The long goodbye to covid-19

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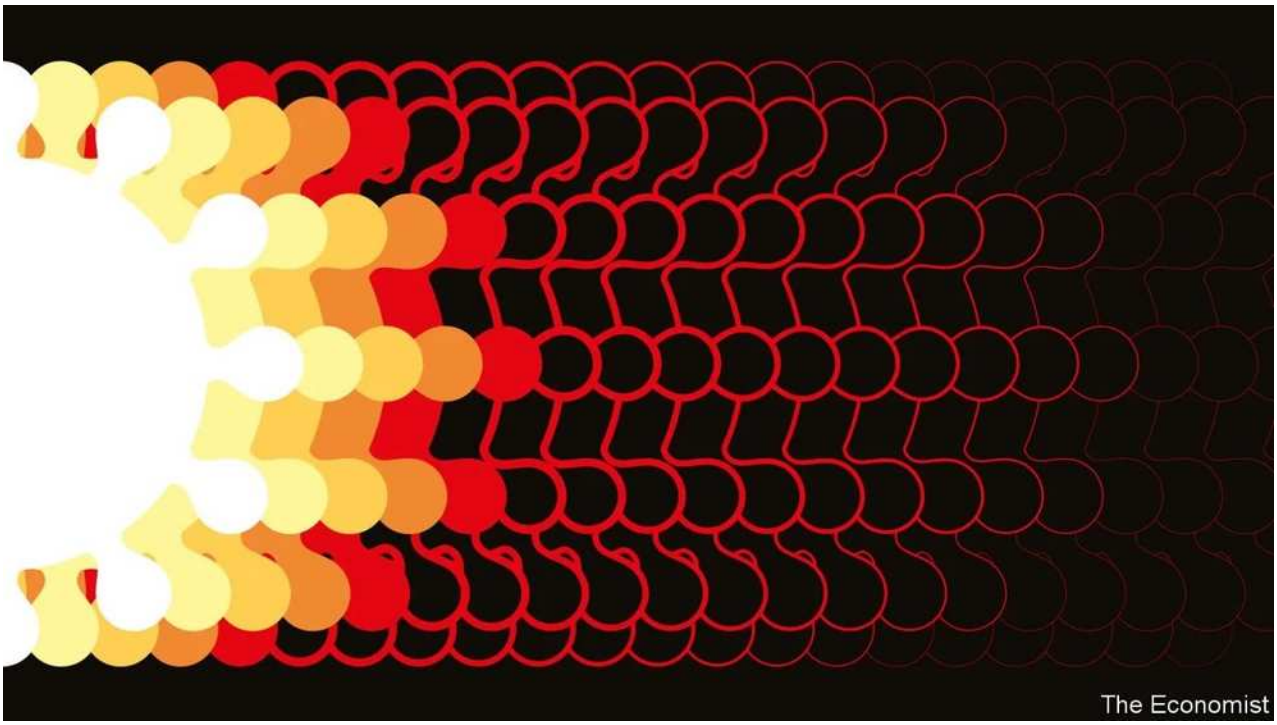
After the disease
The long goodbye to covid-19

The pandemic is still far from over, but glimpses of its legacy are emerging



WHEN WILL it end? For a year and a half, covid-19 has gripped one country after another. Just when you think the virus is beaten, a new variant comes storming back, more infectious than the last. And yet, as the number of vaccinations passes 3bn, glimpses of post-covid life are emerging. Already, two things are clear: that the last phase of the pandemic will be drawn-out and painful; and that covid-19 will leave behind a different world.

This week *The Economist* publishes a normalcy index, which reflects both these realities. Taking the pre-pandemic average as 100, it tracks such things as flights, traffic and retailing across 50 countries comprising 76% of Earth's population. Today it stands at 66, almost double the level in April 2020.

Yet the ravages of covid-19 are still apparent in many countries. Consider our index's worst performer, Malaysia, which is suffering a wave of infections six times more deadly than the surge in January and scores just 27. The main reason for this is that vaccination remains incomplete.

In sub-Saharan Africa, suffering a lethal outbreak, just 2.4% of the population aged over 12 has had a single dose. Even in America, where vaccines are plentiful, only around 30% of Mississippians and Alabamans are fully protected. Although the world is set to produce around 11bn doses of vaccine this year, it will be months before all those jabs find arms, and longer if rich countries hog doses on the off-chance that they may need them.

The lack of vaccination is aggravated by new variants. Delta, first spotted in India, is two to three times more infectious than the virus that came out of Wuhan. Cases spread so fast that hospitals can rapidly run out of beds and medical staff (and sometimes oxygen), even in places where 30% of people have had jabs. Today's variants are spreading even among the vaccinated. No mutation has yet put a dent in the vaccines' ability to prevent almost all severe disease and death. But the next one might.

None of this alters the fact that the pandemic will eventually abate, even though the virus itself is likely to survive. For those fortunate enough to have been fully vaccinated and to have access to new treatments, covid-19 is already fast becoming a non-lethal disease. In Britain, where Delta is dominant, the fatality rate if you become infected is now about 0.1%, similar to seasonal flu: a danger, but a manageable one. If a variant required a reformulated vaccine, it would not take long to create.

However, as vaccines and treatments become more plentiful in rich countries, so will anger at seeing people in poor ones die for want of supplies. That will cause friction between rich countries and the rest. Travel bans will keep the two worlds apart.

Eventually flights will resume, but other changes in behaviour will last. Some will be profound. Take America, where the booming economy surged past its pre-pandemic level back in March, but which still scores only 73 on our index—partly because big cities are quieter, and more people work from home.

So far it looks as if the legacy of covid-19 will follow the pattern set by past pandemics. Nicholas Christakis of Yale University identifies three shifts: the collective threat prompts a growth in state power; the overturning of everyday life leads to a search for meaning; and the closeness of death which brings caution while the disease rages, spurs audacity when it has passed. Each will mark society in its own way.

When people in rich countries retreated into their houses during lockdowns, the state barricaded itself in with them. During the pandemic governments have been the main channel for information, the setters of rules, a source of cash and, ultimately, providers of vaccines. Very roughly, rich-country governments paid out 90 cents for every dollar of lost output. Slightly to their own amazement, politicians who restricted civil liberties found that most of their citizens applauded.

There is a vigorous academic debate about whether lockdowns were “worth it”. But the big-government legacy of the pandemic is already on display. Just look at the spending plans of the Biden administration. Whatever the problem—inequality, sluggish economic growth, the security of supply chains—a bigger, more activist government seems to be the preferred solution.

There is also evidence of a renewed search for meaning. This is reinforcing the shift towards identity politics on both the right and the left, but it goes deeper than that. Roughly one in five people in Italy and the Netherlands told Pew, a pollster, that the pandemic had made their countries more religious. In Spain and Canada about two in five said family ties had become stronger.

Leisure has been affected, too. People say they have had 15% more time on their hands. In Britain young women spent 50% longer with their nose in a book. Literary agents have been swamped with first novels. Some of this will fade: media firms fear an “attention recession”. But some changes will stick.

For example, people may decide they want to escape pre-pandemic drudgery at work, and tight labour markets may help them. In Britain applications to medical school were up by 21% in 2020. In America business creation has been its highest since records began in 2004. One in three Americans who can work from home wants to do so five days a week, according to surveys. Some bosses are ordering people into the office; others are trying to entice them in.

Those who don’t die roll the dice

It is still unclear whether the appetite for risk is about to rebound. In principle, if you survive a life-threatening disease, you may count yourself as one of the lucky ones and the devil may care. In the years after the Spanish flu a century ago, a hunger for excitement burst onto the scene in every sphere, from sexual licence to the arts to the craze for speed. This time the new frontiers could range from space travel to genetic engineering, artificial intelligence and enhanced reality.

Even before the coronavirus came along, the digital revolution, climate change and China’s rise seemed to be bringing the post-second-world-war, Western-led order to an end. The pandemic will hasten the transformation. ■

This article appeared in the Leaders section of the print edition under the headline "The long goodbye"

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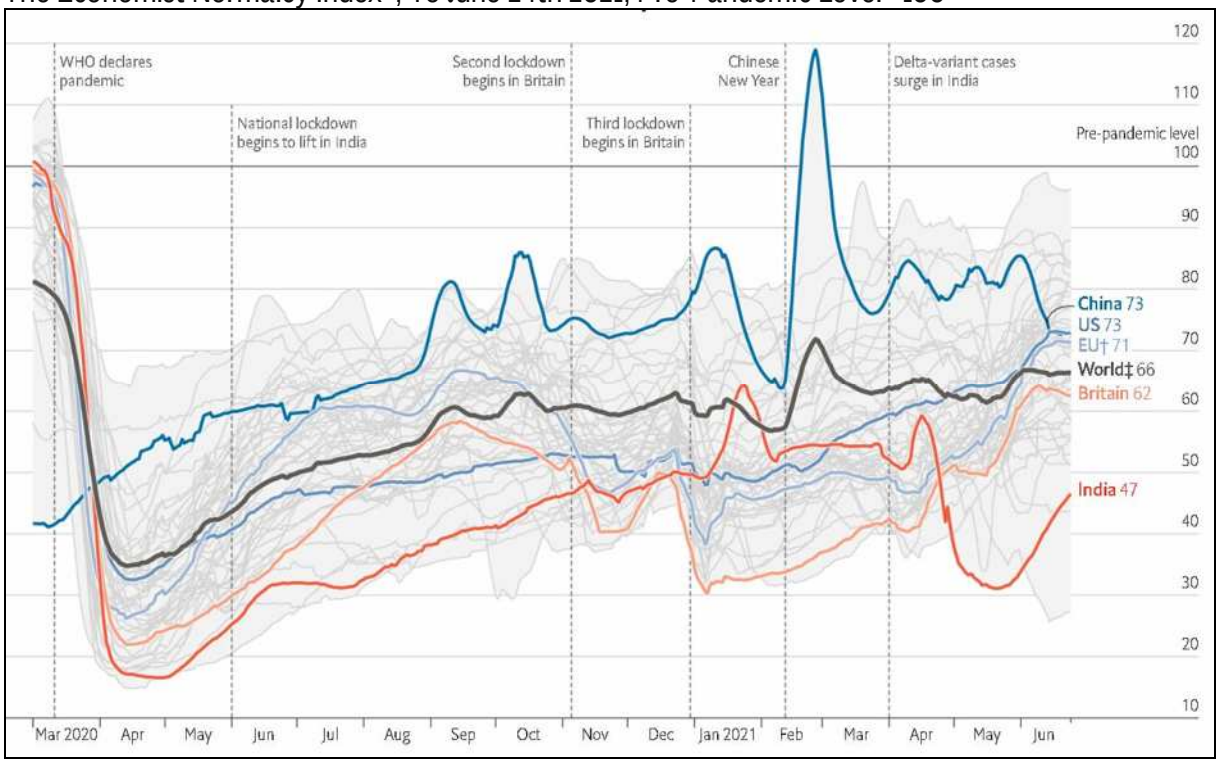
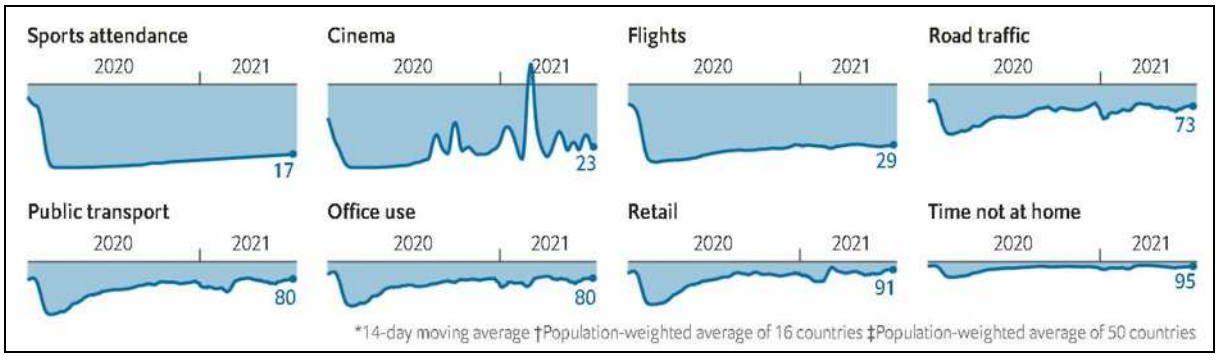
Life is halfway back to pre-covid norms

