Dealing With Covid-19: Where We Are



It is almost 2 years since Covid-19 first entered the global consciousness and the world has since been busy dealing with its consequences as well as taking measures to prevent its continued spread. So, after all that time, where are we with tackling Covid-19 in terms of understanding and technological prophylaxis in developed countries? Peter Ladkin, leader of the SCSC Covid-19 Working Group, provides his assessment.

Joined-up Systems

I propose that our experience has shown that "joining up" heterogeneous systems has been, and likely still is, key to mitigating the pandemic. Examples of this are:

- **Personal Protective Equipment (PPE) preparedness and supply:** the UK had an undersupply of PPE, since pandemic-preparedness measures had been partly run down during "austerity", and found it both hard and expensive to resource it at a time when global demand was outrunning supply
- **Vaccine development, preparation and supply:** there were notable difficulties in the European Union (EU) January-April 2021 in ramping up preparation and supply, since ameliorated
- **Medical emergency logistic systems:** ambulance services and delivery to hospitals that could accommodate Covid-19 patients was severely strained in various places and at times almost to the point of non-performance during the first and second waves in the UK

Let me compare with another integrated-system non-performance. Under the rubric of "Understanding the System", I talked to the SCSC in London in April 2015 about the North American power outages in 2003. There were many operator/supervisor organisations involved. Each had a system; these systems interacted, and the interactions turned out to be essential to a correct operation of the whole. Let me call "the whole" the System. There was an information computer, a predictor/estimator of current demand, a "state estimator", run by one of the involved organisations, Midcontinent Independent System Operator (MISO). MISO's estimation a short while before the overload did not "resolve", because of a lack of veridical input from one key grid component. When rerun/restarted to "resolve" with the new input, it did "resolve" but did not proceed to update automatically, because of – let us say – misconfiguration. It thus did not update information about the ongoing demand-supply imbalance, and by the time the issue was identified it was too late to mitigate. The computer was, but had not been seen as, essential to complete-System functioning, and thus there were not appropriately sensitive operational procedures in place. A full-System hazard analysis across all the various organisations involved would have indicated the MISO estimator as one of two computer systems essential for continued functioning of the grid.

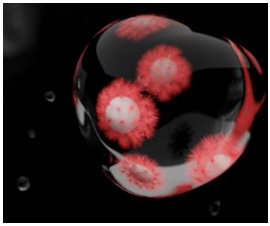
The lesson is almost always the same: the organisations involved hadn't perceived what the System was in its entirety, and had treated key System-components relatively nonchalantly. A solution is "joined-up System analysis".

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Simon Whiteley reported at SSS'21 on his attempt to sketch the architecture of the UK government's pandemic decision-making "system". Simon's sketch wasn't complete, and some parts of the architecture were guesses from news reports. We can imagine that a full (correct) architecture of the system followed by some BPMN-style analysis [1] of weak points and their mitigation could well have improved decision-making. I think the following sections represent where we are in terms of pandemic-related knowledge and systems.

What Works and What Doesn't

It is more or less known what helps Covid-19 patients and what doesn't, from amongst the available medicines and medical procedures. Standards of care are fairly stable. Triage is no longer much of an issue, it seems (that is, in the early stages of symptomatic disease, distinguishing those at risk for hospitalisation from those who will get better on their own).



Concerning procedures, we have learned that what constrains Intensive Care Units in developed countries is not lack of equipment, but lack of personnel. (Recall the rush in Spring 2020 to design and build new mechanical ventilators, and to build new hospital facilities with some IC capacity).

We have also learned – relearned – that pandemic preparedness is essential for public security. The UK did not keep up its emergency supplies of PPE over the previous decade, and suffered disastrously from not having it available.

The Role and Efficacy of Vaccines

Western vaccines have been shown to be astonishingly, almost miraculously, effective, both the vector vaccines and the mRNA vaccines, and there are more on the way. The Chinese vaccines do not appear to be quite so effective, and it also seems the Russian Sputnik has garnered varied reports on its efficacy. Whatever one might think politically of the organisation and motives of capitalist Big Pharma, the companies came through on this one in terms of technology and distribution in those countries able to support it; some of them such as AstraZeneca laudably pro bono publico.

Antivirals

The lack of antivirals, especially for treatment of mild to moderate disease, is slowly being remedied. Regeneron-Roche's Ronapreve (a cocktail of casivirimab and imdevimab) has been approved by the MHRA [2]. The US BLAZE-1 trial of Eli Lilly's cocktail monoclonal antibody combination bamlanivimab + etesevimab on roughly 1,000 participants has shown that it helps [3]. AstraZeneca has an antiviral AZD 7442, which has shown excellent performance in avoiding Covid-19 in those for whom the illness is high-risk, in the PROVENT Phase III trial that involved over 5,000 participants [4].

