19 situation reports at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019

As mark of just how serious the Covid-19 outbreak is, the UK Government wrote off £13.5b of NHS debt, which would have been a constant problem for managing the public health emergency. It means that NHS Trusts saddled with debt have a clean bank balance, which will massively help them in the longer run, and would have been highly unlikely a Conservative Party policy in normal times. Additionally, the Coronavirus Act 2020[57] was introduced to provide powers needed to respond to the current Covid-19 epidemic. These powers are supposed to be for use only if needed, judged on the basis of the clinical and scientific advice, and have been built with safeguards and oversight and accountability in place. They have three main objectives:

1. To give further powers to the government to slow the spread of the virus
2. To reduce the resourcing and administrative burden on public bodies
3. To limit the impact of potential staffing shortages on the delivery of public services

The Institute of Government[58] put together an excellent table to explain them, which has been reproduced below in an easier format to read:

Section	What does it say?
Easing the burden on frontline staff and mitigating impact of staff shortages	
2–9	**Mitigating NHS staffing shortages**
	The Act enables the registration of recently retired health and social care professionals, medical students near the end of their training, and those who have recently left the profession.
	The Act suspends restrictions on the number of hours retired staff who return to the NHS can work. It enables volunteers in the health and social care sectors to take unpaid leave with UK-wide compensation fund.
	The Act also provides provision to facilitate emergency volunteering.
10; 14–17	**Easing pressure on NHS and local authority resources**
	The Act allows NHS providers to delay assessment of a patient's need for ongoing nursing care before discharging.
	The Act eases, in exceptional circumstances, the requirements on local authorities to conduct a "needs assessment" when it appears that an adult may have needs for care and support.
	The Act allows for powers to detain and treat patients for mental health disorders to be implemented using the opinion of fewer medical professionals.
18–21, 30–32	**Reducing administrative burden on frontline staff**
	The Act eases the regulations relating to the registration and certification of deaths and still-births, and permissions to conduct cremations.
	The Act removes the requirement that any inquest into a death from coronavirus be held with a jury in England, Wales and Northern Ireland (as is required by law for other notifiable diseases).
11–13	**Indemnity**
	The Act enables the secretary of state and ministers in devolved administrations to provide an indemnity for clinical negligence liabilities arising from NHS activities.

[57] https://www.gov.uk/government/publications/coronavirus-bill-summary-of-impacts/coronavirus-bill-summary-of-impacts
[58] https://www.instituteforgovernment.org.uk/explainers/coronavirus-act

58	**Management of dead bodies**
	A national authority or designated local authority has the power to require organisations to provide facilities, premises, vehicles or services to manage capacity problems in the transportation, storage and disposal of dead bodies.
22–23	**Modifying requirements under the Investigatory Powers Act**
	Warrants under the investigatory powers act must be signed by the secretary of state and one of 15 judicial commissioners. Because Covid-19-related sickness may result in a shortage of commissioners, the Act will allow additional judicial commissioners to be appointed on a temporary basis and the appointments process to be amended.
	Usually, judicial commissioners must retrospectively approve a warrant within three days of it being made. To relieve pressure on commissioners, the Act allows this period to be extended to a maximum of 12 days. Warrants are usually valid for a maximum of five days. The bill extends this period to a maximum of 12 days.
24	**Extension of time limits for retention of fingerprints and DNA profiles**
	The Act allows the government to extend the period for which fingerprints and DNA profiles may be retained for up to six months if the secretary of state considers that coronavirus is having, or is likely to have, an adverse effect on the capacity of those responsible for national security decisions and it is in the interests of national security to retain fingerprints or DNA profiles.

Containing and slowing the spread of the virus	
50	**Suspending port operations**
	The Act provides powers to suspend port operations if shortages in Border Force staff mean there are insufficient resources to secure the border. Initial decisions to suspend port operations can be taken by senior Border Force Officials on behalf of the Secretary of State. Suspensions for more than 12 hours must be taken by ministers.
51	**Powers relating to potentially infectious persons**
	The government has already passed secondary legislation to give public officials in England emergency powers to test, isolate and detain a person where they have reasonable grounds to think that the person is infected. The Act puts those powers on a statutory footing and extends them to authorities across the whole UK.
	Someone who breaches a direction given under these powers commits an offence and is punishable by a fine.
52	**Powers regarding public gatherings and premises**
	The Act gives ministers, including in the devolved administrations, the power to restrict or prohibit gatherings or events, and the power to close or restrict access to premises. The minister can only use this power if they have made an official declaration that the virus constitutes a "serious and imminent" threat to public health, and that using the powers would either help to control the transmission of the virus, or would facilitate the most appropriate deployment of medical/emergency resources.
	Someone who breaches such a direction commits an offence, punishable by a fine.
36	**Vaccinations in Scotland**
	At present only medical practitioners or those acting under their control can administer vaccinations in Scotland. The Act allows a wider range of health professionals to do so.
37–38	**Schools/childcare providers**
	The Act gives ministers, including in the devolved administrations, the power to require the temporary closure of a school or registered childcare provider. When a minister has given such a direction, the institution must take reasonable steps to stop people attending the premises for a specified period. The minister can also make more specific directions about particular parts of the premises or particular people.
	Ministers have to take advice from public health officials before using these powers.
53–57	**Technology in court**
	The Act makes several provisions for parties and witnesses in court proceedings to appear by live link, rather than in person. It also provides that, where someone is appealing a government decision to restrict their activities to the magistrates' court, they appear by live link.

Economic support	
39–44	**Statutory sick pay**
	The Act enables the government to make regulations to allow certain employers to reclaim the cost of providing statutory sick pay to their employees from HMRC for Covid-19-related absences. It also makes statutory sick pay payable from day one, rather than day four, of sickness. The government hopes this will remove a disincentive to workers staying at home when they are infected.
45–47	**Pensions**
	Rules preventing those in receipt of NHS pensions returning to work will be suspended. The government hopes this will remove a disincentive to retired health professionals returning to work.

72–74	**National Insurance Contributions**
	The Act will temporarily reduce the requirements for changing rates of National Insurance Contributions.
81–83	**Protecting tenants**
	Residential tenancies – protection from eviction: In the Commons, the government introduced new provisions extending the statutory notice period for evictions for most residential tenancies from two months to three months.
	Business tenancies – protection from forfeiture: In the Commons, the government introduced new provisions temporarily restricting the ability to enforce re-entry or forfeiture for nonpayment of rent.
25–29	**Food supply**
	The Act gives the government power to require food suppliers and retailers to provide information relating to food supply chains.

Postponing elections	
59	**The May 2020 elections**
	The Act postpones elections due in May 2020 for local councillors, mayors of local and combined authorities, police commissioners, the mayor of London and London Assembly until May 2021.
60	**Terms of office**
	Councillors, mayors of local authorities and combined authorities, London Assembly members, and police commissioners elected in 2021 will serve for three years instead of four.
61–70	**Further elections**
	The Act postpones any by-elections to local authorities, the Westminster and devolved legislatures, and other electoral events until May 2021.

Exercise of powers and parliamentary scrutiny	
87	**When provisions in the Act take effect**
	Some provisions of the Act (such as the emergency registration of health professionals) take effect on Royal Assent. Others, including those relating to emergency volunteers, temporary modifications to mental health legislation and food supply only take effect when a UK government minister (or, in some cases, a minister of the devolved administrations) makes a regulation switching them on.
88	**Power to turn provisions on and off**
	This allows UK ministers (and in some cases ministers of the devolved administrations) to make regulations to turn some measures in the Act on and off as needed. Ministers may make different regulations for different purposes or areas. Many measures, including powers relating to potentially infectious people and to limit events and gatherings cannot be turned on and off in this way.
89 and 98	**How long measures will last for**
	Most of the Act will stop having effect two years after it is passed. Some provisions, including certain provisions relating to the emergency registration of health professionals and indemnity of health service activity do not expire after two years.
	Following government amendments in the Commons, MPs will now have an opportunity to express a view on the continued operation of the Act's temporary provisions every six months. Every six months, a minister must, 'as far as practicable' make arrangements for MPs to vote to keep the provisions of the Act in force. If MPs are able to vote and vote to stop against keeping the provisions of the Act in force, the government must make regulations to prevent provisions having effect within 21 days. MPs will only be able to vote on the continuation of the powers if parliament is sitting. If they are not able to vote, the powers will remain in force.
90	**Power to change the expiry date of the Act**
	A UK minister (and in some cases a minister of the devolved authorities) may make a regulation to extend some provisions of the Act beyond the two-year time period (for a maximum of six months). The time period may also be reduced.
97	**Reports on the use of the Act**
	The Act requires the government to publish a report every two months on the use of the non-devolved aspects of the legislation. If parliament is not sitting on the day the report is due, it can be published instead, for example on a government website.
99	**Parliamentary debate on non-devolved aspects of the Act after one year**
	The Act requires a parliamentary debate to be held in both Houses of Parliament one year after Royal Assent (so long as key provisions of the Act remain in force at that time). If parliament is not sitting at the time, the debate must be scheduled within 14 days of parliament returning.

Councils have also been given new powers to hold public meetings (annual meetings, full council/cabinet/committee meetings) remotely between 4 April to 7 May which may be further increased should it be necessary. Meetings are being held virtually using tools such as Google Hangouts, Microsoft Teams and Zoom.

Managing the economic downturn

There is likely to be at the very least a long recession worldwide, and at worst a depression. A recession is defined in the UK as negative growth (i.e. economic activity shrinks) for two consecutive quarters (6 months). A depression is a more server prolonged downturn (of 1 -2 years) in economic activity and usually has impacts on many other economies at the same time. The severity of the downturn will depend on how long it takes the world to control the outbreak, recover from its effects on human health and how quickly trade and economic life can return to pre-Covid-19 levels. At present, the depth and length of disruption to the global economy isn't clear. Nor is it clear if any structural changes will be temporary or shape recovery in a more permanent way.[59] The early signs aren't good: jobless claims have skyrocketing in the US to 22 million people in just a few weeks (up to 16 April) which has never happened in history (some projections by the US Fed put the final jobless count to a staggering 45 million[60]); and there's been over 1 million new claims for Universal Credit in the UK (up to 2 April). At current projections, at least a 10% downturn in global demand is expected at best and up to around 40% at worse, easily making it larger than the 2008 financial crisis and nearer to the depression of the 1920s in many respects.[61]

Given global economic interconnectedness, the major economies of the world would all need to come out of the Covid-19 outbreak before economic downturn can reverse. This will include a new set of measures to prepare economies to get back to work safely and to scale the recovery. According to analysts, by taking the right economic measures, societal and economic shocks from the outbreak can be time-boxed to 6 months to 3 years.[62] Some of the interruption to supply chains, and sudden demand for key items like ventilators, face masks, sanitisers, some food stuffs etc. while playing into the pandemic's systemic disruption, is expected to re-equilibrate by market forces once the outbreak is under control without additional government intervention. However, most of the recovery won't be self-adjusting and economic measures will need to continue to evolve with speed, scale and simplicity.[63]

The economic downturn will bring its own challenges, which the UK Government has responded with unprecedented measures and policy announcements:

- The Bank of England (BoE) reduced interest rates from 0.75%, to 0.25% (11 March) and then quickly followed up on 19 March with a further reduction, to the lowest point ever, to 0.1% points, and was the first of the major world economies to make such a drastic cut. This will of course help with cheaper business borrowing to make ends meet, and mortgage lenders can more readily pass on lower rates to people with variable rate (tracker) mortgages. However, some banks have cut the interest rates to offer

[59] See: *Covid-19: Briefing note*, McKinsey & Company, March 25 2020.
[60] *Coronavirus job losses could total 47 million unemployment rate of 32 percent fed says*, 30 March 2020, https://www.cnbc.com/2020/03/30/coronavirus-job-losses-could-total-47-million-unemployment-rate-of-32percent-fed-says.html
[61] Milne, Alistair K. L., *A Critical COVID-19 Economic Policy Tool: Retrospective Insurance* (March 21, 2020). Available at SSRN: https://ssrn.com/abstract=3558667.
[62] See: See: *Covid-19: Briefing note*, McKinsey & Company, March 25 2020.
[63] See: Graham Gudgin: *Speed, scale, simplicity. Three principles for further action by Ministers to protect jobs and help people*, 6 April 2020, https://www.conservativehome.com/thinktankcentral/2020/04/graham-gudgin-speed-scale-simplicity-three-principles-for-further-action-by-the-government-to-protect-jobs-and-help-people.html. Policy Exchange report here: https://policyexchange.org.uk/publication/speed-scale-and-simplicity/

to savers (that also benefits them) and quite incredulously raised interest rates on variable rate mortgages which would in normal times track against the BoE base rate.[64]

- The UK Governments has sought to financially protect people in a way that they have never done so in peacetime. This includes making it easier for businesses to survive the period of downturn through business rate reliefs, grants and interest free loans, as well as paying 80% of furloughed workers' wages capped at £2500 (for employed and self-employed) or to prevent job losses as revenues collapse across sectors with demand for services and products massively dropping off. However, whether these measures will offset the deflationary economic shock and provide targeted support to those most directly affected remains to be seen. Other novel approaches such as "business interruption insurance" may be necessary. This would be for the UK government to retrospectively take on the role of pandemic risk insurer and effectively pay out what companies would receive if they had been covered in advance. Such payments could be made to all businesses large and small, non-profit organisation etc.[65]

- Businesses in England in receipt of the expanded Retail Discount (which covers retail, hospitality and leisure) and with a rateable value of less than £51,000 will be eligible for Retail, Hospitality and Leisure Grant (RHLG). Where the property has a rateable value of up to £15,000 a grant of £10,000 will be payable. Where the property has a rateable value of over £15,000 and less than £51,000 a grant of £25,000 will be payable in line with eligibility criteria. The Government is providing additional funding for Local Authorities to support small businesses that already pay little or no business rates because of small business rate relief (SBRR), rural rate relief (RRR) and tapered relief. This will provide a one-off grant known as small business grant (SBG) of £10,000 to eligible businesses to help meet their ongoing business costs.