The Economist, July 3rd, 2021

Our normalcy index shows life is halfway back to pre-covid norms. Activity tightly regulated by governments has been disrupted more than has behaviour reflecting individuals' choices

The Economist Normalcy Index*, To June 24th 2021, Pre-Pandemic Level=100





In 1920 Warren Harding won America's presidency promising a "return to normalcy", following the first world war and the flu pandemic in 1918-20. A century on, his goal sounds more appealing than ever. It also looks frustratingly hard to achieve.

In theory, vaccines should end the covid-19 pandemic. Already, one-third of people aged 12 and over have at least one shot. Yet many places are sliding backwards. Australia, Bangladesh and Thailand have all imposed new restrictions. Even Chile, where 77% of over-12s have a vaccine dose, locked down its capital last month.

Such cases do not cast doubt on vaccines' effectiveness. In countries like Israel, where most adults have two jabs from Pfizer, life now goes on much as it did in 2019. But in other places, even with the end in sight, normalcy remains a long way off. And differences in vaccination rates do not fully explain why some countries enjoy more of it than others.

Covid-19 has changed life in too many ways to count. Yet any effort to assess how much its impact has receded requires a measure of what normalcy is. We have thus devised a normalcy index, tracking three types of activity. The first is travel, split between roads, flights and public transport. Next comes leisure time, divided among hours spent outside of homes, cinema revenues and attendance at sporting events. The last is commercial activity, measured by footfall in shops and offices.

For each variable, we obtained daily or weekly data for 50 countries, which account for 76% of the world's population and 90% of its gdp. We combine them by measuring the change in each factor from its pre-covid level; averaging the changes in each category; and then averaging the grouped results together. Our global figure weights each country by its population.

We calculate the index relative to a pre-covid norm of 100. When the pandemic was declared in March 2020, China had already locked down, bringing the index down to 80. As the disease spread, the index reached a low of 35. Since last July it has oscillated around 60. It now sits at 66, implying that only half of the disruption caused by covid-19 has been reversed.

Most Western countries are close to this average. America is at 73, the eu 71, Australia 70 and Britain 62. Elsewhere, the range is wider. Both Hong Kong and New Zealand, the leaders at 96 and 88, enjoy nearly full normalcy. In contrast, since April Malaysia's value has fallen from 55 to 27.

Of the eight activities in the index, three were subject to legal orders that ground them to a halt last March: cinemas, sporting events and flights. All three remain 70-85% below the pre-covid baseline today.

Although many cinemas are now open, studios have begun selling content directly to streaming services (see International). Save for a film-going boom in China during New Year festivities in February—when week-on-week revenues rose by 3,600%—the industry has languished between 20% and 40% of its takings from 2019.

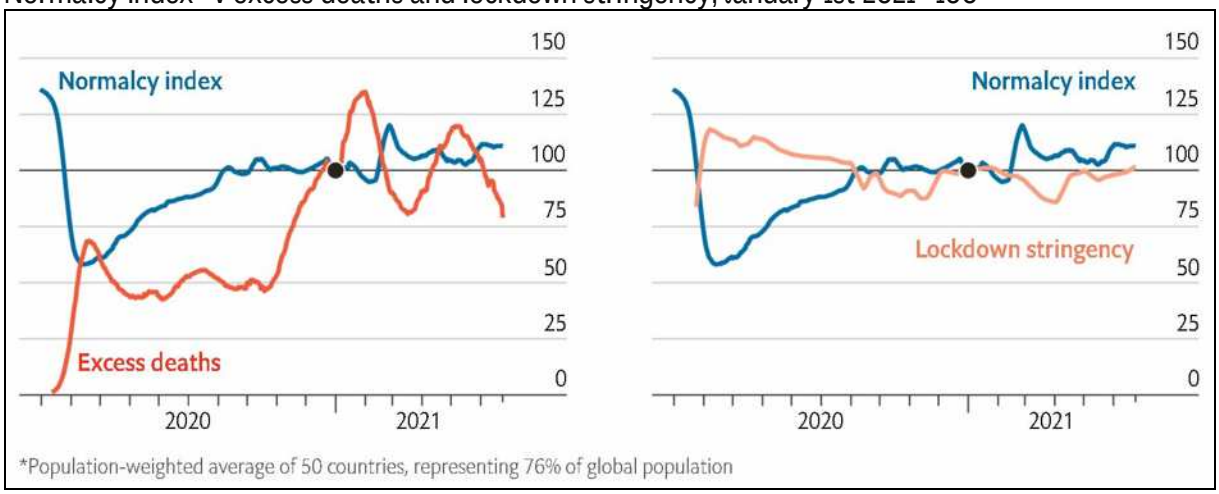
The picture for sport and air travel is a bit rosier. At sporting events, capacity limits have kept crowds at around 20% of their pre-covid baseline. Similarly, there are just 30% as many planes in the sky today as in 2019, owing largely to travel bans and quarantine rules. However, America is an encouraging exception. With robust demand for domestic flights and mass vaccination making attendance limits unnecessary, air travel and baseball stadiums there are at 70% and 90% of their levels from 2019.

Although many governments have required people to stay at home, such rules are hard to enforce. Last April, even though half of the world's population was subject to such orders, the global average of time spent outside homes fell by only 15%. Compliance rates appear similarly low today: around 14% of people are not allowed to venture out, yet time not at home is just 5% below the baseline of 2019.

The final variables in our index depend mostly on choices by individuals or firms. All have largely recovered, suggesting that people are clawing back as much normalcy as governments will allow. Public transport, which cities generally kept in service, is now up to 80% of its pre-covid level. Driving is at 73%; visits to retail stores are at 91%; and attendance at offices is at 80%. Because many office employees can work remotely, the shortfall in this category probably reflects telecommuting more than unemployment.

The country-level values of our index vary widely, from 16 in Peru in April 2020 to 97 in Vietnam the previous month. A few patterns explain most of the differences, both between countries and over time.