On 1st Oct 2021, Merck announced an interim analysis of its Phase III trial MOVe-OUT of its oral antiviral molnupiravir developed with Ridgeback Biotherapeutics. The interim analysis suggests the drug, administered to patients with mild or moderate Covid-19 and at high risk of progression to severe disease, reduced the chance of hospitalisation or death "by approximately 50%" [5]. And more are on the way.

Public Health Measures

The public health measures are now well understood for airborne infectious disease. Masking, distancing, testing, test-trace-isolate, good ventilation inside buildings. Also increasingly understood is the public acceptance (or not) of various measures, including the effects of information and misinformation. One surprising, and to my mind not well understood, connection in some areas is with political parties and politics in general. (Not only in the US; in the current German national election we have candidates standing for political parties that have formed in opposition to public health measures to control the spread of Covid-19).

Schools and Teaching

Schools and their processes are still not well understood. In particular, almost everywhere there seems to be little interest in air filtering technology for poorly-ventilated classrooms (which, in the case of SARS-CoV-2, is pretty much all of them!) A recent study [6,7] of some 200 schools in the UK during presence teaching showed little difference between infection rates in schools that quarantined neighbours of infected children and those which allowed them to continue in school with negative tests. The general return to presence schooling in my state of North-Rhine-Westphalia has not led to any superspreading outbreaks; indeed, local experience in Bielefeld indicates that the infection rate in schools is inferior to the



community-transmission rate. We thus have just moved from quarantining of classroom neighbours to testing them, which has relieved the load on the city public health department somewhat. Of course, such observations are tentative, but they are bound to be more or less right (it is not as if you can miss high-spreading or superspreading events if they are occurring).

We know that on-line teaching/learning is indeed possible at large scale. Also, that the nature of much work can change, because it has. This has been enabled by digital communication technology. These digitally-enabled modes of learning and working can obviously get much better, if we can solve the cybersecurity issues.

Infodemiology

Misinformation is a massive political problem, and not just with Covid-19. Infodemiology is here to stay. The sociology of misinformation in the time of pervasive digitalisation of key forms of communications is very poorly understood. Even less well understood is the social psychology of correcting it.

Public certification of health status

Public certification of health status will inevitably go digital, for two reasons. One is that it is temporally dependent. If you have been jabbed, two weeks later you need the certificate. It is not like applying for a passport, which you can do months in advance of needing it. Second, the existing paper documentation may not be trustworthy. There are already newspaper reports in Germany of the rise of WHO-vaccination-booklet faking services. Both the EU vaccine certificate and the German smartphone app provide a QR code that links to the official record held by the Robert Koch Institute, Germany's public health institute. That is far harder to fake. However, as with any digital certification there are attendant privacy/validity/cybersecurity issues. It remains to be seen if these issues amplify like those with cybercurrency/ransomware, or if they stay socially low-level, as with (real) passport e-technology.

Communication Breakdown

How the AstraZeneca vaccine roll-out got into such a mess was well covered in The Guardian newspaper [8]. It appears, inter alia, that there was a mismatch between what the academics who designed the testing regime needed to see and know, and what various regulatory authorities were expecting from "polished" drug company submissions. It has changed names twice (first, it was AZD1222; then Covid-19 Vaccine AstraZeneca; now Vaxzevria).

"Public health requires public messaging and on vaccinations that requires more than medical-scientific expertise."

It turns out some catastrophic German politics resulted from this, and I think there are a number of lessons in it. Political decisions on vaccines were, and are, based on the recommendations of the Standing Vaccination Committee of the RKI (StIKo). The chair Prof. Dr. Thomas Meertens has told us that the task of the commission is to make the best possible vaccination recommendations for individuals and society, "*independent of the opinions and wishes of politicians and the pharmaceutical industry*" (my translation from e.g., [9], in German). Pure science, no politics.