- Following the announcement of "stay at home" policy, there have been around a million new applications for Universal Credit (figure correct up to 26 March). However, the lead time for the first payments is expected to be at least 5 weeks during which many people will have to find other ways of sustaining themselves e.g. tapping into savings, credit cards, borrowing from family etc. The most acute cases may require resorting to foodbanks. There's also considerable pain for some people who aren't sure how to access Universal Credit. Others will be impacted by the time it takes to clear backlog since each application will need to be processed following proper governance, but the sheer volume of applications to process will mean there will be a long lead time for some people to get financial support. Similarly, for the newly self-employed, the requirement for having to have submitted tax returns last year (April 2019) means that there remains gaps in the help offered for the more recent self-employed for whom simply relying on banks being flexible with overdrafts and credit card payments may not be enough. One other gap that remains is making it easier for people to access these funds and help overall.

- Many banks and mortgage lenders have offered 3-month mortgage holidays, and MOT tests have been waved for 6 month period for vehicles requiring MOT after 31 March 2020. Telecoms companies have waived data limits on access to information and other companies have sought measures to protect essential services. Other measures may also come in time.

- There are also a raft of other smaller measures such as the Government introducing grants for companies to help improve resilience, and provided funding to universities and private companies for vaccine development. The government has also pledged £750 million to support charities, which may

[64] See: *Coronavirus: Lenders raise interest rates on mortgages*, 8 April 2020, https://news.sky.com/story/coronavirus-lenders-raise-interest-rates-on-mortgages-11970689.
[65] Alistair Milne, *Coronavirus: to save businesses, we should pioneer an unusual kind of insurance*, March 25 2020, https://theconversation.com/amp/coronavirus-to-save-businesses-we-should-pioneer-an-unusual-kind-of-insurance-134574?

not be enough for many of them, forcing closure. The UK Government has given the WHO £200 million to help with bringing control over the pandemic.

Collateral damage to society

As citizens we must learn to become more resilient to avoid mental and physical illness linked to the economic downturn and outbreak of illness. Experts[66] have warned of significant collateral damage.

1. Mental health problem, anxiety and suicides linked to self-isolation. There's fear about the virus, about whether we get it or if our loved ones get it. There are also economic fears about losing one's job and livelihood etc. There's also increasing fears about loneliness. These fears may be too much to bear for some people. A few weeks or months may be fine, but if the lockdown is more prolonged the problems will exacerbate with time. A study is under way to track the effects of prolonged isolation. In the meantime there are many way we can keep some sense of balance and avoid struggling with isolation:[67]

    - Reach out to family friends and those whom we love. Now is a great time to spend time with them to reconnect over the phone, facetime, video etc.
    - If it's overwhelming, seek out treatment. Many therapists are available online to help with any anxiety that becomes overwhelming
    - Find things to look forward to each day, whether it's a call a friend, or some sort of an event or workout or running outdoors, put something on the calendar each and every day

2. Some people hoarding supplies of food and medicine will mean others who may be more in need miss out. While hoarding is a natural behavioural response to uneven supply of resources, so is the shaming of people buying more than they need as a response to exerting influence to ensure co-operation between people so that everyone acts in the best interest of the wider public.[68] However, both hoarding and shaming will lead to longer term distrust particularly in conditions where food supplies are plentiful and it's simply about the turnaround time for new supplies getting into supermarkets.

3. The RAND Corporation in the US as well many charities and the Government are bracing for an epidemic of mental health issues for health care workers. This is because health care workers are at the forefront of the battle against the pandemic whose resilience to moral distress, low morale and worries about being infected themselves without adequate PPE will be very visible. This is why the rest of society will need to show their support and appreciation as well as take everyday burdens off health care workers.[69]

4. Heart problems from lack of activity for those with medical conditions, especially if they are in the 1.5m group who have been asked to shield themselves in the home.

5. The impact on health from increased unemployment and reduced living standards. For example, a decline in the size of the economy would also see a loss of three months of life on average across the population because of factors from declining living standards to poorer health care. The benefit of a long-term lockdown in reducing premature deaths could be outweighed by the lost life expectancy from a prolonged economic dip.

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[66] See: https://www.bbc.co.uk/news/health-51979654

[67] Provided by Neil Leibhwitz the chief medical officer for the online therapy provider Talkspace, on BBC News.

[68] See: Stephanie Preston, *Our brain evolved to hoard supplies and shame others for doing the same*, 2 Pril 2020, https://theconversation.com/your-brain-evolved-to-hoard-supplies-and-shame-others-for-doing-the-same-134634.

[69] Sangeta Ahluwalia *et. al.*, *Amidst a pandemic, a mental heath crisis may be looming*, https://www.rand.org/blog/2020/04/amidst-a-pandemic-a-mental-health-crisis-may-be-looming.html, 1 April 2020.

6. Huge personal health costs for people from delaying routine operations and cancer screening. On organ transplants there are on average 80 organ transplants a week in the UK, which has now dropped to a handful.

7. The charity Oxfam has warned that half a billion people may be pushed into poverty due to Covid-19 shut down of economic activity.[70] It is cutbacks in things like retail shops cancelling garments orders in countries like Bangladesh which will force many into no income. Joblessness is set to soar as a result. The hardest hit will be sub-Saharan Africa, North Africa and the Middle East (particularly with oil prices and demand for oil falling). Such countries will require debt relief by the IMF and World Bank, which they plan to offer.[71] The UN has said $2.5 trillion will be needed to support developing countries through the Covid-19 period.

8. Delays in foster care and adoption putting vulnerable children at greater risk.

9. There will be a huge number of backlogs of all kinds in a lockdown situation and dealing with them will require good housekeeping practice by organisations and people will need to be more patient as these delays will cause further knock-on impacts: in retail orders which will have got stuck in the provisioning process due to closure of shops; outpatient clinics will have been postponed as the NHS prioritises Covid-19; applications for things will be put on hold; building work suspended and delay to software developments etc. Backlogs will also mean there will be issues in getting back to normal life after the lockdown.

10. It is likely that agricultural farming will be hugely impacted because of travel restrictions preventing seasonal workers from abroad coming over to pick fruits and vegetables. This could lead to poor yields and price increases.

11. Work has gone remote, with more people working from home than at any time in history, but that will also bring its challenges on cybersecurity and the pressures of squeezing work mode into the home space. Homeworkers could take the following steps to become more secure[72]:

    - Home networking – making sure there is a good password on the wifi and the router
    - Put VPNs on desktops and mobile devices
    - Making sure the latest OS and application updates are installed on all devices
    - Keep the kids away from work computers
    - Keep the entertainment away from work computers

12. The longer people are confined to their homes means there is more likely to be an upturn in domestic issues between couples with the vulnerable and at risk women and children mostly impacted. In fact The National Domestic Abuse Helpline has already reported a 25% increase in calls for help since lockdown on 23 March.[73] Other charities have also seen similar rises. The anxieties and pressures of job losses, pressures of children at home, restriction of freedoms and perpetrators already using isolation "as a tool of control" will all escalate domestic abuse, as reported by charities likes Refuge. For information and support on domestic abuse, contact:

    - Police: 999 press 55 when prompted if you can't speak
    - Refuge UK wide 24-hour helpline: 0808 2000 247

[70] See: https://www.theguardian.com/world/2020/apr/09/coronavirus-could-push-half-a-billion-people-into-poverty-oxfam-warns.
[71] See: https://www.imf.org/en/News/Articles/2020/03/25/pr20103-joint-statement-world-bank-group-and-imf-call-to-action-on-debt-of-ida-countries.
[72] Provided by Mikko Hypponen, Chief Research Officer at F-Secure, to a live global audience of 1700 people on 1 April 2020.
[73] *Coronavirus: Domestic abuse calls up 25% since lockdown, charity says*, https://www.bbc.co.uk/news/uk-52157620, 6 April 2020.

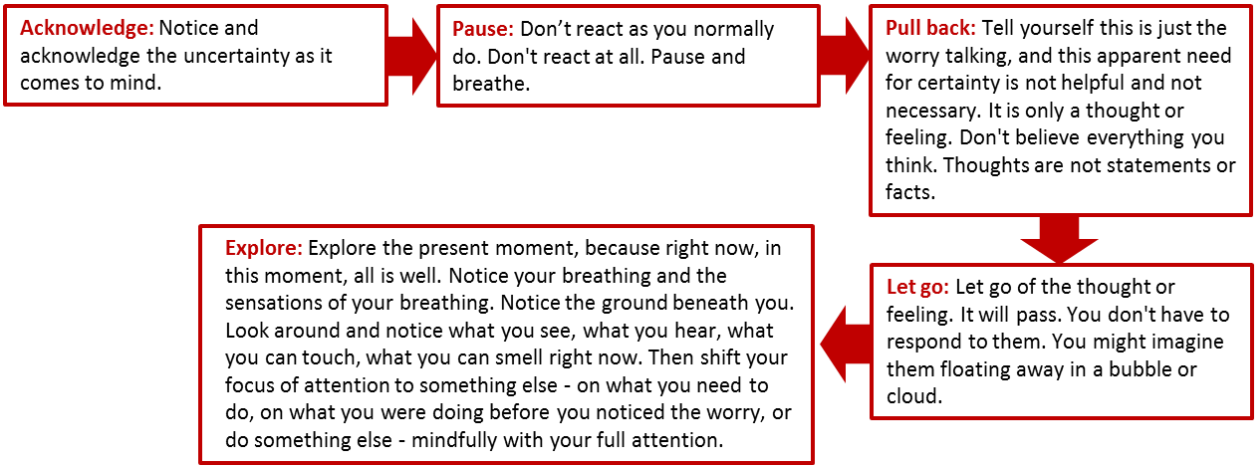
13. With the closure of gyms and swimming pools many people will become more restless at home with withdrawal symptoms or struggling to adapt to a different fitness regime that doesn't involve the ritual of going to the gyms or swimming pools. People in this situation should look to do exercise at home.

14. Fear of Covid-19 contagion may be changing our psychology and causing some people to behave in unexpected ways, more conformist and tribalistic, and less accepting of eccentricity for example. This is known as "behavioural immune system" and can lead to such things as opposing immigration[74] or being harsher to people who are seen to flout rules.

15. There is also the risk of information overload and constant supply of bad news, related to the outbreak, job losses, anxiety of not being able to meet and share time with other people in person etc. To help with some of this the WHO provided the following guidance for protecting mental health during the outbreak, which included the following:

    - Avoid watching, reading or listening to news that could cause you to feel anxious or distressed
    - Seek information mainly to take practical steps to prepare your plans and protect yourself and loved ones
    - Seek information updates at specific times during the day once or twice. The sudden and near-constant stream of news reports about an outbreak can cause anyone to feel worried

Others such as AnxietyUK use an "Apple" technique to deal with anxiety and worries:



The below schema provides a good way of thinking about Covid-19, and utilising this time of isolation to grow and appreciate the things in life that one can be grateful for.[75]

[74] See: Lene Aaroe *et. al.*, *The Behavioral Immune System Shapes Political Intuitions: Why and How Individual Differences in Disgust Sensitivity Underlie Opposition to Immigration*, American Political Science Review (2017) 111, 2, 277–294.
[75] Thanks to Zahra Shah via LinkedIn, co-founder of Seers, for this schema.

Differential impact on people

While it's right to say that the pandemic will impact the powerful and rich simply because viruses don't discriminate, there will absolutely be big knock-on impacts which will be a differentially experienced by people depending on their particular circumstances, as well as aptitude to adapt. See here for a comprehensive view: https://seneddresearch.blog/2020/04/15/coronavirus-equality-issues/. A few have been summarised below.

- People who have lived relatively simpler social lives will feel less impacted socially. People with busier social lives and especially if they're dependent on it for personal meaning (or preoccupation), the more challenging it will be or them to cope with lockdown and social distancing. But in both cases, it will also depend on the individual's ability to adapt and come to terms with the new situation.

- The vulnerable in lockdown are primarily the elderly and those with health conditions will be more anxious about keeping the virus at bay. As will many pregnant women in later stages of their pregnancy, who will be anxious about the availability of NHS services.

- People from BAME backgrounds, particularly if they are from London or the Midlands are likely to be disproportionately impacted. This is because, taking one example, London (which has the largest number of infections) has a 40% BAME population, meaning there is greater risk due to overcrowding and intergenerational households containing elders, with increased prevalence of diabetes and heart disease, lack of Vitamin D etc.[76, 77] The challenge of self-isolating if one member of the family catches Covid-19 will be immense and perhaps impossible in the same house with elder parents or grandparents. BAME people are also more likely to be impacted by the economic fallout of Covid-19.

- The lockdown will hit the young much harder than the rest. "That's true of those missing out on education, of those leaving school or graduating and looking for a first job and of those already in employment. The under-25s are two and half times as likely as those aged over 25 to work in a sector

[76] See: Data from the Intensive Care National Audit and Research Centre (ICNARC) which suggests that 35% of critically ill Covid-19 patients are from BAME backgrounds looking at 2249 patients in critical care units: https://www.icnarc.org/About/Latest-News/2020/04/04/Report-On-2249-Patients-Critically-Ill-With-Covid-19

[77] https://www.diabetes.co.uk/diet/vitamin-d-and-coronavirus

that has been shut down. The lowest-earning 10 per cent of workers are fully seven times as likely to work in such sectors as are the highest-earning 10 per cent."[78]

Good will support from the rest of society

There is no shortage of good will and acts of kindness by ordinary people, whether it is cooking food for NHS staff and other key workers or joining groups of 3D printing enthusiasts to create personal protection equipment like face shields etc. or providing shopping to neighbours and looking out for elderly people in neighbourhoods. Many companies have also sought to help in whatever way they can. EE for example has given unlimited data allowance to NHS workers until 9 October 2020. Amateur sewers across the UK have used their skills to sew scrubs for NHS workers. One war veteran of 99 years of age has managed to fundraise millions of pounds for the NHS by doing 100 laps in his garden. The list of charitable work is literally endless. Social media enabled people to reach out to likeminded people to form groups and to organise to get things done. Partly it's a sign of stoicism, collective spirit and human instinct at times of calamity. And partly it's about doing something useful when everything might feel hopeless as a coping mechanism with anxiety. The collective national ritual of clapping for the NHS at 8pm on Thursday's, verging on a cacophony of noise from hooters and banging drums in some places, is a symbolic show of appreciation and solidarity with nurses and doctors.

[78] Paul Johnson, *Huge ethical choices face those tasked with bringing the UK out of lockdown*, 13 April 2020, https://www.ifs.org.uk/publications/14806.