Normalcy index* v excess deaths and lockdown stringency, January 1st 2021=100



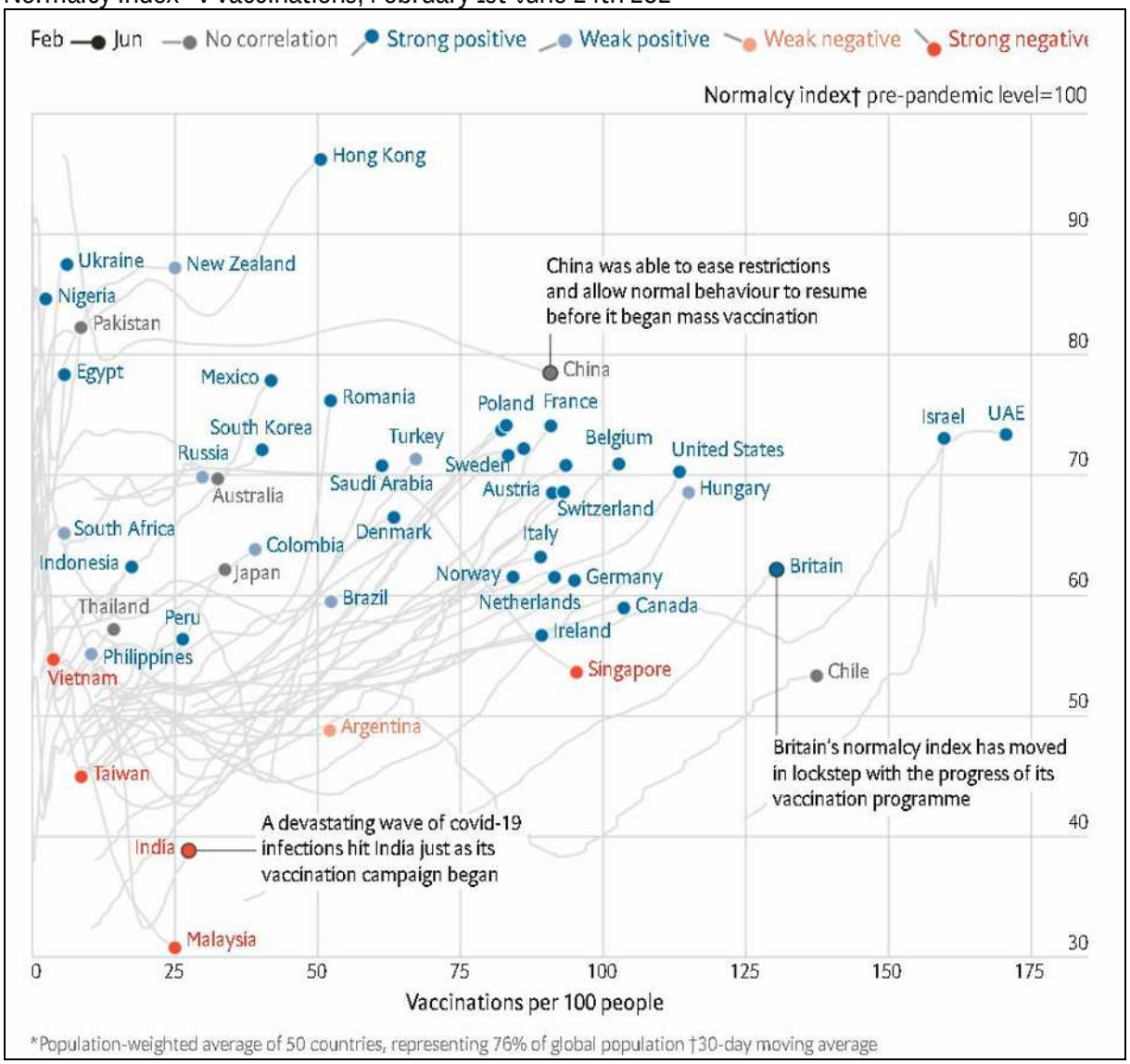
Logically, places facing the worst outbreaks tend to be the least normal. Holding other factors constant, a one-standard-deviation increase in a country's official covid-19 deaths during the preceding month reduces normalcy by four points. Similarly, tightening lockdown rules by a standard deviation lowers normalcy by five points.

However, it takes time for behaviour to reflect the true spread of covid-19. Normalcy tracks official death tolls from the previous month—which could reflect infections from 60 days ago—much more closely than current case counts. It is also linked only weakly to indirect measures of uncounted cases, such as the share of tests that are positive or changes in deaths from any cause. And although vaccines increase normalcy, they do so only once they have had enough time to reduce deaths. Life remains abnormal in most countries where covid-19 outbreaks took off before enough people could obtain full protection.

Normalcy is also influenced by factors unrelated to the pandemic. In general, Asian countries have been less normal than you would expect. Counterintuitively, behaviour has changed more in places with robust civil liberties than in otherwise similar but less free countries. This would make sense if people in such places are unusually likely to trust their leaders, or if they feel more invested in fellow citizens' well-being. And richer countries, where lots of people can work from home, are more abnormal than poorer ones.

Our normalcy index does not track economic recovery closely. Some behaviour, such as air travel, is likely to recover eventually. Other variables, like cinema-going or working from home, could signal an enduring change. We will update our index online every week to keep track of the world's path towards normalcy.

Normalcy index* v vaccinations, February 1st-June 24th 202



Sources: afltables.com; baseball-freak.com; baseball-reference.com; Blavatnik School of Government, University of Oxford; Box Office Mojo; Google; hockey-reference.com; JHU CSSE; Our World In Data; TomTom; pro-football-reference.com; UN ICAO; Transfermarkt; ultimatealeague.com; Wind; *The Economist*

The unvaccinated are at risk as evolution accelerates the covid-19 pandemic

economist.com/briefing/2021/07/03/the-new-variants-of-sars-cov-2-are-much-more-dangerous-to-the-unvaccinated

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Coats of many colours

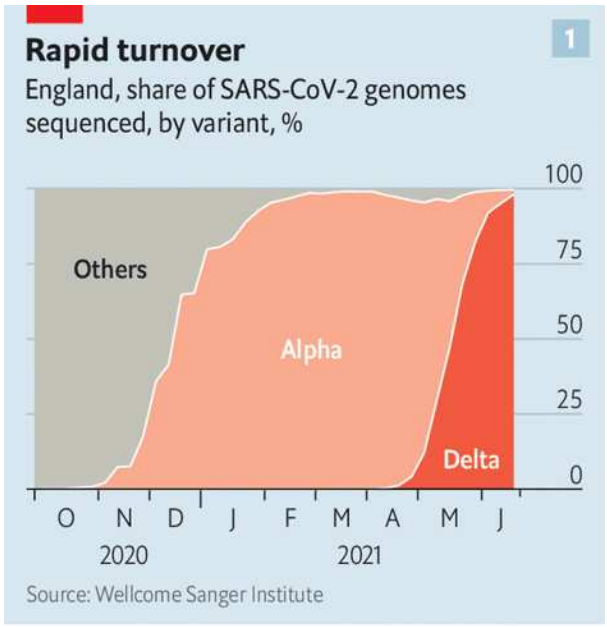
The unvaccinated are at risk as evolution accelerates the covid-19 pandemic

Research is unravelling the virus's deep secrets

FOR MUCH of 2020 the covid-19 virus was, in genetic terms, a little dull. Early in the pandemic a version of SARS-CoV-2 that was slightly different from the one originally sequenced in Wuhan, and spread a bit better, came to dominate the picture outside China. But after that it was just a case of a letter or two of genetic code changing here and there. Sometimes such mutations proved useful for working out where infections were coming from. But none of them seemed biologically relevant. By September Salim Abdool Karim, a South African epidemiologist, was beginning to find his monthly updates on new mutations "quite boring". He considered dispensing with them altogether.

He was soon glad that he hadn't. In the last months of 2020 researchers around the world began to see variants of the virus with not just one or two mutations but ten or 20. What was more, some of these new variants turned out to have new properties—to spread faster, to shrug off antibodies, or to do both.

The first of them, now called Alpha, appeared in Britain in September. By November scientists sequencing virus samples were becoming alarmed at the rate of its spread. Each infection with the original virus, as sequenced in Wuhan in January 2020, had been estimated to lead to roughly 2.5 subsequent infections in the absence of countermeasures like masks, social distancing and lockdowns. Under the same conditions the "reproductive number" for Alpha was reckoned to be almost twice as large: four or five.



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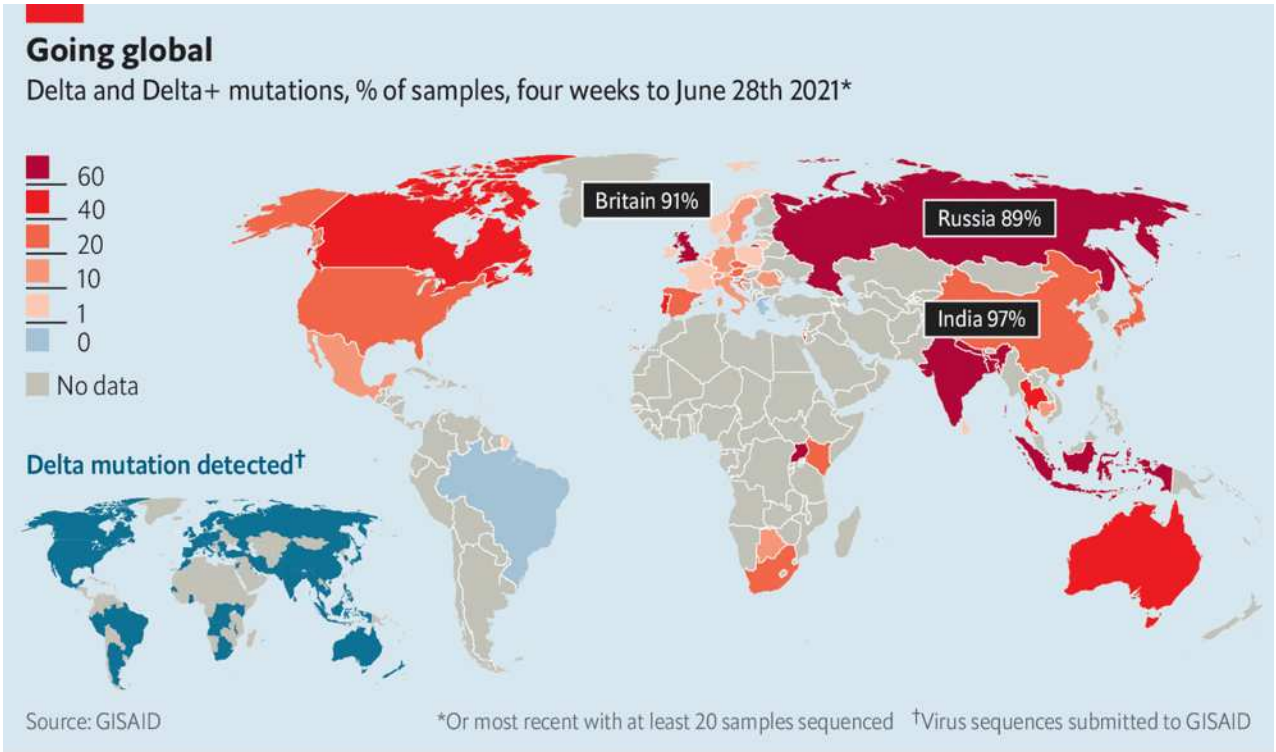
By November Dr Karim was sitting in his office gobsmacked by evidence of a variant similarly studded with mutations, now called Beta, in South Africa. The Gamma variant, formally identified only in 2021, was beginning to make itself felt in Brazil and would go on to ravage South America. Delta, a key factor in the catastrophic Indian epidemic a few months later, raised the transmissibility bar yet further. British scientists estimate that in unvaccinated populations not taking precautions its reproductive number may be as high as eight. In mid-June, only two months after it first appeared there, Delta had almost fully displaced Alpha in England (see chart 1). It now threatens the rest of the world (see map).



