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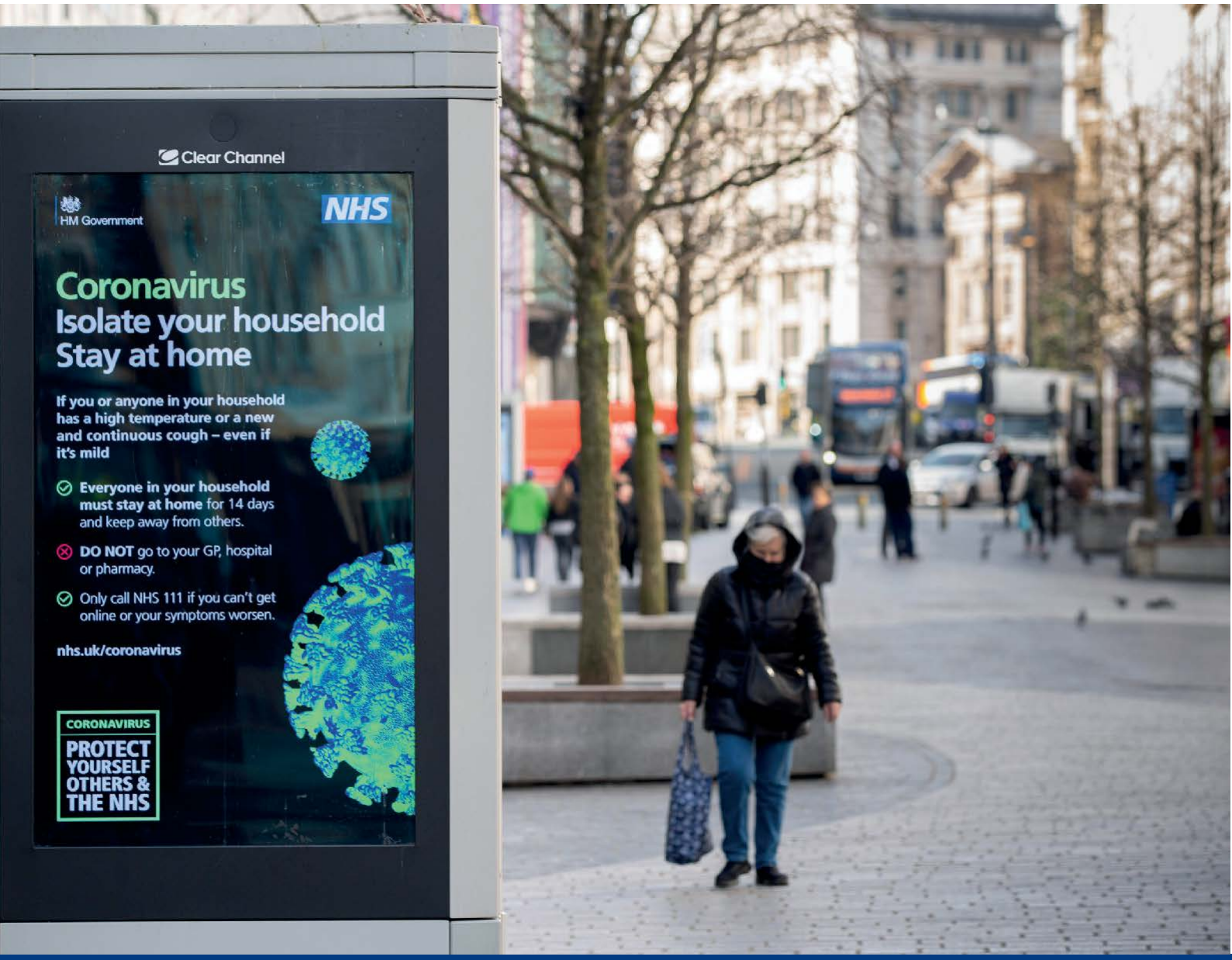

Heseltine Institute COVID-19 Project: Working Paper

Addendum - Conjectures and Refutations: Further Interrogating Potential Determinants of COVID-19's Geographies

May 2021

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The overarching framework guiding this report can be summarised using the formula:

Risk = Fundamental Conditions in union with Proximate Determinants

Or

R = FC U PD

We define the key terms within this formula as follows:

Risk: the likelihood, or the probability, that COVID-19 will lead to a given level of harm and loss in a given country.