5. Exit scenarios and implications for global policy

Relaxing lockdown measures

Pandemics tend to last for 1 to 3 years. This was the case for the 1918 flu pandemic, as well as 1953 and more recently the MERS-CoV outbreak in 2012 and SARS-CoV in 2003. At this moment it's unclear if the public health emergency of Covid-19 will last more than a year. This is because countries have instituted strategies to control the outbreak, which, by the time of writing this paper, many countries have started seeing signs of bringing the pandemic under control, that is, they're seeing a reduction in the number of cases of new infections, and the effective reproduction number (the "R_t" value) is lower than 1.

The longer the lockdown remains, the more the pressure Government and society will be under to ease restrictions. This is because:

- The totality of collateral damage from prolonged lockdown (e.g. delayed treatment for other illnesses, economic crash, growing backlogs in all sorts of services etc.) may far exceed that of the Covid-19 directly
- As other countries ease restrictions (or the perception that they are), there will be growing pressure from the public and businesses to follow

Economists like Paul Johnson of the Institute Fiscal Studies have said that the longer the lockdown the more the number "of people who will die of other conditions over the coming months because the NHS is prioritising coronavirus patients. A lot of them will be elderly, the same group most at risk from coronavirus itself. They also will be disproportionately poor. More people will die in the years ahead as a result of the poverty, unemployment and mental health problems created by the lockdown."[79]

However, the flipside is that relaxing measures too early could slow down the time it takes to reduce the number of Covid-19 cases or cause a second wave of outbreak that could be harder to manage with renewed public messaging and the public feeling drained at the prospect of "here we go again." Other countries may not have significant issues in relaxing lockdown, for example if they have in place better testing and contact tracing etc., which may not be apparent to the UK public.

To help, the WHO has laid out sensible set of criteria for countries before relaxing measures and I urge the UK Government to work towards putting them place before relaxing measures.

1. Disease transmission is under control
2. Health systems are able to "detect, test, isolate and treat every case and trace every contact"
3. Hot spot risks are minimized in vulnerable places, such as nursing homes
4. Schools, workplaces and other essential places have established preventive measures
5. The risk of importing new cases "can be managed"
6. Communities are fully educated, engaged and empowered to live under a new normal

The Government has stated 5 tests of readiness before easing lockdown:

1. To make sure the NHS can cope by providing sufficient critical care across the UK
2. To see a sustained and consistent fall in daily death rates with confidence the UK is beyond the peak

[79] Paul Johnson, *Huge ethical choices face those tasked with bringing the UK out of lockdown*, 13 April 2020, https://www.ifs.org.uk/publications/14806.

3. Reliable data to show the infection rate is falling to manageable levels
4. There is enough testing and personal protective equipment (PPE) to meet future demand
5. Any changes in restrictions would not lead to a second peak

Exactly how long it will take to declare the pandemic over both locally in each country and on a global scale will depend on many factors.

Exit scenario will be a mix of different approaches

Below are broad strategies that outline the different exit scenarios for the public health emergency of Covid-19. The reality is that we will need a combination of all of the below strategies to come together to effectively eliminate the treat of Covid-19.

1. God does something out of His Wisdom (*Hikmah*), Power (*Qadar*) etc. which we cannot properly explain yet other than putting it down to "good fortune" that brings a stop to the outbreak or significantly reduces its impact. We can speculate how this could happen, for example in the theory of lethal mutagenesis for viruses based on error catastrophe theory.[80] There could be the possibility that the SARS-CoV-2 virus mutates in a deleterious manner, making progeny RNA viruses of lower fitness, eventually leading to ecological collapse of the population. While this has been achieved *in vitro* (in the lab) with some viruses, it is of course highly speculative, though not beyond the realms of possibility. It is also possible that we have good fortune and find a vaccine much more speedily than 12 months, or identify effective anti-viral drugs thanks to the sheer effort of thousands of scientists, clinical staff and pharmaceutical companies. It is also possible that the virus doesn't adversely mutate, making a long-term solution more effective and this pandemic becomes a one-off (as opposed to continuously mutating and we end up with pandemics every year). Similarly, there are countless more speculative schemes that we can propose by which God's help may manifest. We simply just don't know. But it is a way out of the pandemic.

2. The lockdown implemented in the UK up to the time of this paper is of course not as hard as China and not as soft as Sweden. One way the exit strategy could play out is to instigate a harder lockdown for a short period of say 2 or 3 weeks, further suppressing contact between different households, with food and medicine delivered to the doorstep of key workers, and longer term travellers from abroad are automatically quarantined for 14 days until the global pandemic is over. While a harder strategy will have many unintended consequences (e.g. deaths from delayed treatment to cancer patients etc.) it will drastically reduce the effective reproduction number (R_t) of Covid-19. However, a socially liberal democracy like ours in the UK will perhaps only consider more drastic measures if existing measures struggle to reduce the number of new cases, which isn't the case.

3. We selectively encourage the spread of the infection across healthy younger people and let their immune system fight it to develop herd immunity, while completely locking down for months on end the over 60s and those identified in the 1.5 million at risk, and quarantine foreign travellers automatically for 14 days. Some of these measures are already in play (e.g. shielding of the 1.5 million most at risk), but since we also have lockdown the development of herd immunity is slow. Herd immunity could be managed with a few cycles of "relaxing measures followed by lockdown" to allow for the spread of the virus whilst protecting the NHS's capacity to deal with more people being hospitalised when measures are relaxed. However, this exit strategy is yet unproven in the field. That is, herd immunity has never been socially engineered like this so it remains to be seen how long it would take to achieve this and the loss of lives or cycles of lockdown-relaxation disruption to society we

[80] Bull JJ et. al., *Theory of lethal mutagenesis for viruses*. J Virol. 2007 Mar;81(6):2930-9. Epub 2007 Jan 3. https://www.ncbi.nlm.nih.gov/pubmed/17202214

would have to endure. Moreover, this strategy may be highly controversial and ethically challenging, particularly if there are periodic spikes in hospitalisation numbers or acute areas of local community transmission or from deaths of people undiagnosed health conditions.

4. We develop a highly effective range of anti-Covid-19 drugs that kills off the virus at different pathological stages and works across patients with different underlying health issues. Alternatively, we develop a safe vaccine and immunise vast numbers of people (70%), which may take up to 2 years. Moreover, it will require vaccination centres to be set up across the UK and prioritising the immunisation of key workers and most vulnerable first as well as ensuring quick production and supply of vaccine across the UK and the world.

6. Lessons of Covid-19 as a "great awakener" of modern society and the basis for believers to argue for and do things differently in an ever-increasingly complex world

Covid-19 symbolism and imaginings

The Prophet of God said, "Do not wish for death, for the torment that the dying person experiences at the moment of death is too difficult to bear. Living a long life and being guided by God to turn to Him and repent is a sign of being blessed."[81] Even if the calamity is too colossal to bear, the general view is encapsulated in the saying of the Prophet, "No one of you should wish for death because of some harm that has befallen him. If he must wish for it, then let him say: 'O God, keep me alive so long as living is good for me, and cause me to die when death is good for me.'"[82] Such emphasis on life in Islam is undeniable. The imperative for the believer is to seek life and do one's utmost to sustain it. This spirit should run through the spine of believers jolting them into doing the right thing in Covid-19.

Covid-19 is exposing many things about the kind of society we live in. We've been reminded of the basic things that really matter in life, our health, family, having a sufficient income and essential food for example. It's also vividly showing us the futility of many things we nonchalantly indulge in that have no real meaning except to fill up our time. However, what we cannot disregard, as sadly many Muslim have, is that Covid-19 has also massively demonstrated just how finely and productively balanced global systems have been in modern times. Indeed that in spite of unmitigated risks and negatives in the modern global system, in conditions prior to Covid-19 mankind (*insaan*) wasn't somehow forsaken by God's compassion (*rahmah*) and loving (*wadud*) and generosity (*kareem*) even if we were guilty of appropriating the earth's resources like there's no tomorrow.

We've seen such things when for example Western countries cancel clothing orders from places like Bangladesh triggering huge knock-on impact on thousands of garment factory workers who face the prospect of going without an income and possibly starvation. Whether that happens or not is of course another matter, especially given that God provides for people in ways we may not perceive. But the point here is that God's compassion for garments factory workers in recent decades was at least partly built into global systems of trade and outsourcing. Closer to home, we've all enjoyed stability and creature comforts of our homes with thick carpets, unlimited supplies of drinking water, temperature-controlled air, video-on-demand, automated machines and internet connected devices, modern medicine and food from around the world. All of this is from God's bounties upon us, from his compassion and generosity. Thus, as believers we ought to recognise the intrinsic value of things, as they happen at both times of ease an difficulty. And when especially in difficulty the tendency to scorn or disregard can be a sign of ingratitude to God for the good times.

That said, as our lives been upended Covid-19, there is a strong in-the-moment anxiety to imagine a post-Covid-19 world as being a different one to the one we've known. But of course imagining and being prepared to make the sacrifices or to put the hard work in to get there are entirely two different things. It's not surprising that, much like ordinary people, many analysts have also started contemplating aspects of a post-Covid-19 world. This is not surprising. We're experiencing a glimpse into a different kind of world, seeing, for example:

- The growth in homeworking
- Shut down of non-essential life and work

[81] *Hadith* reported in the Musnad of al-Ahamd.
[82] *Hadith* reported in the al-Bukhari and Muslim.

- Reduction in our consumption of frills and entertainment
- Spending more time in smaller spaces between spouses, kids and elderly
- The lack of vehicles on our roads giving new vitality to the air and skies in cities across the world. All cities in the UK have seen a >40% reduction in air pollution (nitrogen dioxide) for example.[83]
- Nature and ecosystems are thriving unimpeded by human bludgeon
- Despite our lack of personal freedoms and increased levels of stress, we're realising that we need greater co-operation between people, governments and institutions locally and globally so that we can act as a collective system in the best interest of human survival

Yet despite the commotion, the world continues, and it does so in a reality where it's now our turn as human beings to take the stresses of earthly life and not nature. These glimpses have been an eye opener propelling us into introspection and rethink. Whilst tragedy will hit us on a personal level, for human societies Covid-19 can be a great blessing – and I don't apologise in saying this nor say it lightly. Because, if truth be told, it may actually take something catastrophic in global and systemic disruption to force many of us to pause and at least contemplate how we shape the world we live in. For now, it's poignant that viruses as the smallest "life forms" are doing this, and doing so in the observable world such that we're able to see for ourselves.

Will the changes stick? Yes and no

As of 14 April 2020, over 125,000 people have died from Covid-19 worldwide. In responding to Covid-19, we've had to reshape society and disrupt daily life. This has included holding education children's are now derailed by shutdowns, and triggered massive losses for big and small businesses, and forced millions of people out of work. The big question is, will we as a society go down a "new normal" path, one that isn't just about adapting to the risk posed by not having a viable vaccine against SARS-CoV-2, but also learning the lessons taught by Covid-19 to bring about lasting change and betterment of societal systems?

Sentiments on social media show people longing for a return to the life before Covid-19 lockdown. Naturally, many people have scrambled to protect their assets. And studies in behavioural psychology have shown that we're generally unwilling to sacrifice lifestyles that, through our own agency and social structures, we've intertwined with our sense of identity, comfort and growth. For many people the disbenefits of Covid-19 have been far too painful in the short term to drive changes to behaviour. Losing one's livelihood, for example, means our immediate attention isn't likely to be on how we make the world a better place, but about securing an income. Yet, it is by the very experience of losing our job that we become better placed to see how aggressive capitalist organisations create employment vastly favouring their own needs (zero hour contracts, lack of employment protection etc.) whilst being super-ready to sack workers at the first sight of trouble, in spite of Government support and low interest rates.[84]

It's not just economics at play. For many of us breaking ingrained lifestyle choices, consumption and entertainment isn't going to be something we jump to, and for what end? Our sense of escape hasn't changed. We still want to go on that holiday to a remote island to get away from the stresses of life. We still savour having a great night out and eating the best food from around the world. We still want to enjoy the latest gadgets and technology. And we're not looking forward to the eerie feeling seeing less people on trains and more stories of joblessness and inequality.

However, some changes will stick. There will be an increase in homeworking, more meetings held virtually, and more distance learning etc. These trends have been with us for some years and Covid-19 has more

[83] Anna Khoo, *Coronavirus lockdown sees air pollution plummet across UK*, 8 April 2020, https://www.bbc.co.uk/news/uk-england-52202974

[84] *Bank of England boss: Don't fire people because of pandemic*, https://www.bbc.co.uk/news/business-51943095, 18 March 2020.

vividly brought the experience to more people and accelerated their adoption. There will also be other trends like some non-essential work will not return as companies will look to offload them especially as they will look to recover lost earnings and manage cash flow issues in the short term.

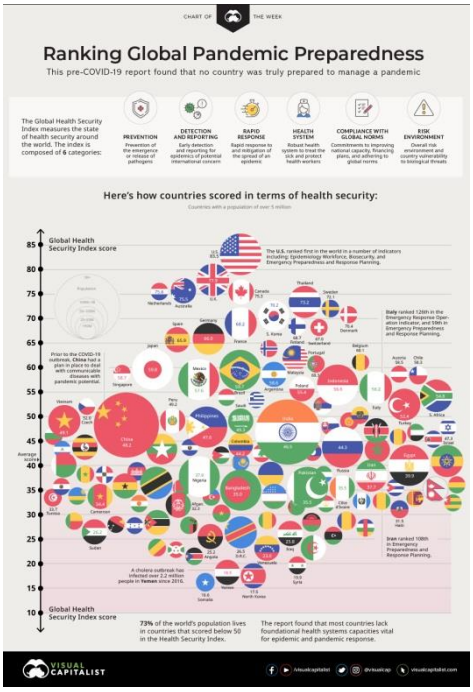
But fundamental rethink in how we do society and socio-economic and political processes isn't going to come as easily as we might think, particularly because of our instinctive drive for short termism and to get back that lifestyle that we've had the in the past kicks in. This was the case after the pandemic of 1918. This is why it's important to have some overarching ideas that we should all ponder on and look at ways to achieve. I have listed some of the most pertinent ones linked to our experience of Covid-19.

Meta-lesson for new directions – pertaining to "what our hands reap" and "corruption in the land"

1. We should seek tight global regulation of live animal markets

- Buying and selling animals for captivity (and those unlawful for consumption for Muslims) is prohibited in Islam and unregulated movement and trade are outlawed in the UK too.
- Most new animal-to-human diseases in recent decades have emerged as the result of human activities pushing wild animals into closer contact with humans and increasing the risk of transmission. These markets need to be regulated through global standards, including standards for cleanliness and not promoting the illegal trade of wild animals.
- In the past, tight regulations came into the UK following the outbreak of BSE in the 1990s (linked to the practice of feeding meat-and-bone meal to young calves) which caused vCJD (a brain disease, also known as "Prion disease") in people, which led to the EU banning UK beef for 10 years.
- MERS also came about in 2012 due to poor practice with camels in Saudi Arabia, and the current outbreak of Covid-19 is widely thought to have originated in animal markets in China, as did the SARS-CoV outbreak in 2002.