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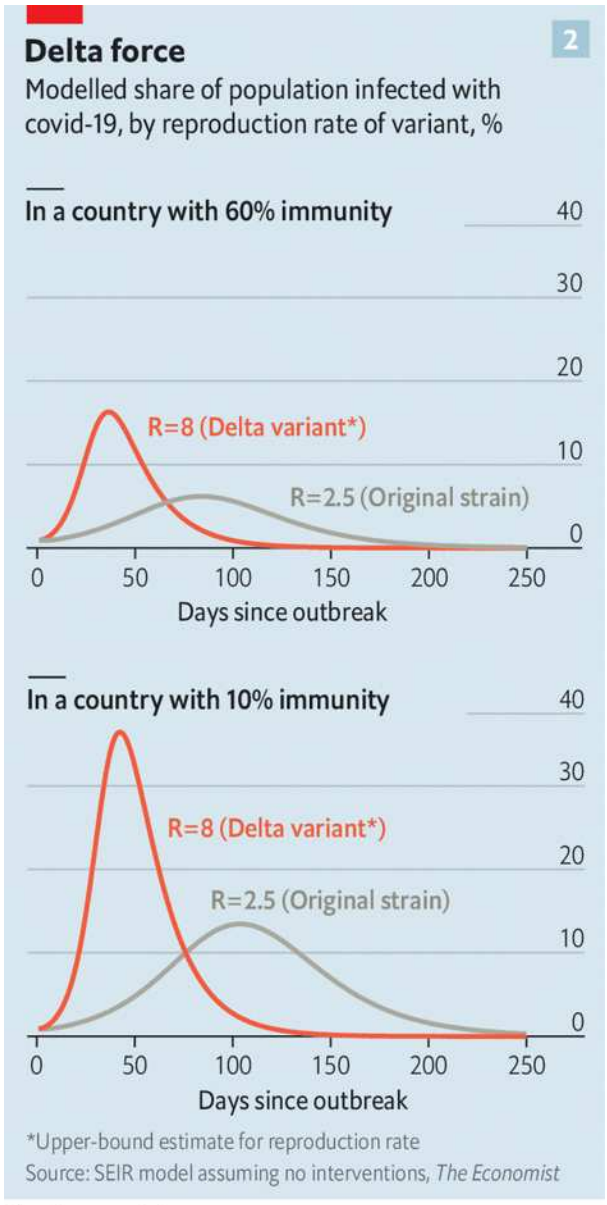
All the variants are more transmissible to some extent. Laboratory tests on human airway cells in Petri dishes have shown that Delta replicates more avidly in them than do earlier variants. That would seem to suggest that a smaller initial dose is needed for an infection to take hold. It also means that the amount of virus lurking in people's airways is probably higher.

Swabs taken from people's nostrils and throats during testing back this notion up. The amount of virus found in samples from people infected with Delta is higher than for other variants. That probably means that people are exhaling more virus than those infected by an older variant and thus that every encounter between an infected and uninfected person poses a greater risk of transmission.

Vaccination slows this spread down, but it does not stop it. The current vaccines do not stop all infections by any version of the virus. Nor do they stop infected people from passing the virus on, though they do make it significantly more difficult. People vaccinated with Pfizer or AstraZeneca jabs who are subsequently infected with Alpha are about half as likely to pass it on as the unvaccinated are.

British studies have found Delta to be around 60% more transmissible than Alpha. They put roughly three-quarters of that effect down to the fact that it is easier to catch if you are not vaccinated and about a quarter to the increased ease with which Delta infects people who have been vaccinated. Around half of the adults infected in a recent Delta outbreak in Israel were fully vaccinated with the Pfizer vaccine.

Happily, studies of vaccines made by Western companies show them to reduce deaths and severe cases of the disease in people infected with every sort of SARS-CoV-2. This protection means none of the new variants is anything like as potent a public-health threat to a largely vaccinated population as the original version was to an unvaccinated one. Delta's increased transmissibility, along with relaxed restrictions on travel and socialising, has seen the number of infections and cases in Britain beginning to climb again. But thanks to widespread vaccination, deaths have barely moved. Deaths are, by their nature, a lagging indicator of infection; but widespread vaccination of the most vulnerable is working as hoped.



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The dangers posed to the unvaccinated and partially vaccinated mean that there is still a public-health case for keeping infections from spreading. Here, unfortunately, the degree to which variants can evade vaccine-produced immunity makes things a lot harder than once they seemed. “If there is a certain degree of immune escape, even if you were to vaccinate 100% of the population, it’s going to keep coming at you for some period of time,” says Adam Kucharski of the London School of Hygiene and Tropical Medicine.

In a population where 60% are immune, either through vaccination or from a past bout of covid-19, the introduction of a variant with a reproductive number of eight would cause a sharp surge in infections unless lockdowns and similar interventions were established right away (see chart 2). For unvaccinated populations the situation is much worse. If no precautions are taken, a reproductive number of eight produces a far more dramatic crisis in an unvaccinated population than one of two or three does. And last year provided ample evidence of how bad things get even with a lower R. Other things being equal, a highly transmissible virus means more deaths and a more acute stress on the health-care system.

Spikes for speedy spread

Other things may not be equal; the danger posed to the unvaccinated by a new variant may not be exactly the same as that posed by older versions. In Britain those infected with the Alpha variant saw a higher level of severe disease than those infected with the original version, but no corresponding increase in deaths.

Whether Delta does the same is unclear. Comparisons with other variants in countries that can measure such things well are made hard to assess by the large numbers of vaccinated people in those populations. The picture emerging from a British symptom-tracking app called Zoe suggests that Delta is presenting with symptoms closer to those for the common cold than those seen with other variants. They rarely have shortness of breath, the hallmark symptom of covid-19 with the variants that dominated the first year of the pandemic. Oddly, vaccinated people who then get infected tend to sneeze more—which is good for the virus not just because sneezes spread diseases but also because it allows covid-19 to be mistaken for hayfever.

So far, though, differences in the severity of disease caused by the different variants have been eclipsed by the simple, deadly fact of their high-speed spread. There is ample room for that to continue. Less than 1% of people in low-income countries have had even one dose of vaccine. In sub-Saharan Africa Delta is fuelling outbreaks that are crushing hospitals and killing health-care workers.

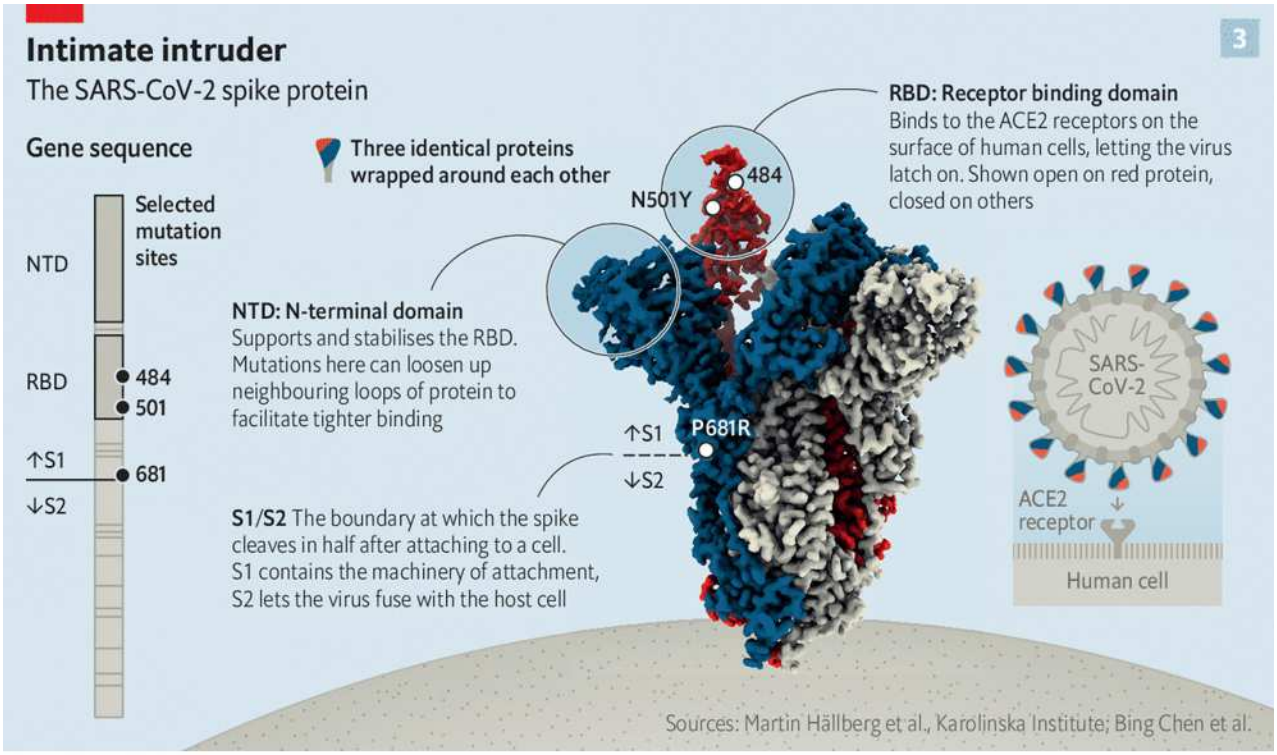
Rich countries, including Australia, Japan and South Korea, where the first wave was largely avoided and vaccination has not been a high priority now look highly vulnerable. By the end of June the risk of Delta had seen almost half of Australia put under lockdown orders. Delta is the dominant strain in Russia, where a vaccination rate of 12% and misinformation-driven vaccine scepticism seem set to make its spread easy.

The variants make vaccination programmes more urgent than ever. But though they may march on through the alphabet for some time to come, there is some reason to hope that they will not get all that much worse as they do so. They may be running out of evolutionary room to manoeuvre.

For a clearer understanding of what is going on, focus on the spike protein that adorns the outer envelope of SARS-CoV-2 particles. You can think of it, as you can of any protein, as being like a paper chain in which every link can have one of 20 colours. The gene for spike specifies the sequence in which those colours appear in the protein's 1,273-link long chain. Mutations in the gene can change the colour of one specific link, add a few new links, or cut some links out. In the Alpha variant six of those links have different colours from those in the Wuhan sequence, and in a couple of places a link or two are missing altogether. The Delta spike has five distinctive mutations.