Fundamental conditions: the efficacy and performance of the prevailing politico-economic-institutional model in that country.

Proximate determinants: the wide range of immediate or direct progenitors (epidemiological, demographic, health, social, economic, political, and environmental) which have combined to put that country in harm's way.

The proximate determinants of COVID-19's geographies are then broken down as follows:

Proximate Determinants = Exposure x Vulnerability (Immunity Status + Susceptibility + Preparedness) x Response

Or

PD = E x V (I + S + P) x R

Within this formula, we define the key terms as follows:

Exposure: the location of a country with respect to the origin and uneven diffusion of COVID-19.

Vulnerability: systemic weaknesses which render some populations more vulnerable and predisposed to feel the full ferocity of COVID-19.

Immunity status: vulnerabilities wrought by variations in population wide levels of immunity to SARS-nCoV-2 2019.

Susceptibility: social, political, cultural, and economic processes which marginalise and impoverish some social groups to the extent that their existence is so precarious that small setbacks have significant consequences.

Preparedness: the calibre of prior disaster risk management institutions, infrastructure and plans.

Response: the competence of those responsible for coordinated emergency management in real time.

Our method of investigation is predicated upon a search for plausibility, not causality. We identify a wide range of conjectures and interrogate these conjectures probing for refutations. This method can certainly help us to sift and sort possible causal factors into those

which appear to be more and those which appear to be less compelling. But the conclusions we reach are of necessity strictly provisional. The data assembled – comprising a diverse range of data sets, collected by different organisations and published in multiple formats – does not permit the kinds of statistical analysis often undertaken to quantify the relative contribution of different variables. In any event, in no sense are the conjectures identified herein exhaustive of all possibilities. Our objective is simply to shed light on variables which are illustrative of the range of categories of potential causal mechanisms set forth in the above formulae. A capstone of our thinking to date is included in the main report. In this addendum some of the background to that capstone is unpacked in greater detail.

Risk = Exposure x Vulnerability (Immunity Status + Susceptibility + Preparedness) x Response

Whilst by definition global in its reach, not every place has found itself equally on the hurricane track or in the eye of the storm; not every place has the same – to coin a phrase – *geographical viral load (*proportion of the population exposed to particularly virulent strains of the virus).

Conjecture 1: Societies whose position in the world economy demands that they function as critical nodes and hubs in global flows of people will be exposed to a greater number and variety of corridors of transition

OECD countries are at the heart of the global economy, the command and control nerve centres in global production systems and commodity chains. 12 are ranked in the top 20 most globalised economies (according to the DHL Connectedness Index). Driven by the pre-eminent global financial hub which is London, the United Kingdom is exceptionally globally connected and is ranked 8th. Geographical centrality may be playing a role by magnifying exposure to SARS- nCoV-2 2019 in the United Kingdom and in countries such as the Netherlands, Belgium, Switzerland, the United Arab Emirates, Bahrain and Saudi Arabia, whilst economic peripherality and geographical isolation may be reducing outbreaks in some African countries and in Australia and New Zealand. But we also note that Singapore, the second most globalised economy in the world, and the globally connected economies of Taiwan and South Korea all have substantially lower death rates than the much less globalised Latin American countries of Peru, Brazil, Chile, Mexico and Colombia, and East European countries of Hungary, Poland, Bulgaria, Slovakia and Slovenia.