2. We should push for global pandemic control measures



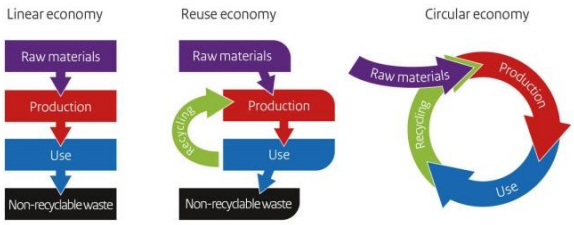
- A report chaired by the John Hopkins Center for Health Security for pandemics caused by high-impact respiratory pathogens in September 2019 for the Global Preparedness Monitoring Board (GPMB) found that no country was adequately prepared, including the UK. The recommendations for capabilities and gaps need to be taken up with greater urgency in the UK and across the world in the aftermath of Covid-19 for better preparedness for future cases.[85] This includes the lack of PPE equipment, ventilators and plans for controlling outbreaks of different diseases etc.
- Politicians should ensure that the Coronavirus Act 2020 time expires and doesn't dilute pre-existing protections, safeguards and civil liberties.
- Similar to regulation to ensure resilience in the banking sector following the Credit Crunch, new legislation should be introduced for critical national infrastructure companies to deal with pandemics.
- Since Covid-19 has given us in rich Western societies an experience of what outbreaks of diseases can do, we should step up and form proactive initiatives to help the fight against infectious disease such as malaria, diarrhoeal diseases, tuberculosis, hepatitis, ebola etc that kill millions of people each year in poorer countries.

3. We should reduce consumption and waste

- Unnecessary use and wastage of anything is prohibited or highly discouraged (*makruh tahrimi*) in Islam.
- Almost 80% of our waste material comes from things we buy from abroad. The throwaway culture is based on many factors including poor product design/utility, our wantonness, fear of missing out (FOMO), the ubiquity of cheap products, global delivery capability, advertising culture, and a perception of plentiful supply. However, as a "system of consumption and waste" this kind of behaviour shows an incredible disregard for nature and future generations.
- We should seek to bring voluntary codes of practice and laws that incentivise companies (e.g. through tax breaks and funding) to right size portions of food and design products that are not one time use or involve throwaway materials.
- On the individual level, Covid-19 has shown that we can abstain from unnecessary purchases, that we can avoid overindulging on food and finish food that we buy and be more disciplined as consumers, all of which are crucial to avoiding the personal responsibility towards reducing wate and fulfil modern practice of abstaining from the world (*zuhd*)

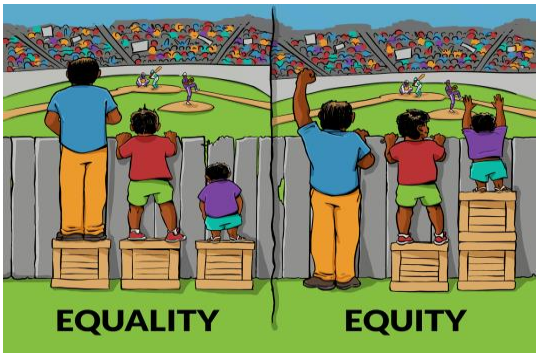
[85] https://apps.who.int/gpmb/assets/thematic_papers/tr-6.pdf

4. We should accelerate transition from linear to circular economy



- A "circular economy" is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.[86] Governments should bring voluntary codes of practice and laws that incentivise companies (e.g. through tax breaks and funding) to have a more sustainable and greener economy.
- As individuals working in manufacturing and other product selling companies we should leverage influence and build business cases to ensure companies take responsibility for production and end of life product recycling
- On a personal level we must support initiatives in business, government and academia that is working to build a framework for an economy that is restorative and regenerative by design.

5. We should redefine equality and equity and create socio-economic policy based on it



- Covid-19 is likely to impact the less well-off more and increase inequality to the level that we will see more poverty. However, as has been shown, it is possible even in a conservative management of the economy for greater directed government intervention in order to hold society together.
- As believers we need to shift the thinking on this and propose a more intelligent way of looking at how we do opportunity and inequality in the UK. The *Qur'an* and its living example in Prophetic life provides a rich source of guidance in this which we need to find a way of bringing into the picture through robust and emotionally intelligent arguments, and crucially do it in a manner that inspires and unleashes the potential of those in power and wealth to feel that they want to do it and be part of the solution. One way is to join with existing initiatives, but there is also merit in forming new projects.
- This includes proposing new socio-economic model of how we think about "growth" (beyond materia/economic terms), how we distribute wealth that helps those less empowered, and incentivises innovation and success based on wider society's well-being.

[86] See: Ellen MacArthur Foundation, https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy.

6. We should seek to enhance global co-operation

- Covid-19 has shown that the basic building block of political authority is still the nation state. With borders closing in an effort to control the outbreak and focussed local communities to look after local issues and local hospitals and staff etc. it has provided much needed correction to runaway globalisation. However, international co-operation is still vital since the interconnectedness of the world is so vast that on many things unless the world acts together in unison it will lead to catastrophic events and impacts that are felt far beyond borders.
- Protecting natural ecosystems, being careful with new technologies, growing environmental resilience, poverty alleviation and economic security, etc. all need global co-operation on mutual terms.

7. We should seek a new social settlement for workers in public services such as the NHS and social care

The Conservative Party manifesto at the 2019 General Elections had a funding shortfall for the NHS. Since then Covid-19 has forced the Government to write off NHS debt. This needs to be followed up with:

1. Real terms increase in NHS spending (funded by an increase in contribution by those on higher incomes only)
2. Nurses training debt should be written off and grants for trainees should come in line with teacher training grants
3. Make one-off appreciation payments to: medics; nurses; diagnostics support staff; and social carers for their frontline work in tackling Covid-19
4. Enshrine into law above inflation annual increase in NHS workers' pay for the next decade, and also those working in public sectors (funded by an increase in contribution by those on higher incomes only)

8. We should ramp-up investments in research into health and social well-being, and technologies that solve climate crisis

- We are now living through what is widely recognised to be the 4th industrial revolution, providing an opportunity to redesign and shape the world around us for more sustainable, healthier and ecologically friendly living. We must think about how we can do this and support initiatives.
- This includes Government support, greater levels of courage by companies, industrialists and philanthropists to be bold, and citizens to encourage/apply pressure to those who can make a difference.

Wider reflections

A comment falsely attributed to Bill Gates reminded us of some of the realities of Covid-19, which we have the choice of embracing and seeing as a corrective to society versus seeing as a great disaster. The thoughts, summarised below, reflect the ethics involved in Covid-19 in terms of demonstrating "what really matter in life" and the lessons we should take.

1.	It is reminding us that **we are all equal**, regardless of our culture, religion, occupation, financial situation or how famous we are. This disease treats us all equally, perhaps we should to. If you don't believe me, just ask Tom Hanks.
2.	It is reminding us that **we are all connected** and something that affects one person has an effect on another. It is reminding us that the false borders that we have put up have little value as this virus does not need a passport. It is reminding us, by oppressing us for a short time, of those in this world whose whole life is spent in oppression.
3.	It is reminding us of **how precious our health is** and how we have moved to neglect it through eating nutrient poor manufactured food and drinking water that is contaminated with chemicals upon chemicals. If we don't look after our health, we will, of course, get sick.
4.	It is reminding us of **the shortness of life** and of what is most important for us to do, which is to help each other, especially those who are old or sick. Our purpose is not to buy toilet roll.
5.	It is reminding us of **how materialistic our society has become** and how, when in times of difficulty, we remember that it's the essentials that we need (food, water, medicine) as opposed to the luxuries that we sometimes unnecessarily give value to.
6.	It is reminding us of **how important our family and home life is** and how much we have neglected this. It is forcing us back into our houses so we can rebuild them into our home and to strengthen our family unit.
7.	It is reminding us that **our true work is not our job**, that is what we do, not what we were created to do. Our true work is to look after each other, to protect each other and to be of benefit to one another.
8.	It is reminding us **to keep our egos in check**. It is reminding us that no matter how great we think we are or how great others think we are, a virus can bring our world to a standstill.
9.	It is reminding us that **the power of freewill is in our hands**. We can choose to cooperate and help each other, to share, to give, to help and to support each other or we can choose to be selfish, to hoard, to look after only our self. Indeed, it is difficulties that bring out our true colours.
10.	It is reminding us that **we can be patient**, or we can panic. We can either understand that this type of situation has happened many times before in history and will pass, or we can panic and see it as the end of the world and, consequently, cause ourselves more harm than good.
11.	It is reminding us that **this can either be an end or a new beginning**. This can be a time of reflection and understanding, where we learn from our mistakes, or it can be the start of a cycle which will continue until we finally learn the lesson we are meant to.
12.	It is reminding us that **our true work is not our job**, that is what we do, not what we were created to do. Our true work is to look after each other, to protect each other and to be of benefit to one another.
13.	It is reminding us that **this Earth is sick**. It is reminding us that we need to look at the rate of deforestation just as urgently as we look at the speed at which toilet rolls are disappearing off of shelves. We are sick because our home is sick.
14.	It is reminding us that **after every difficulty, there is always ease**. Life is cyclical, and this is just a phase in this great cycle. We do not need to panic; this too shall pass.

7. Advice on spending time at home and isolation with children off school

The following is guidance was provided by Shaykh Mohammed Nizami for children being off school which he articulated in a live webinar and later send out notes.

For parents	Time management	Curriculum and overload	Focusing on positive psychology
Take the pressure off - you're not home schoolers or teachers, these are extenuating circumstances.	You don't need to reflect school hours. Home learning is far more concentrated, a few hours is enough.	If the school is teaching online, you don't need to exponentially add to it just because the kids are at home.	Love, patience and kindness are the greatest emotional tools to get the best out of them. But this also requires self-training and cultivating healthy ways to show these emotions.
Look at the positives of this situation. Use this time to cherish the moment and enjoy your kids.	It's better to do little and often.	If a child doesn't get something leave it, there's no rush. You can revisit it later. And often it's not the child but the method of delivery.	You don't want the home to become uncomfortable for your child, or sterile as if it were a boarding school. Be sure to maintain the nature of the home as being a safe-space and a place of warmth and comfort.
Schooling can be overwhelming, keep it simple. You're not home-schooling *per se*, you're filling a temporary role.	Younger children can be done in 15-20mins slots, 2-4 times in the day.	Stressing doesn't help the learning environment. It gets toxic and quite destructive. If you're feeling frustrated, end the session and come back to it later when you're in the right frame of mind.	Using ambiguous praise such as telling them they're clever can be unhelpful. Be specific and tell them what exactly you're praising them for: "well done, you worked very hard today, and put a lot of effort in."
Know yourself: everyone's situation is unique. Don't burden yourself with what others are doing. Don't feel inadequate.	You don't have to do all of the kids simultaneously or on the same day.	There are load of decent and cheap study-books/workbooks on Amazon that they can work through (CPG, Collins etc.) on various subjects and at varying Key Stages.	Kids need exercise, and yes their destruction of the furniture whilst bounding off the sofa and table will be particularly testing. But the circumstances dictate that it just has to happen. Children will need to burn some of their energy (or they'll explode!), remember to get them some exercise and fresh air (away from people of course).
Don't try to keep up with home schoolers, and take their advice loosely. You're not the same.	When it comes to memorising Quran or anything that is cognitively demanding, arrange it for the morning when mind is fresh. Again a little and often is key.	It's not all rote learning. Collect scrap paper and boxes, and give them some glue/sellotape - they'll work wonders. Other things like lego or threading beads develop fine motor skills and creativity.	
Being constructive doesn't mean book work or pen to paper. And besides screen time, it could be arts and craft, or other creative activities (role play etc.).		Screen time can be productive if used mindfully. There are loads of educational videos on YouTube. But keep it limited and earlier on in the day as late viewing messes with their circadian rhythm and sleep patterns.	
Use it as a time to train them in domestic skills, boys and girls - cooking,			

cleaning etc. Give them duties
Use older siblings, it'll train them to cultivate and nurture others!
Partners can discuss their strengths and weaknesses and divide sessions based on these, where possible.
Ramadan will also slow things down so it's good to account for it. Planning for Ramadan now will help the kids to get on independently. You can set them challenges, like reading 6 books within the month. Use incentives!

8. Early responses in Muslim communities

On the question of mosque closure

The earliest alerts about the dangers of Covid-19 focussed on the question of whether congregational prayer at mosque should be stopped to prevent the spread of Covid-19 and in particular to shield the elderly (and infirm with diabetes and cardiovascular disease etc.) who most frequent mosques from falling sick. These alerts initially came from individual Muslim medics on their personal social media channels. It wasn't until the Muslim Council of Britain (MCB) statement on 16 March that the impacts of Covid-19 on mosques were better realised. However, the MCB's lack of deeper connection with mosques and imam organisations meant that coordinating a collective mosque response was very challenging. Partly this was because consultations between individual members of the MCB with wider Muslims leaders and organisations happen in small groups, often cohorts that always work together – in this case Muslim medics (BIMA), and there is historically a general lack of co-operation and co-ordination between imam and religious groups and politically-active bodies that seek to represent them like the MCB.