In reality the links in the chain are 20 different types of amino acid. Each type has subtly different chemical and physical properties. At the time that the chain is created the laws of physics require it to fold up into something more compact. The specific shape into which it folds is determined by its unique sequence of amino acids, as laid out in the gene. And

that shape underlies all the protein's future capabilities. Shape is almost everything in the world of proteins. It is through their shapes that proteins recognise each other. It is through changes of shape that they act.



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Each of the now-familiar protuberances on the surface of SARS-CoV-2 particles is composed of three copies of the spike protein slotted together into a "trimer" shaped a bit like a golf tee (see chart 3). In the cup of these tees are the virus's receptor-binding domains (RBDs). Each of the trimer's constituent proteins can be open or closed at any given time. When they are open ACE2, a protein found on the surface of some human cells, fits quite nicely into the RBD's carefully contrived nobbliness.

Acey deucey

The ACE2 receptor is the virus's main target; it normally attacks only those cells that display it. The act of glomming on to an ACE2 molecule changes the spike protein's shape, revealing a "cleavage site" which is suited to attack by another protein on the cell's surface. As a result the spike gets cut in two—which sounds bad for the virus, but is in fact the necessary next step in infection. It is only after the spike is sliced asunder that the membranes of the virus and the cell can merge.

Tyler Starr, a researcher at the Fred Hutchinson Cancer Research Centre in Seattle, describes the RBD as a "big, squishy interface" that mutations can reshape quite easily. In 2020 he, Jesse Bloom and their colleagues sought to examine this mutability by making versions of the SARS-CoV-2 RBD in which individual amino acids in the protein paper-chain were replaced by alternatives with different properties. These mutant proteins were then tested to see how well they stuck to ACE2; those that did best, the researchers reasoned, might be mutations that evolution would favour. They were right.

In the original Wuhan genome the 501st position in the spike chain is occupied by an amino acid called asparagine. When the scientists in Seattle put an amino acid called tyrosine there instead, the RBD bound to ACE2 more tightly; it turns out that the change twists a key part of the RBD round by about 20 degrees, making the fit a bit more snug. Mutations which cause just that substitution, known as N501Y (or sometimes “Nelly”) subsequently turned up in the Alpha, Beta and Gamma variants. Another change they spotted, now called E484K (or “Eek”), was found in both Beta and Gamma.

Changes to the RBD can also reduce its susceptibility to antibodies. Antibodies also work by recognising shapes, and though they recognise various other bits of the spike protein, notably another region in the trimer’s head called the N-terminal domain (NTD), the most effective of them are specific to particular aspects of the RBD. Some changes to the RBD, such as N501Y, do not make it less recognisable to antibodies. Others, such as E484K, do. Being a lot less susceptible to some antibodies seems to help E484K’s possessors to infect people who have been vaccinated.

The RBD is not the only part of the spike protein where mutations matter. In a preprint published on June 22nd Ravindra Gupta, a molecular virologist at Cambridge University, and his colleagues put forward an argument as to why Delta is both more infectious and better at evading immunity than other variants. It is based on a substitution at site 681, which is at the point where, after the RBD meets ACE2, the protein is cleft in two.

Not ai, therefore em

Dr Gupta says P681R, helped by two shape-modifying mutations elsewhere, makes it easier for the protein to be cut up and thus get into cells. Its presence also means that, once a cell starts producing particles, their spike proteins can get on to the cell’s surface pre-cut. That can lead to virus particles which are shorn of the RBDs which antibodies recognise and ready to fuse with any nearby cell. It can also encourage infected cells to clump together with others. Dr Gupta’s lab has found evidence of these cell clumps in a living model of the human respiratory system.

A full validation of this work will require a detailed picture of the Delta variant’s structure—something which is not yet available. In theory, it should be possible to predict the shape of a protein using nothing but the sequence of amino acids described by its gene and the laws of physics. Doing so from first principles, though, is impossible. DeepMind, an AI company which is part of Google, has shown that machine learning can help a lot. But as yet its capabilities are best demonstrated on small single proteins. This approach is not much good if the protein is large, anchored in a membrane, and naturally found in a dimer or trimer, as spike is. DeepMind has not attempted to predict spike’s structure.

The best tool for seeing spike’s structure in detail is cryo-electron microscopy. Copies of the protein in question are flash frozen using liquid nitrogen (hence cryo); once they are immobilised beams of electrons are bounced off them and used to build up pictures (hence microscopy). Bing Chen, who has run a series of cryo-EM experiments on the spike protein at Harvard, is at pains to stress the time, effort and computer power required to turn thousands of pictures of the protein taken from every conceivable angle into a

three-dimensional image which comes close to resolving the positions of every single atom. But there is no better way to appreciate the changes in the fine details of the protein's structure brought about by the variants' different mutations.

On June 24th Dr Chen's group published long-awaited structures for the Alpha and Beta spike variants. They show the way in which the protein's complex folding allows mutations that are at some distance from each other in paper-chain terms to have effects on the overall shape that it would be near impossible to predict from the sequence alone. A pair of mutations found called A570D and S982A, for example, act to slightly loosen up the protein's structure in Alpha. That makes the RBD open up more. The group is now working on a structure for Delta which might confirm Dr Gupta's insights.

Studies of this sort help reveal how the mutations in the variant spikes work together. But how did these variants come to have so many mutations in the first place? Mutations are normally expected to crop up one at a time; but the named variants each emerged with a whole set of them. That is what has given them sudden and surprising effects.

One way in which they could have emerged fully formed is by evolving in people with compromised immune systems who had very long drawn out SARS-CoV-2 infections. In such cases the virus would be able to continue replicating itself in their bodies again and again, accumulating a number of mutations as it did so. The time required for such a process would help explain why the variants only started to appear towards the end of last year. Studies of five such people have shown that they developed a number of the mutations now seen in variants.

Not all the mutations in the variants are in the spike gene, and some of those affecting other proteins will doubtless also prove to have importance. One of Alpha's mutations appears to give it an advantage when dealing with a non-antibody-using arm of the immune system. Non-spike mutations probably explain why Delta's symptoms appear different. But spike still dominates the discussion. Its structure is crucial to the vaccines. And it also seems unusually mutable.

Dr Starr thinks this mutability may be a consequence of the virus's origin in bats. He points out that most viruses have binding domains that cannot tolerate much mutation, and so they evolve ways of hiding them away from pesky antibodies. The SARS-CoV-2 RBDs are too large for such protection. That would seem like a problem for the virus. But it may be a price worth paying if a larger, more open RBD is easier for evolution to reshape.

The reason that Dr Starr thinks evolvability might be a benefit worth paying for is that, in bats, ACE2 is much more diverse than it is in humans. That means viruses which use the receptors as a target need to be able to adapt the mechanisms by which they do so. The tolerance for mutations that has made new variants of RBD possible in humans may be the "by-product of this arms race...between virus and bats".

Avoiding Omega

If mutation is comparatively easy, though, it also has its limits. In their experiments last year Dr Starr and his colleagues identified changes to the RBD that seemed advantageous but which do not turn up in the real world—presumably because real spike proteins cannot contort themselves enough to accommodate them.

Seeing similar mutations crop up in different variants also suggests that evolution is sampling a somewhat limited number of possibilities. “The fact is that you’re starting to see recurring mutations,” says Dr Chen. “That would be an indication that there are probably not that many places that the virus can mutate.” Strains with radically different ways of becoming more transmissible or evasive may be beyond evolution’s reach.

Another cause for optimism is that spike is not the only part of the process that is complex and mutable. The immune system is, too. The initial infection is the first stage of a protracted struggle in which the immune system has various strategies at its disposal. A study by Jackson Turner of the Washington University School of Medicine and his colleagues which was published in *Nature* on June 28th showed that the immune response produced by infection with SARS-CoV-2 is long lasting, robust and multifaceted. Among other things, some of the B-cells which produce antibodies produce more effective ones later in the course of infection than earlier on. This may be part of the reason why they provide better protection against severe disease than they do against infection.

It is quite possible, though, that not all vaccines will do so equally well. Hundreds of millions of doses of two vaccines made by Chinese companies, Sinopharm and Sinovac, have been sold to low and middle-income countries; they look like being a large part of the world’s vaccine supply for the rest of the year. But there are some doubts about their efficacy, especially against new variants. The original clinical trial of the Sinovac vaccine found a lower efficacy than in any other covid-19 vaccine trial, just 51%. Studies of the vaccine’s use in Uruguay and Indonesia have been a great deal more encouraging. But there is rising concern in Bahrain, Chile, the Seychelles, Turkey and the UAE, all of which have relied on Chinese jabs. The UAE and Bahrain are worried enough to have started offering a third shot of Pfizer’s vaccine to people who have already been given two shots of Sinopharm’s.

Third shots are being looked at by some other governments, too, including Britain’s. The fact that current vaccines protect people against severe disease and death even when infected by the new variants makes the idea that variant-specific vaccines analogous to seasonal flu jabs will be necessary look less likely. The easier alternative of offering people who have been vaccinated twice a third shot, though, perhaps using one of the other vaccines, has advocates.