Conjecture 2: Given its ease of transmission, COVID-19 will thrive in countries with higher population densities and less space per capita

Perhaps SARS- nCoV-2 2019 is more likely to spread in countries with higher population densities. Certainly, the relative 'emptiness' and 'spaciousness' of Australia, New Zealand, the African continent and the Nordic countries has been cited in the popular press as a possible explanation for their lower number of cases and deaths, whilst the higher population densities of the United Kingdom, India and Italy has been invoked as a contributor to these countries' poorer outcomes. But other countries with very low population densities, including the vast majority of states in Latin America, have presided over very significant outbreaks, whilst some countries with very high population densities such as China, Japan, South Korea, Vietnam, Bangladesh, Singapore and Nigeria have managed to avoid the worst of the

pandemic. At least at the global scale, population density per se does not appear to be a strong determinant of the scale of COVID-19's propagation.

Conjecture 3: Given its ease of transmission, urban density is the enemy of containment, and COVID-19 will thrive in more urbanised countries

Recognising that large urban mega-cities represent a perfect petri-dish for COVID-19 contagion, agglomeration is likely to be a significant progenitor of elevated transmission. And so it is no surprise that many of the world's most urbanised countries (Belgium, the Netherlands, Qatar, Argentina and Israel – all with over 90% of their populations urban) have presided over poor outcomes. But other equally urbanised countries have done much better (Japan and Singapore). Moreover, notwithstanding its very poor performance, the United Kingdom is only the 38th most urbanised country (with 83.9% of its population urbanised); other poor performers with comparatively lower levels of urbanisation include the United States (41st), France (46th), Spain (48th), Mexico (49th), Peru (55th). South Africa (86th), Ireland (94th) and India (166th). Meanwhile, East Asia has suppressed the virus in spite of the fact that it is a rapidly urbanising global region and home to the largest number of the largest cities in the world. Moreover, the problem of containing the virus in Global South cities is intensified by a dangerous mix of severe overcrowding, informal housing, poor sanitation, economic precarity and poverty. And yet many of these cities have fared well. The virus is more likely to prosper in more urbanised societies but not universally so and it seems unlikely that urban geography is disproportionately heightening the vulnerability of OECD countries relative to Global South countries.

Conjecture 4: Climatic cycles have conspired to increase the intensity of outbreaks of COVID-19 in the Global North

COVID-19 struck the northern hemisphere and by implication the United Kingdom during its winter; cases and death rates were brought under a degree of control only with the arrival of summer. The relapse of EU countries – including the arrival of a second and third wave in the United Kingdom, coincided with the transition to autumn and winter. Meanwhile, as Australia and New Zealand moved into their (southern) winter, cases and deaths (to a degree) increased. Their journey into spring and then summer coincided in contrast with a suppression of the pandemic. There is surely some validity to the claim that climatic factors have played a role: with winter comes indoor and sedentary lifestyles and seasonally related co-morbidities including seasonal flu. But this claim seems at odds with the intensity of COVID-19 outbreaks in equatorial and desert zone countries such as Brazil (and Amazonian countries more broadly), Mexico, Southern United States (especially Florida) and in the Middle East. Moreover, across 2020, the United States witnessed no bending of the curve and conditions progressively worsened and showed no seasonality.

Conjecture 5: Uneven geographies of COVID-19 reflect mutations in SARS-nCoV-2 2019

Uneven geographies of COVID-19 cases and deaths may simply reflect uneven geographies of pathogen mutation, transportation and potency. There exists a claim that, on entering Europe in January/February 2020, SARS- nCoV-2 2019 mutated and became more potent. This more infectious (and some argue lethal) strain swept across Europe and was then exported to the United States,

where likewise it spread with heightened impact. Subsequently, more virulent strains have emerged in South Africa, Britain and India. This proposition has merit but must be approached with caution. The geographies of different variants of the virus have still to be properly mapped. Moreover, there exist variations within and between populations in North American and European countries equally exposed to individual variants.

Risk = Exposure x Vulnerability (Immunity Status + Susceptibility + Preparedness) x Response

Although the human immune system is universal in its constitution, its robustness varies between societies – evolution and genetic lineage can mediate our innate (or natural or species) immunity; current life circumstances play a role in the evolution of our adaptive (or active or biography-specific) immunity; and social interactions determine the extent of our passive (or borrowed or shared) immunity. In consequence, not everyone has an equally robust immune system.