While the MCB was focussed on shutting congregations down on public health grounds, those running mosques had more considerations to factor in. What didn't help the MCB make the argument clearer was the lack of understanding of how contagious Covid-19 was and why the government hadn't yet proposed more stringent delay measures like school closures. These points were valid questions being asked in wider society, and simply asking mosques to close thus needed better deliberation and communication. Other considerations included:

- The theological rationale for closing mosques
- Managing the expectations of mosque-goers who attend prayer every day who use the mosque as a place of solace and community
- Managing the wider activities that mosques do such as those linked to schools, mortuary and welfare activities – each of which is an integral part of the range of services mosques carry out. More recently, with the lack of planning in the way mosques have shut there is now a shortage of funeral facilities around the country impacting burial service even for non-Covid-19/normal deaths
- Buying time for putting in place virtual spaces to keep communities informed about deaths and religious sermons

Some of the early actions taken by imams and mosque groups were sound, and reflected wider thinking around containment. For example, MINAB, Wifaqul Ulama and the British Board of Scholars and Imams (BBSI) jointly recommended that anyone ill with a temperature or cough, or at high risk of falling ill such as the elderly or those with cardiovascular diseases, should pray at home. They also limited the time anyone could spend in the mosque and asked everyone to make ablution (*wudu'*) at home. These organisations also held daily conference calls to monitor changes in circumstance and measures announced by the Government. However, a couple of important points are worth making here:

- It is fair to say that like the MCB, the reach of these organisations is limited and ultimately decisions were made locally by mosque committee members. Whilst this meant that congregations were stopped at varying times, by the time the Government announced shielding measures, the overwhelming majority of mosques had closed. Further to that, once the Government clarified that all places of worship should close (23 March), any remaining places did so. Overall, whilst chaotic and not without public recriminations particularly of mosques in Leicester (which continued to hold large *Jumu'ah* congregation unlike most mosques elsewhere), Muslims did well on this, compared

to, for example, Sikh and Christian places of worship. It is good to see that the MCB and mosques have continued to hold regular community briefings.

- There was at least one *fatwa* which very poorly argued for mosques to remain open asuusual, which was rightly rebuked.[87]

Charity responses

The National Zakat Foundation (NZF) was first of the big charities to respond Covid-19. No other organisation was able to so quickly facilitate a nationwide support for Muslims, specifically the provision of cash grants to meet the interim lack of support from Government (see earlier), and represents an excellent example of an organisation that has focussed on building networks of people across the UK making it much more resilient to respond to everyday hardship in a public health emergency (Covid-19) in as much as one-off tragedies like Grenfell.

Some mosques, faith-centres and Muslim-run radio stations have also organised themselves more locally to buy food and offer services for people in need. This has only been possible where there are existing networks and teams doing some kind of regular charity work. Other organisations like mental health groups have also combined resources.

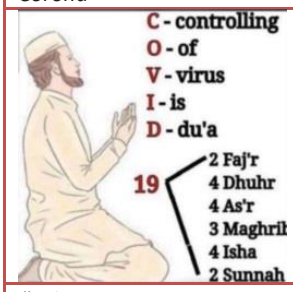
Disinformation and hysteria

In a public health crisis disinformation about poor theology has been widespread. This has a tendency to damage ordinary Muslims from understanding God and having a secure understanding of God's account of reality as well as causing unnecessary hysteria and panic. Unfortunately with Muslims hooked on social media, disinformation and hysteria will remain with us for quite some time beyond Covid-19. One reason why it gets so far is because WhatsApp groups and private social media groups often don't have rules and people actively don't manage them.

Below are some helpful points on how one can spot when news is fake[88]:

[87] Mohammed Nizami, *Should mosques remain open for congregational prayer? Countering a poor fatwa*, http://nizami.co.uk/should-mosques-remain-open-for-congregational-prayer-countering-a-poor-fatwa/.
[88] Adapted from a European Union publication.

Below are some examples of disinformation:

Examples of viral religious disinformation on social media	Fact check/analysis
"Today all the Muslims in UK will give azan at 8 pm. They all will step out of their houses, from windows or in yards to make a call in support of all the countries fighting for coronavirus and seek forgiveness from Allah for our sins and pray to Him to open His door on us. Please forward this msg to all your Muslim contacts as soon as possible. And don't shy to participate as this is the time to awake Islam not only in our hearts but also to indulge non Muslims. Please stand for Islam, stand for yourself. JazakAllah"	This was a facile political act attempting to copy the orchestrated rendition of azan across flats in Spain a week prior. Turning to God at times of calamity by a publicity stunt of mass chorus of the call to prayer is not what the Prophet taught, which was to pray *salat*, taken means to protect oneself, giving more in charity (*sadaqah*) etc.
"Dear humanity, *[…] I'm the one who has busied tyrannical governments from furthering their oppression of their Muslim minorities. I am the one who has humbled the pharaohs of the 21st century and snapped the spine of arrogance in every one of them. I am the one who closed the venues of alcohol, fornication, gambling, smoke and terrified every user of interest. I am the one who harasses the disbeliever behind closed doors as he now questions everything he ever stood for. I am the one who struck fear into the heart of every sinner and cornered him into regret. I am the reminder that moral decay cannot go without retribution. I am proud of this, I don't apologise for it, and shame on the hard hearts of humanity for needing me as their reminder.*[…] *Corona"*	This is poor theology, not least because many Muslims will die, and God tests all people, including Muslims with fear and loss, and God also gives divine respite to the whole of humanity on earth, which is why God is still compassionate even to oppressors on earth. Moreover, They cause cognitive dissonance for believers because many Prophets and Companions were also afflicted with plagues and viruses. In short, these messages are simply unhelpful stunts.
	Not only does this go against the necessity of observing social distancing to control the transmission of the virus, it also confirms a fatalistic mindset in some Muslims, that *du'a* alone is sufficient. The 2 Sunnah prayer units (*raka'at*) added here is purely arbitrary just to make the number of prayer units add up to 19.
"Salaam everyone. Just wondering if anyone can help out with something. I work in child protection and unfortunately we had 2 little Muslim boys come into care last night (1 year old and 2.5 year old). We are desperate to find Muslim foster carers so they end up in a culturally inappropriate foster care home. If anyone is keen to care for these young boys or knows anyone please ask them to contact below. Either registered carers or not,if you cant, can you please spread this msg through your networks. Thanks you. … Sister Ruqiyah."	This is a completely fake message (as confirmed by the Muslim Fostering Network, personal communication) that plays into the fears of some Muslims about the long-term shortfall in Muslim foster carers.
"The athiest who says 'why worship a God that I cannot see,' is now hiding in their home from a virus they cannot see!"	Statements like this are highly insensitive and provocative, and do nothing to offer solace and compassion to others, even if they hate religion, which is not the way of the believer.

9. The sound basis of the believer's *muhasbah* paradigm negates fatalism

Fatalism is the opposite of *muhasabah*

Fatalism emphasises the restriction of all experience to fate. This is the idea of an "inevitable predetermination" but predicated on what I argue here is a partially-formed understanding of theology and understanding of Divine providence (*Qadar*). Whilst the *Qur'an* does indeed remind us of exceptional tribulations at the end of times that occur which "none other than God can remove," (*Qur'an*, 53:58), for most situations, as the *Qur'an* states, "God does not change the condition of people until they change what is in themselves" (*Qur'an*, 13:11). That is, in the first instance it is within people's agency to bring about change, even if it seems small and of course whether people achieve the overall desired outcome or not is a different matter. In God saying this He is hinting at a deeper relational exercise for human beings to discover and engage in as the sources of remedy and direction of action. Had this not been the case, then you could argue there wouldn't have been any need for revelation, or any need to explain to people about anything, and certainly there wouldn't have been any need to act according to what we observe or perceive. But, as our own perceptions and experiences of the observable world directly tell us, there are laws of nature and human systems that require us to act knowing as much as we can about how, when and why we should act. In God using the word "*nafs*" to indicate both physical and metaphysical (beyond observable physical and social order) aspects of human beings (as opposed to just "believers") and directing His message to human beings, He is telling us that the observable laws, nature and order of the world applies equally to all people.

I want to focus on these concepts here because what we see in much of the active faith-identity mode within Muslim communities today is a "fatalistic mindset," which has unfortunately come to light even more with Covid-19. Where, the rhetoric of "turning to God" as supplication (*du'a*) is often seen as the only mode of the believer. That's even before any attempt has been made to understand the nature of the tribulation (*musibah*) let alone adopting a problem solving attitude. A "fatalistic mindset" means that believers are more likely to find themselves thinking that tribulations are only removed through sincere prayer and do not need accompanying action. In thinking in this way, believers often fall into a trap that, I would argue, only makes God's guidance less meaningful and more irrelevant. Without taking initiative to problem solve, human beings become a "stone," reduced to "dead matter," as Muhammad Iqbal (1877-1938) lamented.[89] Some scholars such as Muhammad Taha Jabir al-Alwani (1935-2016) note that through the ages Muslims began seeing things with a "fatalistic mindset"[90] by which they seem to be referring to the increasing influence in more recent centuries of fundamentalist thought (both the Salafi and the neo-Sufic strands) in the late 19th century, and the rather simplistic forms of Muslim Enlightenment apologetics which started to use social Darwinism[91] and Newtonian naturalism to explain everything in existence.

Being a "slave" (*'abid*) to God might imply to some that it doesn't entail responsibility. In a fatalistic mindset, effort to resolve existential challenges—in the "struggle against the schemes of one's ego, the vicissitudes of the world and the vagaries of both power and powerlessness"[92]—becomes irrelevant and distracting. Enlightenment thinking from Europe by the twentieth century aggravated the fatalistic mindset in bringing about confusions in the sources of authority in knowledge, brought about by a mix of introducing European education, the expulsion of the scholarly classes by secular elites, and the

[89] Muhammad Iqbal, *The Reconstruction of Religious Thought in Islam*.
[90] Taha Jabir al-Alwani, *Islamic Thought: An Approach to Reform*, IIIT, 2006.
[91] Social Darwinism is the theory that individuals, groups, and peoples are subject to the same Darwinian laws of natural selection as plants and animals, and was earlier used to justify political conservatism, imperialism, and racism and to discourage intervention and reform of human systems.
[92] Zaid Shakir, facebook update, 16 September 2014.

democratization of knowledge through print and modern media. Fatalism also grew out of learned helplessness and apathy as a way of coping with the sense of loss and lack of control. This latter type of fatalism is generally seen among rural communities (of any religion or faith system) as they are more severely impacted by natural disasters, and are generally less literate, and therefore have a more immanent and less sophisticated experience or account of wider reality. And it's perhaps not surprising to come across elements of it imported into the UK in some of the first generation elders who were from rural communities.

However, this is a far cry from what God tells us that we should be doing. Much of this can be corrected if we better understand from a systems thinking perspective, for example, if we understand in a more holistic way concepts such as *muhasabah*. It means "to take account" and at its core there are 3 interlinked ideas:

1. The warning from God that we should not become people who "love the immediate and leave the Hereafter" (*Qur'an*, 75:20-21)

2. That we must act in order to take our own account, "man will be a witness against himself" (*Qur'an*, 75:14), meaning our action or inaction will be used as a witness against us and so to avail ourselves of it we have to use our senses and act rationally with discernment inasmuch as use our hearts (emotional intelligence) to liberate ourselves. That is, our lived lives (and how we used our bodies) are a record used to liberate or incriminate ourselves, meaning God is just and does not accuse us of anything beyond our own being

3. That no bearer of burden shall bear the burden of another and that mankind shall deserve nothing except what it pursued/strived/earns with his own effort (*Qur'an*, 53:38-39)

Death and illness are inherent-to-life signs from God of our own earthly ends. The imperative is to get on with worldly life, living it as righteously as possible and seeking God's acceptance. As believers we recognise that everything that happens are signs of God, whether they're observable or not, and carried to their logical ends, they should remind us to spend our time on earth in righteousness: "We sent not the signs except to warn" (*Qur'an*, 17:59). *Du'a* is prescribed for believers to prove our own servitude to God and avoid falling into arrogance, "Call Upon Me and I will answer you! Those who are arrogant to worship God will enter Hell, humiliated" (*Qur'an*, 40:60). Of course whether we enter into hell or heaven has much more to it than is reflected in a simple reading of a single verse of the *Qur'an* which I don't intent to go into here and in fact we shouldn't take literal views since this is not how the Prophet explained revelation to us, and besides it is wholly counter-intuitive. There are many aspects of *du'a* which are beyond just the ritual. For example, it is in one sense similar to contemplating God's wondrous creation (*ayaath*) to affirm His existence; through *du'a* we seek to acknowledge God's provision. And, from a psychology perspective, it offers us a way of coping with stress, and helping us to solidify good intents and moods as we verbally express our desires, as a form of neuro-linguistic programming (NLP).

The other point to note here is that, God knows that human beings will be arrogant, but He has still promised that His "compassion prevails over anger" towards creation,[93] and God also maintains in the *Qur'an*, "We reveal of the *Qur'an* that which is a healing (*shifa*) and a mercy (*rahmah*) to the believers" (*Qur'an*, 17:82). This *shifa* and *rahmah* qualities of the *Qur'an* can be conceptualised (and not to reduce it to just this) as a type of engaging the world knowing its bounds as learnt from the *Qur'an* inextricably linked to human interactions (*shifa*) and taking account (*muhasabah*) of those interactions, and by doing so we unleash the mercy (*rahmah*) locked into the nature of the world. But both "knowing" and "taking account" entail acting with the perception of what God wants of us.

[93] See *hadith* (*muttafaqun alaihi*, agreed upon) collected by Al-Bukhari and Muslim, in which "Abu Huraira said that the Prophet said: 'When God completed the creation, he wrote in his book with him upon the thrown: Indeed my mercy prevails over my wrath.'"

God's ordered system of nature and phenomena

God has structured the physical world according to laws of nature and phenomena that operate and cause effects in their own relational terms. These laws or ordered systems (*nizam*) operate independent of, for example, whether we believe or don't believe in God or whether we take guidance from revelation or not. Taking gravity as an example of these laws of nature, it is a force that exists across the universe and is a consequence of mass. Because we know this to be the case with good certainty, it logically follows that we can predict the impact of gravitational force on things like motion and the shape of objects. This is because gravity itself has consequences. We can also go further and use such observable laws to define objects like "planets," for example, if they are spherically shaped (not irregular like asteroids), and this spherical shape arises as a result of gravity. Whether one believes in God or not or whether one takes guidance from revelation or not is completely irrelevant to the phenomenon of gravity which will operate on its own terms. The same can be said of viruses. Viruses infect according to conditions that support viral infection. Whether one believes in God or not or whether one takes guidance from revelation or not is irrelevant to the phenomenon of viral infection.

We often can't explain phenomena and then often skip our senses and reasoning and go straight into bad theology by claiming divine intervention solves our mistaken or limited understanding of phenomena. As if to suggest that mystical action is a cause of phenomena in the material world. Sometimes people attempt to bring intellectual salience by substituting the word "metaphysical" for "mystical," notwithstanding the fact that this is often done using people's sense perception, experience and intellectual faculties to interpret "mystical action in the world." However, on this point, my argument is simply that there isn't any need for convoluted attempts to bring phenomena into a rational viewpoint. Most believers get the point and accept that denying the existence of metaphysical activity (for example angels) is a form of *kufr* (disbelief), as it reduces existence to the physical world and activity to the observable. But substituting metaphysical for mystical is facile, as metaphysical is a philosophical and rational term for the non-physical, while mystical is a subjective term.