But there is as yet no evidence that it is necessary. And third shots pale as a priority compared with first and second shots for those who have had neither, and now need them more than ever. ■

This article appeared in the Briefing section of the print edition under the headline "Coats of many colours"

How to assess the costs and benefits of lockdowns

economist.com/finance-and-economics/2021/07/01/how-to-assess-the-costs-and-benefits-of-lockdowns

1 juillet 2021

Lives v livelihoods
How to assess the costs and benefits of lockdowns

The policy will stay in governments' toolkits. A growing body of research will guide its use

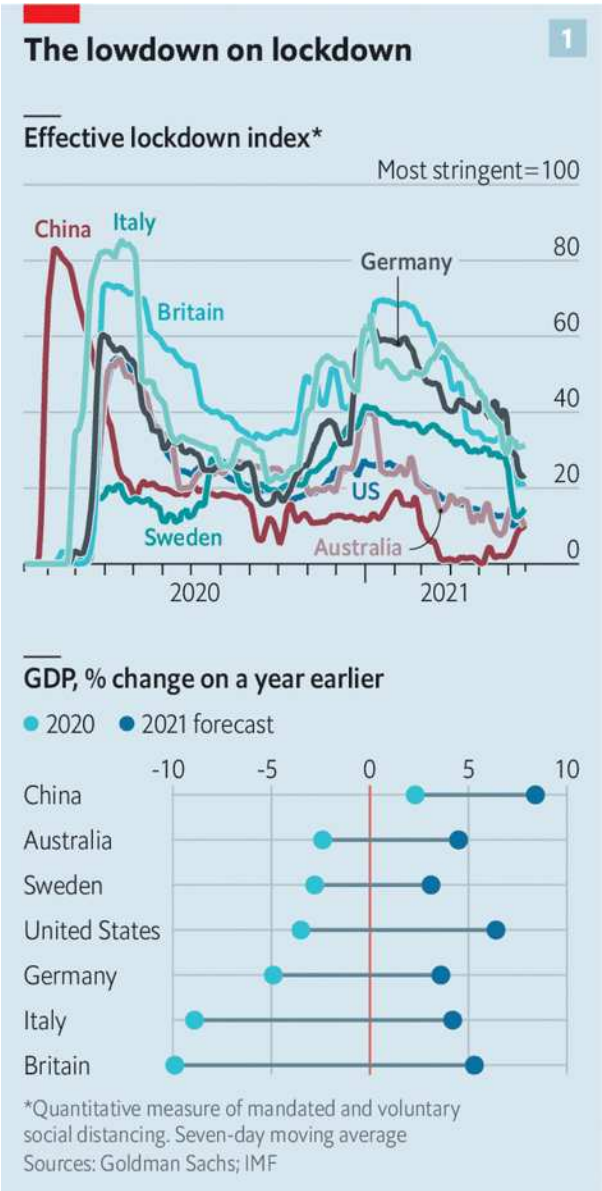
"TO ME, I say the cost of a human life is priceless, period," said Andrew Cuomo, the governor of New York state. As they tried to slow the spread of covid-19 in the spring of 2020, politicians took actions that were unprecedented in their scale and scope. The dire warnings of the deaths to come if nothing was done, and the sight of overflowing Italian hospitals, were unfamiliar and terrifying. Before the crisis the notion of halting people's day-to-day activity seemed so economically and politically costly as to be implausible. But once China and Italy imposed lockdowns, they became unavoidable elsewhere.

Much of the public debate over covid-19 has echoed Mr Cuomo's refusal to think through the uncomfortable calculus between saving lives and the economy. To oversimplify just a little, the two sides of the lockdown debate hold diametrically opposed and equally unconvincing positions. Both reject the idea of a trade-off between lives and livelihoods. Those who support lockdowns say that they have had few malign economic effects, because people were already so fearful that they avoided public spaces without needing

to be told. They therefore credit the policy with saving lives but do not blame it for wrecking the economy. Those who hate lockdowns say the opposite: that they destroyed livelihoods but did little to prevent the virus spreading.

The reality lies between these two extremes. Lockdowns both damage the economy and save lives, and governments have had to strike a balance between the two. Were trillions of dollars of lost economic output an acceptable price to pay to have slowed transmission of the disease? Or, with around 10m people dead, should the authorities have clamped down even harder? Now that politicians are considering whether and when to lift existing restrictions, or whether to impose new ones, the answers to these questions are still crucial for policy today. Alongside vaccines, lockdowns remain an important way of coping with new variants and local outbreaks. In late June Sydney went into lockdown for two weeks; Indonesia, South Africa and parts of Russia have followed suit.

Countries have used a range of measures to restrict social mixing over the past year, from stopping people visiting bars and restaurants to ordering mask-wearing. The extent to which these strictures have constrained life has varied widely across countries and over time (see chart 1). A growing body of economic research now explores the trade-off between lives and livelihoods associated with such policies. Economists have also compared their estimates of the costs of lockdowns with those of the benefits. Whether the costs are worth incurring is a matter for debate not just among wonks, but also for society at large.



The Economist

People who see no trade-off at all might start by pointing to a study of the Spanish flu outbreak in America in 1918-20 by Sergio Correia, Stephan Luck and Emil Verner, which suggested that cities that enacted social distancing earlier may have ended up with better economic outcomes, perhaps because business could resume once the pandemic was under control. But other economists have criticised the paper's methodology. Cities with economies that were doing better before the pandemic, they say, happened to implement restrictions earlier. So it is unsurprising that they also fared better afterwards. (The authors of the original paper note that pre-existing trends are "a concern", but that "our original conclusion that there is no obvious trade-off between 'flattening the curve' and economic activity is largely robust.")

Another plank of the no-trade-off argument is the present-day experience of a handful of places. Countries such as Australia and New Zealand followed a strategy of eliminating the virus, by locking down when recorded infections rose even to very low levels and imposing tough border controls. "Covid-19 deaths per 1m population in OECD countries that opted for elimination...have been about 25 times lower than in other OECD countries that favoured mitigation," while "GDP growth returned to pre-pandemic levels in early 2021

in the five countries that opted for elimination," argues a recent paper in the *Lancet*. The lesson seems to be that elimination allows the economy to restart and people to move about without fear.

Something for nothing

But correlations do not tell you much. Such countries' success so far may say more about good fortune than it does about enlightened policy. What was available to islands such as Australia, Iceland and New Zealand was not possible for most countries, which have land borders (and once the virus was spreading widely, eradication was almost impossible). Japan and South Korea have seen very low deaths from covid-19 and are also cited by the *Lancet* paper as having pursued elimination. But whether they did so or not is questionable; neither country imposed harsh lockdowns. Perhaps instead their experience with the SARS epidemic in the early 2000s helped them escape relatively unscathed.

When you look at more comparable cases—countries that are close together, say, or different parts of the same country—the notion that there is no trade-off between lives and livelihoods becomes less credible. Research by Goldman Sachs, a bank, shows a remarkably consistent relationship between the severity of lockdowns and the hit to output: moving from France's peak lockdown (strict) to Italy's peak (extremely strict) is associated with a decline in GDP of about 3%. Countries in the euro area with more excess deaths as measured by *The Economist* are seeing a smaller hit to output: in Finland, which has had one of the smallest rises in excess deaths in the club, GDP per person will fall by 1% in 2019-21, according to the IMF; but in Lithuania, the worst-performing member in terms of excess deaths, GDP per person will rise by more than 2%.

The experience across American states also hints at the existence of a trade-off. South Dakota, which imposed neither a lockdown nor mask-wearing, has done poorly in terms of deaths but its economy, on most measures, is faring better today than it was before the pandemic. Migration patterns also tell you something. There have been plenty of stories in recent months about people moving to Florida (a low-restriction state) and few about people going to Vermont (the state with the fewest deaths from covid-19 per person, after Hawaii), points out Tyler Cowen of George Mason University. Americans, at least, do not always believe that efforts to control covid-19 make life more worth living.

What if all these economic costs are the result not of government restrictions, though, but of personal choice? This too is argued by those who reject the idea of a trade-off. If they are correct, then the notion that simply lifting restrictions can boost the economy becomes a fantasy. People will go out and about only when cases are low; if infections start rising, then people will shut themselves away again.

A number of papers have bolstered this argument. The most influential, by Austan Goolsbee and Chad Syverson, two economists, analyses mobility along administrative boundaries in America, at a time when one government imposed restrictions but the other did not. It finds that people on either side of the border behaved similarly, suggesting that

it was almost entirely personal choice, rather than government orders, which explains their decision to limit social contact; people may have taken fright when they heard of local deaths from the virus. Research by the IMF draws similar conclusions.

There are reasons to think these findings overstate the power of voluntary behaviour, however. Sweden, which had long resisted imposing lockdowns, eventually did so when cases rose—an admission that they do make a difference. More recent research from Laurence Boone of the OECD, a rich-country think-tank, and Colombe Ladreit of Bocconi University uses slightly different measures from the IMF and finds that government orders do rather a lot to explain behavioural change.

Moreover, the line between compulsion and voluntary actions is more blurred than most analysis assumes. People's choices are influenced both by social pressure and by economics. Press conferences where public-health officials or prime ministers warn about the dangers of the virus do not count as "mandated" restrictions on movement; but by design they have a large effect on behaviour. And in the pandemic certain voluntary decisions had to be enabled by the government. Topped-up unemployment benefits and furlough schemes made it easier for people to choose not to go to work, for instance.

Put all this together and it seems clear that governments' actions did indeed get people to stay at home, with costly consequences for the economy. But were the benefits worth the costs? Economic research on this question tries to resolve three uncertainties: over estimates of the costs of lockdowns; over their benefits; and, when weighing up the costs and benefits, over how to put a price on life—doing what Mr Cuomo refused to do.

The cure v the disease

Start with the costs. The huge collateral damage of lockdowns is becoming clear. Global unemployment has spiked. Hundreds of millions of children have missed school, often for months. Families have been kept apart. And much of the damage is still to come. A recent paper by Francesco Bianchi, Giada Bianchi and Dongho Song suggests that the rise in American unemployment in 2020 will lead to 800,000 additional deaths over the next 15 years, a not inconsiderable share of American deaths from covid-19 that have been plausibly averted by lockdowns. A new paper published by America's National Bureau of Economic Research (NBER) expects that in poor countries, where the population is relatively young, the economic contraction associated with lockdowns could potentially lead to 1.76 children's lives being lost for every covid-19 fatality averted, probably because wellbeing suffers as incomes decline.

Research is more divided over the second uncertainty: the benefit of lockdowns, or the extent to which they reduce the spread of, and deaths from, covid-19. The fact that, time and again, the imposition of a lockdown in a country was followed a few weeks later by declining cases and deaths might appear to settle the debate. That said, another recent NBER paper failed to find that countries or American states that were quick to implement shelter-in-place policies had fewer excess deaths than places which were slower to act. A paper published in the *Proceedings of the National Academy of Sciences*, a scientific

journal, by Christopher Berry of the University of Chicago and colleagues, cannot find “effects of [shelter-in-place] policies on disease spread or deaths”, but does find “small, delayed effects on unemployment”.

Is the price right?

Running through all this is the final uncertainty, over putting a price on life. That practice might seem cold-hearted but is necessary for lots of public policies. How much should governments pay to make sure that bridges don’t collapse? How should families be compensated for the wrongful death of a relative? There are different ways to calculate the value of a statistical life (VSL). Some estimates are derived from the extra compensation that people accept in order to take certain risks (say, the amount of extra pay for those doing dangerous jobs); others from surveys.