Conjecture 6: Racial differences in immunity to SARS (like) viruses

A claim has emerged that SARS- nCoV-2 2019 is part of a family of viruses which have circulated historically in Asia but not (or less so) in Europe and North and Latin America, resulting in varying degrees of 'evolutionary' or 'inherited' immunity and vulnerability. But Anglo-Saxon countries have witnessed variegated outcomes: the United Kingdom and the United States, for example, have been highly impacted whilst Australia, Norway and New Zealand have been comparatively lightly impacted. Moreover, case and mortality rates amongst Asian migrant populations in North America and Europe have been elevated relative to the host population.

Conjecture 7: Socio-economic differences in immunity to SARS (like) viruses

Notwithstanding variations in the quality of data, there exists a claim that case fatality rates and infection fatality rates have been higher in high income countries and lower in low income countries. A so-called 'hygiene hypothesis' posits that people in poorer countries have developed stronger immune systems by dint of their life circumstances (poverty, overcrowded housing, slum housing, poor sanitation, lack of access to clean water, work as waste pickers and so on). Microbiomes (bacteria, viruses, fungi and single-celled archaea microbiome) in the human body play a vital role in human health, improving digestion, repelling disease-causing bacteria, regulating people's immune systems and producing vitamins. Global North countries, in contrast, by sterilising their environments have effectively starved the immune systems of their populations of the training required to fortify personal resilience. Throughout 2020, this hygiene hypothesis was deployed to account for lower death rates in India; the recent upsurge in cases and deaths in India however places its validity in question. The historical record is also unsupportive; arguably, people living in Europe's slums in the nineteenth and twentieth centuries found themselves immunocompromised, not immunocompetent. Moreover, whilst bacterial infection cannot be compared with viral infection, it is becoming clearer that both interact, and that antimicrobial resistance (AMR) can lead to secondary infections in COVID-19 patients, aggravating immunocompromisation. Given that the United Kingdom has much lower AMR mortality rates than many countries of Africa and South-East Asia, it is difficult to argue that AMR is behind its elevated death rates.

Conjecture 8: Given their ageing demographic structures, North American and European populations have been more vulnerable to COVID-19

COVID-19 has proven to be a bigger threat to the elderly and much less of a threat to those under 18 years of age and in particular children. Indeed, for the adult population, the risk of contracting and becoming seriously ill appears to increase progressively with age. Given their older population profiles, it is unsurprising that OECD countries have been especially vulnerable to COVID-19. Italy has the second oldest population in the world and Germany, the Netherlands, Hungary, Poland, Belgium and France rank in the top 15; it is little surprise then that these countries have been particularly challenged by COVID-19. Nevertheless, whilst home to an ageing population, it is evident that the United Kingdom ranks behind many other European countries. According to the UN Population Division, the United Kingdom ranks 31st in terms of life expectancy at birth (82.9 years), 31st in old age dependency (29.1 per 100) and 23rd in median age (40.2 years). Furthermore Japan, with the oldest population profile in the world, has evaded the worst of the pandemic. Greece, Denmark and Sweden, with older populations than the United Kingdom, also perform much better. Meanwhile, Peru, Mexico, India, South Africa, Brazil, Qatar and Saudi Arabia's youthful population structures have not afforded them better results.

Conjecture 9: Because COVID-19 linked co-morbidities vary between populations, so too there exists an uneven geography of vulnerability to COVID-19