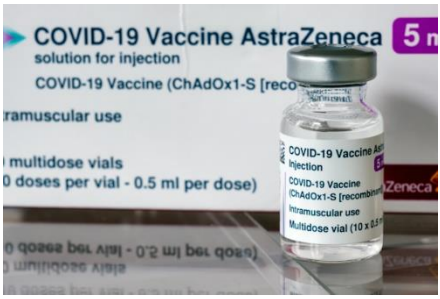
But public health requires public messaging and on vaccinations that requires more than medical-scientific expertise. It requires politicians to formulate appropriate messages and get them through to the public in such a way that they stick. One message is: *Get your jab*. But there are different jabs; people will ask: *which jab*? To which the best answer is: *it doesn't really matter.* But that is not what the scientists on StIKo were saying (see below). What resulted was murky messaging, which was not well smoothed for consumption by the general public. StIKo recommendations and their history are available [10]. It happened as follows:

- on 14th Jan 2021, in the first StIKo recommendation the AstraZeneca vaccine AZD1222 was not yet approved by the European Medicines Agency (EMA)
- on 29th Jan 2021, in the second recommendation the AstraZeneca vaccine was approved for those aged 16-64, but insufficient data were said to be available for those 65 and over (I understand this was the StIKo; the EMA had approved it unrestricted as far as I know)
- by 12th March 2021, the restriction was lifted: AZD1222 was also recommended for all age groups for which it had been approved – but then came Vaccine-Induced Immune Thrombotic Thrombocytopenia (VITT)
- On 8th April 2021, the StIKo recommended that people under 60 who had one dose of AZD1222 receive a second dose of one of the mRNA vaccines
- On 12th May 2021, the StIKo recommended the vector-based vaccines (AZD1222 and the Johnson&Johnson/Janssen vaccine) only for those aged 60 and above.



It played out in public like this. We first heard BioNTech/ Pfizer and Moderna were good; nothing about AZD1222. Then, that AZD1222 was good if you were under 65. Most of the public knew nothing about the mid-March relaxation of the under-65 restriction. The news about VITT emerged in March 2021, and then Covid-19 Vaccine AstraZeneca (as it was by now called) was not for those under 60 anymore. It also came out that many people were reacting to their first dose of Covid-19 Vaccine AstraZeneca with flu-like symptoms, and being off work for a day was not unusual; examples were covered in the newspapers. (It turned out that there was often reaction to the mRNA vaccines also, but after the second dose, not the first, so this news arrived later).

The result of this was a mess; intelligent people of my acquaintance were saying *"I'll get a jab if it's BioNTech or Moderna but I don't know about this AstraZeneca stuff"*. (I personally benefitted. My state procured some 450,000 extra doses of Covid-19 Vaccine AstraZeneca and offered them over Easter to anyone over 60. I was on the booking WWW site 15 minutes before it opened on Easter Saturday and got my jab Easter Monday. Turns out there was more demand than supply).



Just as VITT emerged in a few people vaccinated with AZD1222, it turns out that some younger people vaccinated with the BioNTech/Pfizer BNT162b2 vaccine (now known as Comirnaty) contract myocarditis and/or pericarditis. However, VITT is a life-threatening event, whereas the heart problems associated with Comirnaty are said to be straightforwardly treatable, e.g., [11]. But here also there is need for political messaging. Human social networks are quite highly connected; it turns out none of us are very far from exceptionally rare adverse events: I have a friend whose friend's husband got VITT after an AZ jab; I have a colleague whose friend got myocarditis from a BioNTech jab. I learned of these by word of mouth, not Facebook or Twitter. Such cognitive "availability" of rare adverse events requires active management to emphasise the rarity of their occurrence, especially in the era of so-called "social media".

One could conclude from this that driving public-health policy purely by science is not ideal. Medical science sees new things about a new disease and its treatment constantly; effective public health messaging needs to be simple, consistent and preferably immutable. These two requirements can easily conflict.

Compounding this is the matter of data and its management. VITT was seen in Vienna and Germany in early March. By April there were some 31 cases in 2.6m first-vaccinations. In contrast, in the UK at the same time there were said to be 4 cases in some 13.7m vaccinations. And then, at the beginning of April the UK retroactively identified 22 firm + 8 more cases. There was a lot of noise in the VITT signal and it took hard work to extract it. In such a situation, formulating consistent public messaging can look all but impossible.

I see these situations as involving multi-system issues, where the requirements/expectations of each localised system (the scientific testing system; the drug approval systems in different states; the record-keeping on associated health problems; the necessary public health messaging and its ideal characteristics) were partly inadequate to the task and partly contradicting each other. Some system engineering could well help improve things.

And Everything Else?

Much of the rest seems to me to fall into the category of political-social. For example, can countries "loosen up" without suffering a new severe wave? The UK tried in July 2021; Germany was not far behind. In Germany, we seem indeed to be into a fourth wave. In Bielefeld, "holiday season" ended mid-August for families with school-age children; daily new infections peaked two weeks later at the end of August; hospitalisation peaked two weeks after that, and deaths started to cluster a week after that. Current thinking seems to be that "opening up" has overburdened neither society nor the health services, and many are relieved at that.