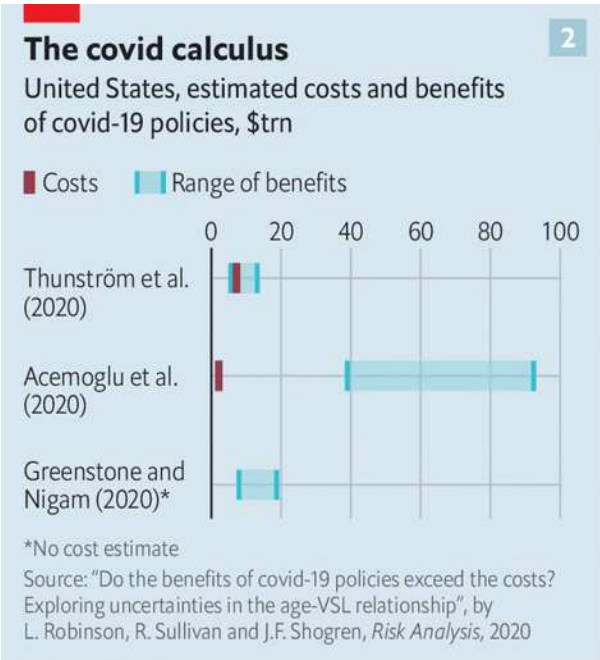
Cost-benefit analyses have become something of a cottage industry during the pandemic, and their conclusions vary wildly. One paper by a team at Yale University and Imperial College, London, finds that social distancing, by preventing some deaths, provides benefits to rich countries in the region of 20% of GDP—a huge figure that plausibly exceeds even the gloomiest estimates of the collateral damage of lockdowns. But research by David Miles, also of Imperial College, and colleagues finds that the costs of Britain’s lockdown between March and June 2020 were vastly greater than their estimates of the benefits in terms of lives saved.

An important reason for the big differences in cost-benefit calculations is disagreement over the VSL. Many rely on a blanket estimate that applies to all ages equally, which American regulatory agencies deem is about $11m. At the other extreme Mr Miles follows convention in Britain, which says that the value of one quality-adjusted life-year (QALY) is equal to £30,000 (which seems close to a VSL of around £300,000, or $417,000, given how many years of life the typical person dying of covid-19 loses). The lower the monetary value you place on lives, the less good lockdowns do by saving them.

The appropriate way to value a change in the risk of death or life expectancy is subject to debate. Mr Miles’s number does, however, look low. In Britain the government’s “end-of-life” guidance allows treatments that are expected to increase life expectancy by one QALY to cost up to £50,000, points out Adrian Kent of Cambridge University in a recent paper, and allows a threshold of up to £300,000 per QALY for treating rare diseases. But it may be equally problematic to use the American benchmark of $11m for covid-19, which disproportionately affects the elderly. Because older people have fewer expected years left than the average person, researchers may choose to use lower estimates of the VSL.

The best attempt at weighing up these competing valuations is a recent paper by Lisa Robinson of Harvard University and colleagues, which assesses what happens to the results of three influential cost-benefit studies of lockdowns when estimates of the VSL are altered (see chart 2). Adjusting for age can sharply reduce the net benefits of lockdowns, and can even lead to a result where “the policy no longer appears cost-beneficial”. Given that these models do not take into account the harder-to-measure costs of lockdowns—

how to price the damage caused by someone not being able to attend a family Christmas, say, or a friend's funeral?—the question of whether they were worth it starts to look like more of a toss-up.



Once you open the door to making adjustments, things become more complicated still. Research on risk perception finds that uncertainty and dread over an especially bad outcome, especially one that involves more suffering before death, mean that people may be willing to pay far more to avoid dying from it. People appear to value not dying from cancer far more than not dying in a road accident, for instance. Many went to extraordinary lengths to avoid contracting covid-19, suggesting that they place enormous value on not dying from that disease. Some evidence suggests that the VSL might need to be increased by a factor of two or more, writes James Hammitt, also of Harvard, in a recent paper. That adjustment could make lockdowns look very worthwhile.

The malleability of cost-benefit analysis itself hints at the true answer of whether or not lockdowns were worth it. The benefit of a saved life is not a given but emerges from changing social norms and perceptions. What may have seemed worthwhile at the height of the pandemic may look different with the benefit of hindsight. Judgments over whether or not lockdowns made sense will be shaped by how society and politics evolve over the coming years—whether there is a backlash against the people who imposed lockdowns, whether they are feted, or whether the world moves on. ■

Dig deeper

All our stories relating to the pandemic and the vaccines can be found on our coronavirus hub. You can also listen to The Jab, our podcast on the race between injections and infections, and find trackers showing the global roll-out of vaccines, excess deaths by country and the virus's spread across Europe and America.

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Office re-entry is proving trickier than last year’s abrupt exit

economist.com/business/2021/07/01/office-re-entry-is-proving-trickier-than-last-years-abrupt-exit

1 juillet 2021

BusinessJul 3rd 2021 edition

After the exodus
Office re-entry is proving trickier than last year’s abrupt exit

As economies reopen employers face tough choices

EIGHT YEARS ago Google’s then finance chief, Patrick Pichette, recalled being asked how many of the tech giant’s employees telecommuted. His answer was simple: “As few as possible.” Despite the fact that Google was busy churning out apps that enabled remote work, his comment was also unremarkable. From Silicon Valley and Wall Street to the Square Mile in London, La Défense in Paris, Potsdamer Platz in Berlin and Hong Kong’s Central, the world’s business districts welcomed millions of office grunts every workday. Congregating in one place was believed to spur productivity, innovation, camaraderie. It enabled bosses to keep a beady eye on their underlings. Work from home was something to be done only if it absolutely couldn’t be avoided.

In March 2020 it suddenly could not. The covid-19 pandemic forced governments around the world to impose strict lockdowns. Overnight, most of the world’s offices became off limits. To survive, companies everywhere embarked on a gigantic experiment in home-working. City workers swapped suits for jogging trousers and city-centre flats for the

suburbs. In a corporate change of heart that typified the era, Google gave each employee globally $1,000 for home-office furniture, offered them virtual fitness videos and cooking lessons, and urged everyone to “take good care of yourselves and one another”.

As vaccination rates rise in the rich world the home-working experiment is being unwound (see chart 1). But the speed of the unwinding, and its scope, has become a matter of hot debate among chief executives, and between them and their staff. The strategies that emerge out of these debates will shape not just what happens in the next few months but also the longer-term future of office work.

The Economist

One change is already obvious. The universal anti-remote-work mindset of yesteryear is gone, replaced by a range of attitudes that vary by industry and region. At one extreme, some companies now expect all workers to be back at their desks. At the other, certain firms are doing away with offices altogether. Most businesses fall somewhere in the middle.

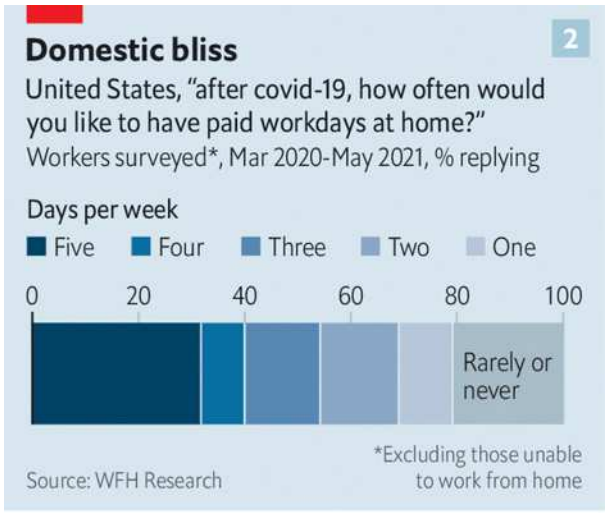
The most ardent supporters of the status quo ante can be found on Wall Street. David Solomon, boss of Goldman Sachs, has called remote work an “aberration”. His opposite number at Morgan Stanley, James Gorman, recently quipped, “If you can go into a restaurant in New York City, you can come into the office.” Jamie Dimon, chief executive of JPMorgan Chase, has conceded that “people don’t like commuting, but so what?” The three bank bosses worry that remote workers are less engaged with the company, and potentially less productive.

Whether or not they agree with the Wall Street titans deep down, their counterparts in Europe see such intransigence as an opportunity to lure disaffected bankers who prefer greater flexibility. UBS, a Swiss lender, is reportedly about to allow two-thirds of its employees to pursue “hybrid” work, which combines some days at home and some at the office—in part as a recruitment tool. NatWest, a British bank, expects just one in eight workers back at the office full-time, with the rest on hybrid schedules or primarily home-working. People at Germany’s Deutsche Bank will work remotely up to 60% of the time. Noel Quinn, chief executive of HSBC, has described drifting back to pre-pandemic patterns as a “missed opportunity” and would like the Asia-centric bank’s staff to embrace hybrid arrangements.

Many technology CEOs seem to share Mr Quinn’s sentiment. They fret that strict return-to-office mandates will put off restless software engineers. Dylan Field, co-founder of Figma, which helps firms create and test apps and websites, worries that employees will jump ship if the rules are too restrictive. Tech workers may indeed be getting more footloose, with quit rates seemingly higher and poaching more rampant than usual. Perhaps in recognition of this, in June Facebook said that all of the social-media giant’s full-time employees could apply for permanent remote work. Companies such as Spotify, a music-streamer, Square, a fintech firm, and Twitter have told many of their staff they can work remotely for ever if they please.

Corporate chimeras

Across regions and industries evidence suggests that people like the ability to work from home at least occasionally. A poll of 2,000 American adults by Prudential, an insurer, found that 87% of those who worked from home during the pandemic wanted to be able to continue doing so after restrictions ease. According to the same survey, 42% of remote workers said they would search for a new job if they were asked to return to the office full-time. Only one in five American employees say they would seldom or never want to work from home (see chart 2). In a recent poll of more than 10,000 European office workers, 79% said that they would back legislation prohibiting bosses from forcing people to work from the office.