We know that God has ordered (*kun fa ya kun*) intrinsic causal relationships on earth, in the laws of physics, chemistry and biology etc. and that God commands us to probe, explore and discover His signs (*ayaath*) in the material world using our sense perception, experience and intellectual faculties. God speaks of precision (e.g. of the orbit of the moon in *Qur'an*, 36:40) and predictable, sequential dynamism (e.g. of the water cycle in *Qur'an*, 12:18) of natural systems in the *Qur'an*. Many sentences in the *Qur'an* such as "Do you not see…" (*alam tara*, *Qur'an* 29:31) also emphasise that our senses and intellectual faculties do provide real information about the world. Taking a "systems approach" to looking at phenomena it's possible to acknowledge that there are vast arrays of cause and effect relationships between direct and indirect variables in a highly sophisticated and well-balanced network of causes, effects and configurations of objects, time and space operating in the material world. By "systems thinking" I mean here, "sensitivity to the circular nature of the world we live in; an awareness of the role of structure in creating the conditions we face; recognition that there are powerful laws of systems operating that we are unaware of; a realization that there are consequences to our actions that we are oblivious to."[94]

Similarly, there are natural causes and effects in social, political and economic systems. For example, the universal principle of "doing good" applies to every sane human and demonstrates an innate level of moral intuition that can guide us to right or wrong in, at least, in the basic morals like killing and cheating etc. God points to this when He says that He "inspired it [the human self/sensory perception/cognitive function] with discernment of its wickedness and its righteousness" (*Qur'an*, 91:8). Of course that's not the whole explanation of morality and what constitutes "good action," which I don't intend to cover here, but the point is that there is a universal phenomenon of "doing good" which we perceive to be consistent and operates in all human beings to a degree. Similarly, we've created civilisation with societal norms and

[94] See: https://thesystemsthinker.com/systems-thinking-what-why-when-where-and-how/

understandings of mutual dealings because we understand their relational consequences in human systems. These human systems arise fundamentally out of our effort to manage our human nature, such as in meeting Maslow's hierarchy of needs, and in negative aspects of human character like envy (*hasad*), wantonness (*batar*), pride (*hasad*), showing off (*riya*), hatred (*bughd*), fear of poverty, heedlessness (*gaflah*) etc. as well as positive ones like selflessness (*ithar*), kindness (*lutf*), love, empathy (*ma'arifah*) etc. Just like the laws governing natural phenomena, the laws for human systems need investigating and research.

What this means is that we can conceptualise our perception of fate as:
Perception of fate = $\Sigma(G_t + E_t + S_t + C_t + M_t + X_t)_t$

Where: G = genetic predetermination, E = environmental influences; S = Social influences; C = constants in life (e.g. risks in everyday life, age, diseases, death etc.); M = multifactorial effect (the idea that the combination of each of the variables affecting each other as well as the sum of the other variables altogether will have an overall different impact); and X = unknown variables. Each of these factors will vary with time as denoted by *t* as well as the sum of all the variables interacting with each other will vary with time. As human beings we don't have the ability to perceive let alone control every variable nor can we extracting ourselves from the consequences of knowing the limits of the variables. This is why no matter how well we understand or perceive the world there will always be variables outside of human control or perception. The implication for the believer is that we will always be contingent on God (*tawakkul*) and the need for supplication (*du'a*) will always exist.

Once one conceptualises these things in a proper way a system, it should become clearer as to why God says that "none other than God can remove" (*Qur'an*, 53:58) for the end of times (Judgement Day) and that it could also apply to other tribulations too. That is, for other tribulations, the system of causation can become too complex and finely balanced that a human relational exercise to modulate things may be far too difficult or impossible. The greatest calamity will of course be the end of times, when the true reality of this statement of God will manifest. But we also have a view in Islamic thought the end of times draws nearer with the ubiquity of sin and heedlessness, and tribulations can be seen generally as being in a long line of litmus tests to see who amongst us will remain steadfast on truth. In this way, this sentence of the *Qur'an* can be taken to speak about compound tribulations before the end of times where the systems of causation are overwhelming.

Calamity and loss aren't necessarily punishments

The believer accepts that divine punishment can occur on earth through pain, loss, plagues and disasters, but that mankind has been given divine respite[95] (*imhal*) until Judgement Day (*Qiyamah*). We can infer this from many proof points (*adilla*) in the *Qur'an*.

1. The first proof is simply in the logic that God maintains a distinction of ultimate accountability and judiciousness that can only happen in the "court of God," Judgement Day, as it were. "Man will say on that Day [referring to the Day of Judgment], "Where is the [place of] escape?" (*Qur'an*, 75:10), meaning there was once a place of escape, which was on earth, where "God intended ease and not hardship" (*Qur'an*, 2:185). If that wasn't sufficient proof, then God spells this out, "And if God were to impose blame on people for their wrongdoing, He would not have left upon the earth any creature, but He gives them respite (*you-ukhir-hum*) for a specified term. And when their term has come, they will not remain behind an hour, nor will they precede [it]" (*Qur'an*, 16:61).

[95] See: Shaykh Arnold Mol's excellent article: https://www.academia.edu/36916673/_Divine_respite_in_the_Ottoman_tafs%C4%ABr_tradition_Reconciling_exegetical_approaches_to_Q.11_117_Osmanli_da_ilm-i_tefsir_ed._M.T._Boyalik_and_H._Abaci._Istanbul_ISAR_2019_539-592.

2. God's laws of nature and phenomena operating on earth do not distinguish between people on the basis of whether they believe or don't believe in God or whether or not they follow God's guidance. Earthquakes are a good example of this. God has made it necessary that the movement of the earth's crust is determined by the forces of plate tectonics, and that these plates would move in opposing directions to cause earthquakes. Under this condition, someone living on or near plate tectonic boundaries would be expected to experience earthquakes than someone who lives far from a plate boundary. But does this mean that those who take the pain of earthquakes by virtue of living near an active plate boundary are automatically to be perceived as "more sinful" (and "more" in comparison to whom)? The answer is clearly no. The same applies to someone being afflicted with a virus or flood.

3. Sometimes when we perceive something to be a punishment it is in fact the unintended (or intended) consequences of human corruption. That is, because of our lack of insight, negligence, moral corruption, greed or overstretches we create outcomes that bring on tribulation (*musibah*). That is, we've not been able to mitigate risks. God clearly says that human corruption from poor choices and blameworthy behaviours is at the root of many disasters that afflict human beings, "And whatever disaster (*musibah*) strikes you, it is for what your own hands have earned" (*Qur'an*, 42:30). Now, while we know that God is the source of all that happens, being focussed on how God in his essence (*sifat*) does things for us gets us nowhere beyond self-indulgent speculation about things that nobody can possibly know or prove since we cannot comprehend God's realm, and God Himself cautioned that no human mode of perception can fully grasp God, yet He encompasses all perception, and enables human beings to perceive (*Qur'an*, 6:102) and, "There is none like Him" (*Qur'an*, 112:4). Instead what we are meant to be doing is self-accounting (*muhasabah*) which entails taking responsibility for the variables that are within our control and choice, and on that basis perceiving the outcome insofar as our control over the variables, as the result of our own doing, knowingly or unknowingly, and simply part of what our "hands have earned." God's account of reality informs us of these. And of course, clarifying this further God holds us responsible only for what we bear which is fully known to God only and no one else (*Qur'an*, 2:286).

   Now, it is entire plausible to argue that Covid-19 is a reflection of "whatever disaster (*musibah*) strikes you, it is for what your own hands have earned" (*Qur'an*, 42:30), since God has laid a natural order to the world, it follows that if we transgress their limits we will face consequences. Let's take a couple of examples of diseases. BSE (or "mad cow disease" / bovine spongiform encephalopathy) was caused by the shoddy practice of feeding cows with feed contaminated with parts that came from others cows that were sick with BSE. Farmers engaged in this practice in the early 1990s to save on cost. But the result is that, as of 2019, 232 people have died from vCJD (the disease caused by eating BSE infected cows), almost all from the UK. Similarly, MERS came about in 2012 due to poor practice with camels in Saudi Arabia, and the current outbreak of Covid-19 is widely thought to have originated in wet animal markets in China, as did the SARS-CoV outbreak in 2002. It is entirely plausible to interpret these *musibah* as the result of what "our hands have earned." Of course what "our hands have earned" can also be positive things too like the ongoing repairing of the ozone layer as a result of world-wide ban on things like chlorofluorocarbons[96] or improved air quality in cities that have introduced vehicle emission restrictions etc.

   Equally, it is possible to perceive Germany as an outlier country with such low number of Covid-19 deaths despite having a relative higher number of infections (compared to other European countries). Fortuitously, a number of human variables have come together which has meant that the Covid-19 impact has been much lower in Germany than in other countries unlike in other countries e.g. a combination of extensive testing and self-isolation, high levels of trust in public institutions and government, demographics, health care resources etc. Now this good fortune of Germany could also be interpreted as a form of protection from God because, for example, Germany has helped refugees

[96] See: https://climate.nasa.gov/news/2916/the-atmosphere-tracking-the-ongoing-recovery-of-earths-ozone-hole/

more so than any other European country. Similarly, the question should arise, is God showing us the reality of global reduction in pollution levels, or slowing down environmentally unfriendly economic activity to decelerate the destruction of ecosystems and the environment?

When we take calamities as punishments, there is also distinction to be made between punishments from God as a result of our ingratitude (inner working of our *nafs*) about which God says, "And [remember] when your Lord proclaimed, 'If you are grateful, I will surely increase you [in favour]; but if you deny, indeed, My punishment is severe'" (*Qur'an*, 14:7) versus perceived punishment as a result of failure to work with the order with which the natural and human systems have been created.

4. God reminds us of stories of past peoples who were punished for their sins e.g. the people of Aa'd for arrogance and boastfulness, the people of Thamud for rejecting God, the people of Pharoah for oppression and cruelty, the people of Noah for taking false deity etc. However, the corollary to this, which most people forget, is that while some were indeed punished since they saw their plight as an affliction and resorted to crookedness of sorts—as God says "Do they not see how many generations before them did we destroyed…?" (*Qur'an*, 6:6)—others from the same communities, indeed families, who were also afflicted at the same time (with flood, disease etc.) were in fact elevated by virtue of how they responded to their plight. That is, they were patient, and continued with acts of righteousness (charity, kindness, forgiveness etc.) including living a broad view of righteousness (*salih*) in problem solving and making use of the plentiful blessings from God that they saw they were emphatically still blessed with, and got on with their lives or sought to make things better for others etc. This establishes the paradigm for believers, that whether something should be seen as punishment or not is entirely dependent on how as individuals we respond to them. If pain and hardship befalls us, yet we respond by being more God-conscious, could we perceive the pain as punishment or would it be a blessing, albeit in disguise? That's not to brush off the significance of the lived experience of pain and hardship of course, but the point is that our perceiving something as *bona fide* punishment from God is highly suspect. This is the *Sunnah* (way) of God, and how it was meant to be: "And among mankind is he who worships God as it were upon the edge (i.e. in doubt): if good befalls him, he is content therewith; but if a trial befalls him he turns back on his face (i.e. reverts to doubting and heedlessness). He loses both this world and the Hereafter. That is the evident loss" (*Qur'an*, 22:11).

5. The same pattern of thinking applies to the primordial (before earthly time) dialogue between the angels and God, "Will You place therein those who will make mischief therein and shed blood, human beings will cause bloodshed on earth?" (*Qur'an*, 2:30). However, God knew that despite bloodshed, he would also raise people of incredible virtue like the Prophets and many people will be guided and remain far from partaking in carnage or pillaging the earth. This is why God responded to the Angels saying: "I know that which you do not know" (*Qur'an*, 2:30)? The same pattern of thinking applies to many other aspects of Qur'anic dialogue, such as when God deplores the world (*dunya*) as a place of "amusement and diversion and adornment and boasting to one another and competition in increase of wealth and children" (*Qur'an*, 57:20). God saying this does not negate the possibility of people who despite the predispositions (or natural order) of the world will still stay away from indulgence. For whom, instead, the world becomes a place of patience, gratitude, good actions (*'amal*) and productive engagement etc.

6. In fact, believers should see *musibah* (tribulations, loss and pain etc.) as impacts that are on a spectrum that varies in intensity, significance and duration. By doing so, it is possible to see that micro-*musibah* (or micro-tribulation/loss/pain etc.) occur throughout the day and throughout our lives. A setback to a plan, for example, can be perceived as a micro-*musibah*. But that setback has the potential to make us rethink and change direction to something more effective perhaps or even allows us to fail fast before escalating our commitment to a plan that was ultimately doomed to failure or poor outcomes. This way of rationalising micro-*musibah* should be completely intuitive to God saying that, "He does not burden

the soul beyond what it can bear" (*Qur'an*, 2:286). Difficulties (*musibah*) generally pass with time – whether it's because we learn to cope better or become more resilient or find a solution or someone helps us out or it's just a temporary/seasonal effect. However, we must understand that the nature of the world is that before tests pass, they extract and expose worldly nature and character. They extract what we produce to counter it, and they expose what is deeper inside within us. What this means is that we must ponder on the lesson we should learn. If we do this properly, we stand a better chance of coming through tests, which will hopefully be that we become better people, more endowed with such things like compassion, generosity and responsibility. If we don't, then, either the opposite happens: we become bitter and crooked, as the *Qur'an* says, our "hearts remain locked" (*Qur'an*, 47:24) from perceiving God (these are cognitive and experiential barriers that prevent us from realising the Divine), because in one sense, even as believers, we remain "deaf, dumb and blind" (*Qur'an*, 2:18).

7. As believer's we accept the deeper meaning of God's saying, "…He does not change the condition of people until they change for themselves. It will have [the consequences of] what [good] it has gained, and it will bear [the consequences of] what [evil] it has earned" (Qur'an 13:11). This verse is hinting at multiple things such as a consistent order (*adda*) in the world, which requires human effort to perceive and investigate. Denying this implies that nothing can ever be known. God is also hinting that this consistent order of the world also reflects how He responds to our behaviour which materialises from our inner state (*hal*). Based on this, the majority of exegetes understood this verse as referring to God blessing or punishing people in relation to their inner state of their heart which may or may not be visible to the outer world. This is why it's important not to reduce the ways of the world purely to physical workings ("natural order"), especially when applying a systems approach, as much could be hidden and known to God only (metaphysical). This doesn't mean that the metaphysical is irrational (as the term mystical often implies).