Generally, people in OECD countries enjoy longer and healthier lives (they have much higher life expectancies and higher Health Adjusted Life Expectancies, or HALEs) and ought to be at reduced and not elevated risk. Whilst at 69, the United Kingdom's HALE score ranks only 29th in the OECD (n=37 countries), it is higher than most countries in the Global South. In contrast, years of life lost to disease (YLD) amongst people over 70 years of age living in both OECD and non-OECD countries appears to be broadly similar, rendering neither with a less healthy elderly cohort. Globally, at 27 YLD per 100 in the population > 70, the United Kingdom presents as an average country with neither a particularly healthy nor unhealthy elderly population. Finally, specific COVID-19 linked co-morbidities are consistently present at high levels in OECD countries, placing them at a disadvantage. Within the OECD and beyond, countries particularly burdened by COVID-19 linked co-morbidities do tend to suffer from elevated COVID-19 case and death rates. COVID-19 linked co-morbidities (diabetes and kidney, chronic respiratory and cardiovascular disease) account for 25% of all DALY's lost in the United Kingdom; a standard percentage in the OECD. Nevertheless with 29% of the adult population classified as obese (OECD average = 24%, Global average = 17%) and with an asthma prevalence rate of 9.1% (OECD average = 6%, Global average = 4.4%), the United Kingdom ranks as the 3rd and 2nd most unhealthy country in the OECD. We might say, then, that the underlying health of the United Kingdom, the general health of those over the age of 70 and common COVID-19 linked morbidities cannot easily be linked to the poorer outcomes witnessed in the

United Kingdom. Similarly, Australia, Greece, New Zealand, Israel, China and Taiwan all present as exceptions, performing better than the prevalence of co-morbidities might imply. Nevertheless, the United Kingdom has very acute problems with obesity and asthma – two specific comorbidities associated with adverse COVID-19 outcomes, which might have contributed to its difficulties.

Conjecture 10: Government policies towards Bacillus Calmette-Guérin (BCG) help to explain COVID-19 geographies

It has been hypothesised that the BCG vaccination for TB provides a degree of spillover protection against COVID-19. Many OECD countries have discontinued (the United Kingdom, Spain, France, Germany, the Nordic countries, Australia and New Zealand) or never had mandatory and universal vaccination programmes (United States, Canada), whilst the vast majority of non-OECD countries continue to administer mass vaccination. Between 1953 and 2005, the BCG vaccine was provided universally to children in secondary school in the United Kingdom. But from 2005, this was downscaled to a targeted programme for babies, children and young adults at higher risk. People living in OECD countries – including the United Kingdom – may then lack a degree of residual or spillover immunity. But Eastern European countries (who administer strong BCG programmes) are amidst a catastrophic wave of cases, whilst Portugal (which also has a mandatory BCG programme) has recorded cases and deaths per capita on a par with its neighbour Spain (where universal BCG vaccination has been discontinued). Furthermore, the vast majority of Latin American countries, South Africa, Russia, India and Middle Eastern states all have suffered significant COVID-19 outbreaks in spite of their comprehensive BCG vaccination policies.

Risk = Exposure x Vulnerability (Immunity Status + Susceptibility + Preparedness) x Response

Social, political, cultural, and political processes increase the vulnerability of populations exposed to natural hazards: poverty, social exclusion and poor governance all increase susceptibility to harm. Because there exist marked inequalities within and between societies, between more-resourced and less-resourced social groups, it follows that vulnerability to hazards is unevenly distributed. Poverty alone is perhaps the greatest progenitor of precarity but women, ethnic minorities, people with disabilities, children, the elderly and refugees also experience disproportionate harm.

Conjecture 11: The uneven impact of COVID-19 is rooted in growing socio-spatial income and wealth inequalities

COVID-19 geographies cannot be explained by poverty (as measured by World Bank GDP per capita, UN HDI scores, UNU Susceptibility measures or World Bank Poverty Rates); a majority of the poorest countries in the Global South appear to have had considerably fewer cases and deaths than the richest countries within the Global North. Of course, great caution is required; this might be in part (or indeed in whole) an erroneous conclusion predicated upon nothing more than poor data reporting. But COVID-19 has preyed on growing 'within country' inequalities disproportionately impacting poor and Black, Asian and Minority Ethnic (BAME) communities (those already furthest from the labour market, living in high density population neighbourhoods, suffering digital poverty,