The Economist

Young workers, often seen as casualties of remote working, have warmed to flexible schedules. Members of Gen-Z, now aged 16-21, were more likely than any other age group to cite personal choice rather than employers' policies as the main reason for continuing to work remotely, according to a study by Morgan Stanley. At the same time, many workers of all ages are still keen to come to the office every now and again—not least to enjoy reliable air-conditioning during what is shaping up to be a scorching northern summer. Salesforce, a business-software giant itself implementing a work-from-anywhere model, found that although nearly half its employees are opting to stay home most of the time, four in five want to maintain a physical connection with the corporate office.

The public sector, often the largest employer in a country, faces similar considerations. Britain's tax authority is offering all employees the right to work from home two days a week. In America the federal government predicts that many civil servants will want to maintain flexible schedules after the pandemic. Ireland, which wants 20% of its 300,000 public servants working remotely by the end of the year, is offering financial support to encourage them to relocate outside cities. It will create more than 400 remote-working hubs, allowing staff to work closer to home. Indonesia has set up a "work from Bali" scheme for civil servants to help revive the tropical island's tourism industry.

All this suggests that hybrid arrangements will persist in most places (with the possible exception of Wall Street). They present their own challenges, however. They blur the lines between work and family life. Virtual meetings can be even more tedious than in-person ones; people who have admitted to Zoom fatigue include Eric Yuan, the video-conferencing app's billionaire founder. And hybrid schedules make managing office space tricky, especially at a time when many companies, including HSBC, are planning to reduce their office footprint.

Given a choice, most Australian workers would prefer to work from home on Mondays and Fridays, according to EY, a consultancy. Even if managers' suspicions that this is a thinly veiled effort to extend the weekend prove unfounded, that means that offices would be far busier on Wednesdays, the least popular choice for home-working, than at the start and end of the work week.

Some firms still intend to let people come in whenever they want. Others are getting inventive. Mr Field of Figma gives his staff a choice: work remotely full-time or, if you come in at least twice a week, get a desk in an office. Snowflake, a data-management firm, will let individual units decide how to organise themselves. Many companies, including giants such as Apple, have got around the problem by mandating days when employees are required to be present.

Normality bites

The sudden reconfiguring of work life is leading to friction. Workers who want more flexibility are finding themselves at odds with employers calling for a return to something closer to pre-pandemic normal. Some of Apple's employees have criticised the tech giant's requirement to work in-person three days a week as tonally "dismissive and invalidating". The AFL-CIO, America's biggest trade-union federation, is facing health-and-safety complaints from its own staff over its measures to bring workers back to the office in the absence of improved ventilation and amid fears of continued risk of infection while commuting on public transport.

Watch Video At: https://youtu.be/n2NTmmcPDHk

Such disagreements are spilling over into boardrooms. Some shareholders, including big institutional investors, are keen to promote flexible working not only to retain talent but also to burnish companies' environmental, social and governance (ESG) credentials. S&P Global, an analytics firm, says that under its assessments, the ability to work from home is one measure of employees' health and wellbeing, which can influence up to 5% of a firm's ESG score. This is roughly the same weighting attached to risk and crisis management for banks, or human-rights measures for miners. It may affect things like gender and racial diversity. Studies find that mothers are likelier than fathers to favour

work from home. Research by Slack, a messaging app, found that only 3% of black knowledge-workers want to return to the office full-time in America, compared with 21% their white counterparts.

That is a lot for companies to ponder, even as they deal with short-term controversies, such as whether or not to bar unvaccinated workers from the office. Disruptive though it was, last year's abrupt transition to remote work may, ironically, prove considerably smoother than the shift to whatever counts as normal in the post-pandemic era. ■

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Africa’s latest wave of covid-19 could be its worst yet

economist.com/middle-east-and-africa/2021/07/01/africas-latest-wave-of-covid-19-could-be-its-worst-yet

1 juillet 2021

Third time unlucky
Africa’s latest wave of covid-19 could be its worst yet

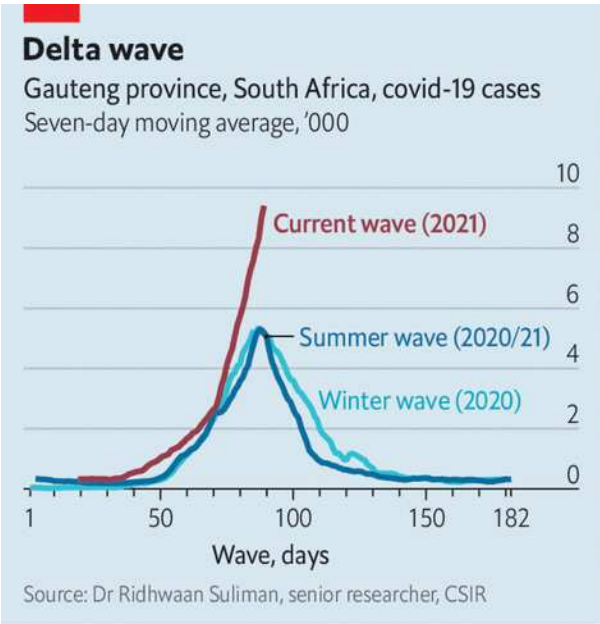
A lack of vaccines means it will not be the last

IN THE EARLY months of the pandemic it was common to hear that Africa had been spared the worst of covid-19. Experts pointed to low official rates of illness or death and speculated about whether they were a result of youthful demography, Africa’s experience of dealing with infectious diseases such as Ebola and HIV, or something else entirely, perhaps underlying immunity. The premise was shaky, however. Most African countries test tiny numbers of people. Only a few keep good track of deaths. One that does, South Africa, has suffered one of the world’s highest levels of excess mortality during the pandemic. The sanguine view also neglected how, even if Africa’s waves really were less deadly than elsewhere, there might also be more of them because of low vaccination rates.

Today there is little sign of the continent being spared. As of June 28th the seven-day rolling average of confirmed cases in South Africa was 267 per million people, more than five times the global average, and rising steeply. Almost a quarter of tests are positive, suggesting that many cases are going undetected. “The latest surge threatens to be Africa’s worst yet,” says Matshidiso Moeti, the head of the World Health Organisation (WHO) in Africa. Cases are rising especially quickly in 12 countries, she says, though

“health systems are already pushed to breaking point” in many more. In Namibia, Uganda and Zambia, among other places, oxygen is running out and hospital beds are full. The WHO calculates that, within weeks, the Africa-wide caseload of the third wave will surpass the peak of the second, which in turn was higher than the peak of the first.

Dr Moeti highlights two reasons for the strength of the latest wave. The first is public fatigue. In rich countries covid-19 was seen as a once-in-a-lifetime event to be endured until vaccines arrived; in many African ones it is another burden among many, with no sign of relief. Governments have been slower to impose lockdowns this time around. They have no money to pay people to stay at home, fear the effects on commerce and note the lack of public clamour for restrictions. "The third wave has come with a severity that most countries were not prepared for,” adds John Nkengasong, the director of Africa Centres for Disease Control and Prevention (Africa CDC), a continent-wide public-health body.



The Economist

The second is the arrival of new variants. Not every African country can sequence virus genomes. But more than half have reported the Alpha variant first detected in Britain and the Beta variant initially spotted in South Africa. Nearly a quarter have reported the Delta variant linked to India’s catastrophic second wave.

Those countries include Congo and Uganda. Neither has many confirmed cases of the virus. Congo, a country of 87m people, has recorded 40,000, fewer than Glasgow, a Scottish city of 630,000 people. But, in an indication of covid-19’s true spread, 32 of the country’s 600-odd MPs have died from the disease. In Uganda more than 200 MPs and parliamentary staff have tested positive in the past few weeks. This is part of a broader trend. As of February, Africa accounted for 17 of the 24 government ministers or heads of state who are reported to have died from covid-19, noted a paper in the *British Medical Journal*.

South Africa is at the centre of the continent's third wave. On June 27th President Cyril Ramaphosa announced a partial lockdown, warning that cases would surpass previous peaks. Gauteng, the province that is home to Johannesburg and about a quarter of South Africans, accounts for more than half of recent cases. The week to June 26th saw more excess deaths in Johannesburg than at any time since records began in 1997. Hospitals are overwhelmed. Ambulances drive around looking for beds. In the absence of a government plan, doctors use WhatsApp groups to find out if other hospitals have space. Even the best private hospitals are wrestling with grim decisions about who gets a spot in intensive-care units—in other words, with who lives and who dies. "It's real 'Who gets the parachute?' stuff," says a doctor.

South Africa is also dealing with public fatigue, a battered economy and new variants. Delta is "rapidly displacing" the Beta variant, says Mr Ramaphosa. But the government has added to the carnage. There is no permanent health minister, following the suspension of Zweli Mkhize, who is accused of steering a contract to a firm run by associates (he denies the allegations). A large public hospital in Johannesburg is closed because the provincial government was slow to repair it after a fire in April. Mr Ramaphosa's televised "family meetings" initially won plaudits. But his appearances are increasingly tone-deaf. The latest restrictions, which include another ban on alcohol sales, came late in the day.

Inoculation would have lessened the impact of the third wave. But just over 1% of Africans have been fully vaccinated. Of the nearly 3bn doses administered globally, fewer than 2% are in Africa.

Hesitancy remains a problem. Tanzania has yet to start jabbing arms because its late president, John Magufuli, denied the usefulness of vaccines. South Africa rejected a shipment of AstraZeneca doses on the grounds that data suggested it would not stop mild infection, an argument criticised by scientists who said it would probably reduce the risk of hospitalisation and death. In Gauteng those who can are seeking other options. Diplomatic missions are organising their own vaccines. Expatriates are flying home to get jabbed.

But the main reason for low vaccination rates is simple: a lack of supply. Dr Nkengasong notes that African countries have placed enough orders to meet Africa CDC's target of getting 60% of the continent vaccinated by the end of 2022. The problem has been turning orders into deliveries.

An announcement made on June 30th should help. The International Finance Corporation, an arm of the World Bank, and the American, French and German governments, said they would provide €600m in financing to help Aspen Pharmacare, a South African firm, manufacture vaccines. The deal could help produce as many as 250m single-shot Johnson & Johnson doses for the continent this year, including 30m for South Africa. Such volumes raise the prospect that a fourth wave could be less deadly than the third. ■

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