8. The believer accepts that God tests believers with "…fear and hunger and loss of wealth and lives and fruits..." (*Qur'an*, 2:155). God also says: "And we have made some of you as tests for others" (*Qur'an*, 25:20). Our reality is like this because God in His Wisdom (*Hikmah*) has not only imposed rational order (*nizam*) in the physical world and human interactions but also made them necessary in our world. This means that they have natural relational consequence on us as human beings, which are intended to be a test for us. The believer accepts the nature of the world being bound to God's order that operate equally for all human beings irrespective of religion. Having belief in God doesn't necessarily avail one of such test as proved by the hardship faced by many Prophets and God directly rules this out for believers: "Do men think that they will be left alone in saying, 'We believe, and that they will not be tested'". (*Qur'an*, 29:2). To make this real, the Prophet gave a "realist account" of reality to the Companions:

   > "The Prophet drew a square and then a line in the middle of it and let it extend outside the square and then drew several small lines attached to the central line, and said: 'This is the human being, and this, [the square] in his lease of life, encircles him from all sides, and this [line], which is outside [the square], is his hope, and these small lines are the calamities and troubles [which may befall him], and if one misses him, another will snap [overtake] him, and if the other misses him, a third will snap [overtake] him.'"[97]

9. These "tests," the *Qur'an* explains, come about in order to differentiate "those who are truthful" who seek to remember God and strive to be patient, useful and upright etc. from "those who are false" (*Qur'an*, 29:1-2), who fail to strive and recognise God. The word for steadfast in Arabic is *istiqamah*, which is most similar to the Ancient Greek word *sophrosyne*, describing the idea of excellent character and soundness of mind, in a well-balanced individual with temperance, moderation, prudence, purity, decorum and self-control. This is the description of the one who remains firm upon being tested.

[97] *Hadith* in al-Bukhari.

10. We supplicate (pray *du'a*) to God in order to acknowledge our dependence on Him as all sources of all time, matter, existence and forces. This is the normative view of believers. We are of course not in control of all variables, and God of course has not required us to be so. In fact the prophet taught dispensations (*rukhsa*) to make things a little easier when things can get difficult to manage, such as when travelling or when sick etc. Not embracing these dispensations is a sign of arrogance, that we do not take the path of humility despite our obvious human weaknesses. The lack of control in determining outcomes is another reason why we seek help, protection and ease from God, and in doing so living the reality of being subservient to God (*'ubudiyyah*). God reminds us that, we "are dependent on God, and God is the Independent (*Al-Ghani*), the Praiseworthy (*Al-Hamid*). If He wills He could take you away and bring a new creation. And this is not difficult upon God" (*Qur'an*, 14:19-20). It doesn't mean that we should expect God's help to come in the form of some sort of miracle or in completely unexplainable phenomena. Thinking like this is inconsistent with having already acknowledged the possibility of other variables which we have admitted to having no control over despite our best efforts. If that is the case, as we claim it to be, it seems short-sighted to then perceive that God doesn't have a measure for those same variables that we claim are beyond us but which nevertheless operate in observable effects that we can perceive.

11. It follows that our supplications being granted or not should not necessarily be perceived with disparaging questions about "why isn't God listening?" as it were. God is independent of that, as all-Wise (*Al-Hakim*), all-Hearing (*As-Sami'*) and all-Knowing (*Al-Alim*), and if we look deeper it won't take long to see that God is in reality constantly fulfilling our needs whether we are conscious of them or not, or whether we can observe them or not.

12. It is evident that God provides for us from sources we could never imagine (*Qur'an*, Talaq:3). In just 120 years the human population increased from about 2 billion in 1900 to 7.7 billion (yes, we've added 5.7 billion people in 120 years), yet there is no real shortage of food (only faulty human distribution) and no one at the start of the 20th century could have imagined how this would be possible; it was simply beyond human capability and understanding at the time. A similar question now engulfs us with climate change and moving to more sustainable models of living. It is here that God is telling us to put our trust in God but in doing so we must do our utmost in pursuit of that goal. This paradigm operates inasmuch in our everyday life.

13. Similarly we often perceive failure or calamities as loss. Whilst it is natural to feel like that, it's worth remembering that God has informed us that (to paraphrase) "…we may dislike a thing while it is good for us, and it may be that we love a thing while it is bad for us; yet only God knows for sure while we don't" (*Qur'an*, 2:216).

Re-introducing *fitn* (test) with a "systems framework"

The above discussion leads us well into the concept of *musibah* or *fitna* as cyclical and holistic framework. Both of these words are found in the *Qur'an* and *hadith* literature. *Musibah*, literally translated, is "calamity," "misfortune" or "disaster." *Fitna*, literally translated, is "test," "temptation," "trial," "restlessness," "conflict" etc. We can reasonably say that *musibah* is a type of *fitna* because it brings about test/trial for the individual who must evaluate and choose how they want to act. There are other types of *fitna*, such as in wealth and children (*Qur'an*, 8:28) which test our resolve in being patient and fulfilling our responsibilities that come with being parents and possessing wealth etc.

The Prophet said many things regarding *fitna* in different contexts such as at times of conflict, interrelations between people, spiritual diseases of the heart, mental anguish and physical illness etc. Here I want to offer some general reflections to bring the meaning or guidance of the Prophetic saying into a "systems thought

process" and propose a model for how *fitna* operates and what does it mean for us in our response to being tested. To keep things simple, I will not go into the minutia of variant narrations (*riwayah*) or *hadith* criticisms etc. Here are some examples of *hadiths*:

- "There will come tribulations in which one sitting will be better than one standing. The one standing will be better than one walking. The one walking will be better than one running. Whoever seeks these tribulations will be destroyed by them. Whoever finds a place of shelter or refuge let him take refuge in it."[98]

- "If God wants to do good to somebody, He afflicts him with trials (*musibah*)"[99]

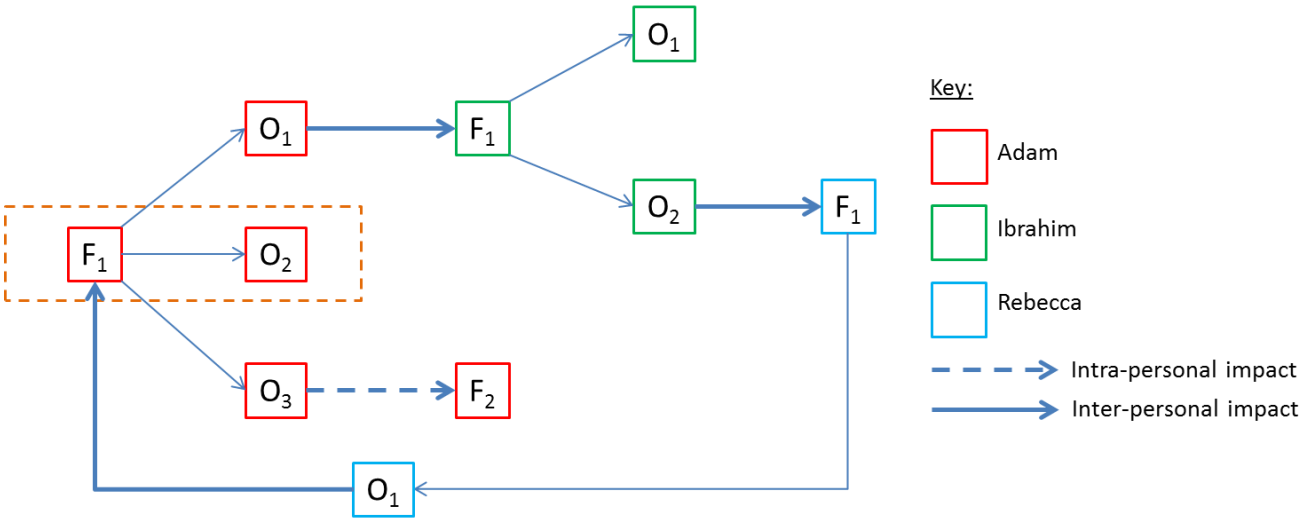
- "The happy man is he who avoids *fitna*: happy is the man who avoids *fitna*; happy is the man who avoids *fitna*, but how fine is the man who is afflicted and shows endurance."[100]

- "When God wants good for his slave, He hastens his punishment in the world. And when He wants bad for His slave, He withholds his sins from him until he appears before Him on the Day of Judgement … Indeed greater reward comes with greater trial. And indeed, when God loves a people He subjects them to trials, so whoever is content, then for him is pleasure, and whoever is discontent, then for him is wrath."[101]

- "If God sends punishment upon a nation then it befalls upon the whole population indiscriminately and then they will be resurrected [and judged] according to their deeds."[102]

These *hadiths* are just a tip of the iceberg of *hadiths* on *fitna*. In other words, there are a number of ways of dealing with *fitna* depending on situational context. What we do and how we do it depends on our own agency, time, space, and context, which we can sometimes know intuitively or, more often than not, by understanding a problem space. In a systems view of the world we can look at how variables are connected together. Let's take a hypothetical model I have put together below to demonstrate how we can better understand the concept of *fitna* and bring it into modern applications, so that we can apply *Shari'* principles, and if God wills, hopefully be guided. This system reflects God's saying, "Is, then, He Who creates comparable to any that cannot create? Will you not, then, take heed? For should you try to count God's blessings, you could never compute them" (*Qur'an*, 16:17-19).

[98] *Hadith* in al-Bukhari and Muslim.
[99] *Hadith* in al-Tirmidhi.
[100] *Hadith* in Abu Dawud.
[101] *Hadith* in al-Tirmidhi.
[102] *Hadith* in al-Bukhari



Consider a scenario where Adam experiences *fitna 1* (F_1 red box) which can lead to one of three outcomes O_1, O_2 or O_3 (all red boxes). Outcome O_2 resolves the *fitna* and the original *fitna* comes to an end. However, if the outcome is O_1 (red box) then it has a knock-on impact on Ibrahim which then becomes Ibrahim's *fitna 1* (F_1 green box), which may or may manifest in the same way as it did for Adam. The impact of outcome O_1 of Adam has now transferred to a 2nd person, Ibrahim (green boxes). Outcome O_2 for Ibrahim (O_2 green box) has a knock-on impact on a 3rd person, Rebecca, who experiences the impact as a *fitna* F_1 (blue box). But Rebecca's outcome O_1 is Adam's *fitna* (F_1) reproduced. Now you have a circular compound *fitna* that can only be broken if Adam either achieves outcome O_2 or outcome O_3. But outcome O_3 leads to a second *fitna* F_2 for Adam. In this system there are circular impacts and linear impacts, as well as outcomes that can stop the *fitna* from escalating to secondary effects or becoming systemic. Each person has choices to manage the *fitna*, for example if Ibrahim can achieve outcome O_1 then the *fitna* is managed. It's also possible for Ibrahim to strive for a different action/outcome if he's aware of the systemic nature of the *fitna* and minded to put a stop to it as best as possible. Equally by the time the *fitna* impacts Rebecca there may only be one action possible, which can only lead to *fitna* F_1 for Adam.

Taking account of the general corpus of Qur'anic indications (*ishara*), stories (*qasas al-ambiya*), the life of the Prophet (*sirah*) and lives of the Companions and in fact people of erudition and God throughout history etc. and based on this model, it means the following needs to happen:

1. Adam must do his best to achieve outcome O_1
2. Ibrahim must do his best to achieve outcome O_1
3. Rebecca must work with Adam to resolve the problem, which may involve Ibrahim.
4. Adam, Ibrahim and Rebecca must problem solve in their own local contexts and ought to realise how their actions have consequences beyond and that there are causes and effects happening which are impacting one another.
5. Adam, Ibrahim and Rebecca must all be grateful when the *fitna* resides or they've not been impacted, but Ibrahim and Rebecca will need to be even more grateful.
6. Adam and Ibrahim may need to be additionally patient, but Adam needs to be most patient
7. Adam has the highest weight of responsibility to achieve outcome O_2 and make easier for Ibrahim and Rebecca

I believe the above model was taught by the Prophet and the leading Companions understood the nature of *fitna* in a systems framework that was relevant to their time.

10. God in causation – readjusting our relationship with the natural world

Between Ghazali and Ibn Rushd

We end this paper with a discussion on the question of causation, which I think is a necessary adjunct to the discussion in the previous section on the believer's *muhasabah* paradigm. A more holistic understanding of causation I would argue allows believers to make better sense of the goings on in the natural world such as in our current predicament of Covid-19 pandemic. The root of the discussion lies in a discussion in classical Muslim period between two of the greatest Muslims scholars, which we shall briefly delve into.

The great Iraqi theologian, often known as the "Proof of Islam" (*Hujjut al-Islam*), Imam al-Ghazali (1045-1111), was an extraordinary scholar, the like of whom as later Muslim communities may perhaps never see again. However, one ought to realise that in much of his philosophic works he was responding to earlier philosophers like Ibn Sina (980-1037) and al-Farabi (872-950) who came before Imam al-Ghazali, and who were by far the most famous advocates of Greek logic in the historical Muslim world, particularly of Aristotle. Imam al-Ghazali wasn't responding to the famous judge (*qadi*) of Andalucia in Spain, Ibn Rushd (known in the West by the Latinised name "Averroes"), who was born in 1126, 15 years after the death of Imam al-Ghazali. This is an important point to remember in the discussion. By the end of Imam al-Ghazali's lifetime philosophy had already moved on and Ibn Rushd's contribution significantly evolved philosophical thought, and I would argue he better "systems" integrated some aspects into the Islamic paradigm. As I will go on to show, if we leave the discussion on this topic at the point of Imam al-Ghazali, and in fact forget the 900 years of the ebb and flows of deep thought since, we risk leaving the discussion in limbo and future generations of Muslims will struggle to produce religiously-inspired thought which I find is stale and incapable today of revitalising societies in comparison to outputs from elsewhere (non faith-centred).

In my view, this is generally what's happened among many Muslims, the results of which we see most starkly in the laity's religious identity. The laity by definition has always been like this. And scholars throughout the ages have lamented the simplicity of the laity. In more recent times, the likes of Muhammad Iqbal and Taha Jabir al-Alwani lamented the waning of religiously-inspired thought among Muslims. But what's different today is that more Muslims are educated to university degree level than ever before, and it seems bizarre to call them "laity" given that, unlike in the past, they do have access to information and they can do research to find things out for themselves. In fact, it's precisely because more Muslims are more educated and among the growing middle classes that they're asking theological questions for which religious scholars don't necessarily have the right depth and breadth of convincing answers, and which is adding to the Muslim public's confidence in the relevance of faith and godliness in modern contexts.