Next, the sociology of continuing to wear masks. Do we or don't we, when and where? Much of it seems to concern what we may be doing and how old we are.

Third, how socially to handle various kinds of denialism (I read in the British Medical Journal a comment from an ICU doctor about dealing with people who are critically ill with a disease which they and their family refuse to believe exists).

I don't think systems scientists have much to say about any of these three issues at present.

End Game

How will this play out? Prognosis of Covid-19 is a mug's game and I am unwilling to enhance my reputation as one. Let me refer instead to some recent public comments.

On 1st October 2021, the Corona Protection Regulations in North Rhine-Westphalia were prematurely loosened (originally, they were valid until 8th October 2021). With Autumn/Winter in Northern Europe, people are generally more indoors with fewer wide-open windows. Both of these entail that conditions will be more favourable for transmission of airborne disease. Respected virologist, avid Covid podcaster and Christmas-ornament model Christian Drosten [12], is concerned that there will be an Autumn-Winter wave in 2021/2, and sees the signs already [13].

Professors Sir John Bell and Dame Sarah Gilbert spoke on 23rd Sept 2021. Sir John believes things "should be fine" once Winter 2021/2 has passed. Dame Sarah observed to the Royal Society of Medicine that viruses become weaker as they circulate, and there is no reason to expect a more virulent version of SARS-CoV-2 to arise [14].

The situation by next spring will likely be dependent on how the proportion of the population that is vaccinated rises. And that seems to be a political question that almost no one can currently answer.

References

[1] https://en.wikipedia.org/wiki/Business_Process_Model_and_Notation, accessed Sept 2021

[2] https://www.gov.uk/government/publications/regulatory-approval-of-ronapreve, accessed Sept 2021

[3] https://www.nejm.org/doi/full/10.1056/NEJMoa2102685, accessed Sept 2021

[4] https://www.astrazeneca.com/media-centre/press-releases/2021/azd7442-prophylaxis-trial-met-primary-endpoint.html, accessed Sept 2021

[5] https://www.merck.com/news/merck-and-ridgebacks-investigational-oral-antiviral-molnupiravir-reduced-the-risk-of-hospitalization-or-death-by-approximately-50-percent-compared-to-placebo-for-patients-with-mild-or-moderat, accessed Oct 2021.

[6] Young, BC, Eyre DW, et al, Daily testing for contacts of individuals with SARS-CoV-2 infection and attendance and SARS-CoV-2 transmission in English secondary schools and colleges: an open-label, cluster-randomised trial, The Lancet 14th Sept 2021, DOI: 10.1016/S0140-6736(21)01908-5, https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)01908-5/fulltext, accessed Sept 2021

[7] Viner RM and Koirala A, The Lancet 14th Sept 2021, DOI: 10.1016/S0140-6736(21)02092-4, https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)02092-4/fulltext, accessed Sept 2021

[8] Sarah Boseley, The Oxford vaccine: the trials and tribulations of a world-saving jab, The Guardian 26th June 2021, available at https://www.theguardian.com/world/2021/jun/26/the-oxford-vaccine-the-trials-and-tribulations-of-a-world-saving-jab, accessed Sept 2021

[9] https://www.rheinpfalz.de/politik_artikel,-impfkommission-rügt-politiker-_arid,5228866.html, accessed Sept 2021

[10] https://www.rki.de/DE/Content/Infekt/Impfen/ImpfungenAZ/COVID-19/Impfempfehlung-Zusfassung.html, accessed Sept 2021

[11] https://www.cdc.gov/vaccines/covid-19/clinical-considerations/myocarditis.html, accessed Sept 2021

[12] Drosten Rauchermann image, https://www.berlin.de/aktuelles/berlin/6773638-958092-drostenraeuchermann-unter-schutznachfrag.html, accessed Oct 2021.

[13] Drosten: Corona-Herbstwelle deutet sich mancherorts an (in German), Die Welt, 24th Sept 2021 https://www.welt.de/newsticker/dpa_nt/infoline_nt/wissenschaft_nt/article234090426/Drosten-Corona-Herbstwelle-deutet-sich-mancherorts-an.html, accessed Oct 2021

[14] Indya Clayton, Oxford professor says Covid could be more like common cold by next spring, Oxford Mail, 24th Sept 2021, https://www.oxfordmail.co.uk/news/19603160.oxford-professor-says-covid-like-common-cold-next-spring, accessed Oct 2021

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