That said, before I go on, I want to emphasise two points:

1. My intention isn't to rehash the age-old Orientalist trop of "decline" – which is much more complex and nuanced. No. What I specifically mean by "decline" is the use of guidance from God by probing deeper into the *Qur'an* and Prophetic life to directly inform and make faith relevant in our modern socio-economic and political contexts. A good example of that for us in the UK is simply the question, "How do we apply the *Shari'* thinking to deal with the pressures on the NHS?" In delving deeper into this, Shaykh Mohammed Nizami rightly points out that of course there is nothing explicit in divine writ that tells us so, "…but the values of healing the sick (*shifa'a*) through a communal contribution (*takaful*) at the point of need is there. But *takaful* also comes with a sense of civic responsibility that disparages waste (*israf*), and excessive request (*mas'alah*), and excessive medication (*tadawi*). For us, this is the essence of responsible citizenship towards the NHS, where our morality affords all citizens access to

healthcare, but that access is tempered by a social responsibility not to abuse the service..." This is just one example, but there are countless similar questions that are at play.[103]

And so in this sense, while the development of Europe thinking benefited from Ibn Rushd's commentaries (on Aristotle which mainly had to do with logic), as Muslims we seem not to have benefited from Ibn Rushd's philosophical works. For example, his *The Incoherence of the Incoherence* (*Tahafat at-Tahafat*) as a point-by-point response to Imam al-Ghazali's *The Incoherence of the Philosophers* (*Tahfat al-Falasifah*). Much of Ibn Rushd's thought was lost simply because Andalucia (Southern Spain) was in deep conflict from the 12th century, and his philosophical works were not copied enough to become widespread unlike his works in *fiqh* which are have been quoted even in South Asian Islamic literature for some time. With that, we seem to have forgotten Ibn Rushd's repeatedly-made point that on many matters Ibn Sina was alone in holding certain views. In this sense, Ibn Rushd was perhaps much more simplifying and nuanced than Imam al-Ghazali on some matters, though as they lived in different eras and contexts and played different roles as scholars in society, making too many comparative judgements may not be appropriate.

2. My second intention isn't to say that we should take Ibn Rushd at face value. No. Some of Ibn Rushd's ideas are problematic for us today. The point is, we shouldn't rely on just one or two scholars for our approach and intimacy with God's guidance. Guidance from the *Qur'an* reveals itself under different contexts, time and space. The *Qur'an* isn't a linear book, and becomes guiding only when we apply it in the present.

With the above said, it seems to me that in discussions on cause and effect Imam al-Ghazali was perhaps making the point that: the certainty with which we associate causes to effects does not factor in the overarching metaphysics (i.e. God), and this becomes apparent in the case of miracles and in upholding the reality of God's power (*Qadar*) as the "source" of causation. Imam al-Ghazali pointed to many psychological, social and perceptual traps that are inherent to human cognitive functions to argue the falsity of Ibn Sina's position. That is, causation is contingent (dependent) on God as necessary being. And causation can therefore change if God so desired as God is not Himself bound by laws external to His being. The philosophers he attacked believed causation is not contingent but eternal and independent, as they also defended the idea of an eternal world.

I would particularly like to point out Question 17 of Imam al-Ghazali's *The Incoherence of the Philosophers* (see below), which I think has become somewhat of a trap that Muslims in their active populist religious identity today can fall into, leading to an inflated immanent reliance on God without understanding that God's order in how variables are or are not interconnected reflect his Wisdom and creativity, and most importantly it is how God intended for us to perceive and experience reality, and on that basis judiciously make use of it. Anything else and we risk discounting human ingenuity, agency and becoming agnostic to observable causes and effects all around us, including the natural sciences. In the religious identity of Muslims unfortunately this is what has happened leading to a fatalist mindset that often curtains the believer's faith and religiously-inspired thinking from informing their polities. If you have doubts in what I have said, Covid-19 has subtly resurfaced these issues, see, for example recent articles by Shaykh Mohammed Nizami,[104] Shaykh Akram Nadwi[105] and Shyakh Siraj Hendricks[106] (these are only the article that I have come across, but I am sure there are many others).

[103] See my book: *Being British Muslims: Beyond Ethnocentric Religion and Identity Politics*; and also look out for forthcoming book *Resilience in the Open Society*.
[104] http://nizami.co.uk/should-mosques-remain-open-for-congregational-prayer-countering-a-poor-fatwa/
[105] https://alsalam.ac.uk/guidelines-for-muslims-on-coronavirus-covid-19/, https://alsalam.ac.uk/contagion/
[106] https://seekersguidance.org/articles/featured-articles/covid-19-an-islamic-perspective-shaykh-seraj-hendricks/

I also want to point out that Imam al-Ghazali's aim in *The Incoherence of the Philosophers* was not to establish a positive doctrine of causation (and other things) but rather to undermine the position of Greek philosophy in the Muslim world. Imam al-Ghazali's ideas were highly sophisticated and he seems to be doing lots of things at the same time, which perhaps requires an equally brilliant mind to fully appreciate their intricacies. But, alas, simplicity is also important, and it seems that there are also contradictions in what Ghazali mentions in Question 17 which he later probelmatises in his own thinking. For example, in Question 18, Imam al-Ghazali states, "these are observed matters which God has ordained to flow according to habit." That is, while in Question 17 Imam al-Ghazali asserts that cause and effect is a perceptual phenomenon and contingent on God, he later seems to be suggesting that there are nonetheless natural order ("habits") of the world. Ibn Rushd thus argued against what he called the "sophistical" nature of Imam al-Ghazali's thinking. See the discussion between Imam al-Ghazali and Ibn Rushd below.

Imam al-Ghazali (1045-1111):

> "The connection between what is habitually believed to be a cause and what is habitually to be an effect is not necessary, according to us. But with any two things, where "this" is not "that" and "that" is not "this" and where neither the affirmation of the one entails the affirmation of the other not the negation of the one entails negation of the other, it is not a necessity for the existence for the one that he other should exist, and it is not necessity of the nonexistence of the one that the other should not exist – for example, the quenching of thirst and drinking, satiety and eating, burning and contact with fire, light and appearance of the sun, death and decapitation, healing and the drinking of medicine, the purging of the bowels and the using of purgative, and so on include all that is observable among the connected things in medicine, astronomy, arts and crafts. Their connection is due to the prior decree God, who creates them side by side, not to its being necessary in itself, incapable of separation. On the contrary, it is within divine power to create satiety without eating, to create death without decapitation, to continue life after decapitation, and do so on to all connected things. The philosophers denied the possibility of this and claimed it to be impossible."[107]

Ibn Rushd (1126-1198) answers Imam al-Ghazali (which I agree with on this point and I believe is vital for Muslims today):

> "To deny the existence of efficient causes which are observed in sensible things is sophistry, and he who defends this doctrine either denies with his tongue what is present in his mind or is carried away by a sophistical doubt which occurs to him concerning this question. For he who denies this can no longer acknowledge that every act must have an agent. The question whether these causes by themselves are sufficient to perform the acts which proceed from them, or need an external cause for the perfection of their act, whether separate or not, is not self-evident and requires much investigation and research. And if the theologians had doubts about the efficient cause which are perceived to cause each other, because there are also effects whose cause is not perceived, this is illogical. Those things whose causes are not perceived are still unknown and must be investigated, precisely because their causes are not perceived; and since everything whose causes are not perceived is still unknown by nature and must be investigated, it follows necessarily that what is not unknown has causes which are perceived. The man who reasons like the theologians does not distinguish between what is self-evident and what is unknown, and everything Ghazali says in this passage is sophistical."[108]

[107] Al-Ghazali, *The Incoherence of the Philosophers*, translated by Micheal E Marmura, p. 166.
[108] Ibn Rushd, *The Incoherence of the Incoherence*, translated by Simon Van den Bergh, p. 318

Where Imam al-Ghazali was absolutely right to assert, and which I think was his primary worry for the laity, was that it's possible that ordinary believers start looking at the causes of the world so much so that they forget God as the ultimate source. This is a valid concern because, even if we look at the Islamic legal profession in classical periods, by Imam al-Ghazali's era for example, it often became in many places a dry technical legal exercise and not necessary focused on producing godly people. This was observed by many scholars and duly rebuked by them including Imam Ghazali himself in his *The Revival of Religious Sciences* (*Ihya 'Ulum al-Din*). Similarly, on the issue of obsessing over causes without recognising God, Imam al-Ghazali in *The Niche of Lights* (*Mishkat al-anwar*) refers to people who overly sought fulfilment in their lives searching for the causes of the natural world but in doing so failed to perceive God.[109]

While Imam al-Ghazali had a valid point here, in our times it is not that as religious-minded Muslims we are obsessed with searching for the causes of the world, but that we have become incapable of producing thought that addresses the causes of the world beyond offering rhetoric and rituals, to offering real problem solving attitude. After all, it is a collective obligation (*farida*) on believers to play our part in healing our world (*khulafah al-ard*). Revelation demands it. This is my main point.

Modelling cause and effect

On the subject of cause and effect of course with advent of Newtonian physics and empirical science our conceptualisation of causation has gotten much more simplifying in my view. I will now summarise a way of understanding causation considering some scenarios using formulae to illustrate.

Scenario 1: normal/predictable cause-effect relationships: A + B = C

Where A and B are variables which upon addition (it could be any relation, modification, subtraction, multiplication or division or space or time etc.) it results in the effect/outcome C. Equals ("=") is God's *Qadar* (Divine power/decree). A, B, C are entities that are dependent on God's Lordship (*Rububiyyah*) to maintain their integrity, character and inter-relationship. Miracles are not negated by this.

In this scenario, patterns are predictable and reproducible to, say, >95% statistical confidence. The involvements of other variables are not negated, but, all things being equal, this arrangement of phenomena will always persist empirically, at least to 95% probabilistic certainty. (Note, I'm only using 95% for illustration as it's a well-known figure in probability theory used in science, but this is no to be taken as fixed).

Scenario 2: outliers or anomalies in cause-effect relationships: A + B = D

Where everything else is the same as in scenario 1 but D is a different effect. You don't get C as the effect but D, which is sufficiently different (anomalous) to represent a distinct effect to C. However, it's still God who effectuated D, and the integrity, character and inter-relationships are dependent on God's Lordship (*Rububiyyah*). In this scenario, it's apparent that there are other factors involved, which remain unknown or undetected (at least at that point), but their relational arrangement is such that they effectuate D and not C. So here the actual formula might be A + B (+ X + Y) = D. where X and Y remain hidden or unknown. Note that miracles aren't necessarily negated in this scenario as they involve broader factors to do with the perception of reality.

Scenario 3: inexplicable or rare events with no apparent cause-effect relationships: $A_1 + A_2 + \Sigma(A_n) = E$

[109] Al-Ghazali, *The Niche of Lights*, translated by David Buchman, p. 45.

Here, variables aren't known or remain sufficiently ambiguous to us or they're not empirically determinable. But the effect E happens which is completely inexplicable as understood by the body of knowledge at the time. However, it's still God who effectuated E, and the integrity, character and inter-relationships of whatever variables and their particularly rare (or unknown) arrangement(s) that were necessary are still dependent on God's Lordship (*Rububiyyah*) - none of this changes. Now, this scenario could be construed as a miracle or it could be merely reflecting scenario 1 or 2 which it just so happens we've not been able to study or understand the cause-effect relationship involved, or perhaps because we're unable to resolve to the level of the particular arrangement of any of the entities (due to limitations in our sense perception or through technological instruments etc.) - we may never be able to of course.

The important point here is that no one was knowingly/deterministically setting out to achieve effect E. It happened by chance or serendipity (perceived or otherwise) - the probability of it happening was too large. It could have happened because one prayed to God for God to effectuate E, and by some particular arrangement which remains unknown the prayer came true. At the time it happened, I would argue that it could be perceived as a miracle. I would argue that miracles are not fixed to just being rare occurrence or perceived to defy laws of nature, but relative to the meaning it has in the space and context that it happened, even if it looks improbably for all of time. Our understanding of the laws of nature has changed and will continue to change. Variables/causes "A_1" or "A_2" could conceivably be the direct interventions of angels (obeying God's decree) – the point is it remains empirically completely unknown, both in its mechanistic nature and metaphysically, which in turn makes us perceive that it's a miracle. Imam al-Ghazali was suggesting that Ibn Sina negated this possibility of miracles because he couldn't see that this was possible in the way Ibn Sina had positioned it. We don't accept this view of Ibn Sina, but we should not forget that both Imam al-Ghazali's and Ibn Rushd's ideas needs refinement for us today.

In all of this we should remember that God is ultimately incomprehensible, so the meaning of God being the only source of True, and Truth and Power, etc. are ultimately difficult to understand with our limited human minds, beyond what God has revealed about how we should understand His essence (*sifat*). And hence when we attempt to reconcile what we see through sense perception, or empirically, with how God fits into it, we should expect to end up with paradoxes, contradictions and confusions. I believe, Imam al-Ghazali did this so well that he had to conclude on both positions that supported Ibn Sina (as it was basically a viewpoint of the *Qur'an* that the physical world is made orderly, with balance) as well as supported the opposing view. This is just Imam al-Ghazali's sincerity and professionalism coming out and what makes him a great scholar of Islam.

However, few ordinary Muslims can operate at this level of intellectual rigour, and hence there is a genuine question about how is the complex position of Imam al-Ghazali to be absorbed by ordinary Muslim? The answer is that it doesn't, and ordinary Muslims look to take shortcuts to make any dilemmas and ambiguities go away, but in doing so the unwitting tendency is to cast revelation as irrelevant to their polities.

And, as I have hoped to have shown in this paper, the believers in their God-centred mode are more needed in today's world than ever before. But huge barriers remain in getting there. If ever there was a lesson from Covid-19 for believers, it is to make it a springing board for a more inspiring God-centred future.

11. Ending *du'a*

May God accept this work and overlook any errors, omission or overstretches made. May God protect us from the scourge of Covid-19. May God alleviate those suffering and give restitution of more God-centred human societies arising out of Covid-19. May God help us to bring control over Covid-19 and may His compassion envelope those who have passed away.

End of paper