engaged in the most hazardous occupations and most reliant upon public transport). Countries with the highest levels of inequality in the OECD (United States, Chile, Colombia) and in the Global South (across the whole of Latin America (especially Brazil), India, Russia and South Africa) have endured the worst of the pandemic. But in East Asia (especially China and South Korea) and New Zealand growing inequalities have not jeopardised or even tempered efforts to suppress COVID-19. Meanwhile, a significant number of African countries have avoided the worst of COVID-19 notwithstanding their very high levels of inequality. As measured by the UNHDRO Palma Index, WID Palma Index of Inequality, and the World Bank GINI Index of Inequality, the United Kingdom displays average levels of inequality within the OECD group and below average levels of inequality globally. Nevertheless, inequalities have significantly increased in the past 40 years. Moreover, the United Kingdom has the most unequal space economy in the OECD world, suffers from regional inequalities and an acute North-South divide.

Conjecture 12: Authoritarian regimes which command public trust have been more able to mobilise and give effect to stringent public health controls than democratic governments which have lost their social licence

Authoritarian governance models go some way to explaining success in supressing the virus. With the exception of Turkey and Mexico, all OECD countries score between 1-3 in the Economist Democracy Index 1-8 scale (1= most democratic) and yet most have recorded higher cases and deaths per capita than countries such as China, Vietnam, Egypt, Nigeria, Malawi, and DRC, all of whom score 6-8 (8 = least democratic). This has perhaps been unsurprising given that enforced lockdowns, contact-tracing technology, mandatory mask wearing, etc., require a degree of coercion and a preparedness to forgo certain personal liberties. To be as effective, democracies need to command a very high level of public confidence. Surveys measuring public trust in government suggest that democratic governments are failing miserably to inspire trust and loyalty from citizens. Curiously, populist governments seem to have presided over particularly poor outcomes: Trump in the United States, Johnson in the United Kingdom, Bolsonaro in Brazil, Modi in India, Orban in Hungary, and Erdoğan in Turkey. These movements tend to come freighted with (ill-founded, for the most part) assertions about the need to reclaim citizen liberties and rights from purported illiberal liberal states, and this proclivity to privilege individual freedoms over state mandates might be part of the explanation. The United Kingdom government consistently ranks amongst the least trusted (in surveys such as those undertaken by the OECD, the Edelman Trust, and the World Values Survey WVS), with polls averaging at around 40% trust. A schism has opened between representative democratic institutions and popular sovereignty which has in turn almost certainly mitigated against the capacity of democratic polities to implement stringent containment measures. Asian democracies such as South Korea, Taiwan and Japan are exceptions to the rule; enhanced reverence to the state and citizen attitudes towards authority, community and compliance may explain the better performance of these democratic policies. Meanwhile, countries like Australia and New Zealand have demonstrated a capacity to gain a democratic license to limit personal liberties, at least for a period.

Conjecture 13: Centralised political systems which govern regions and cities from a distance preside over poorer outcomes than federalised states with decentralised/devolved powers and bespoke localised responses

The OECD itself has hypothesised that the proximity of governments and their disaster risk management institutions and infrastructures to the people they serve has been an important determinant of the efficacy of responses. Larger countries and countries with highly centralised government structures and powers are more likely to suffer significant outbreaks and elevated harm. By comparison, smaller countries and countries with more decentralised federal structures and more powerful regional and local authorities are better placed to understand local nuances, mobilise local assets and suppress the virus locally. But many decentralised states have not fared well including Belgium, India, Brazil, Argentina, Spain, the United States and South Africa. Likewise, whilst some highly centralised countries have presided over poor outcomes (for example, the United Kingdom and Ireland), others have enjoyed relatively better results (such as China, Greece and South Korea). Perhaps then, it is not the degree of centralisation or decentralisation that matters but the extent of inter-governmental coordination, the balance struck between centralised and decentralised strategies, and the unlocking of collective leadership, assets and capacities.

Conjecture 14: The uneven impact of COVID-19 is rooted in the demise of social cohesion; countries where social capital, solidarity, mutuality and reciprocity have been eroded and depleted most will suffer disproportionate harm

Historically, the work which place-based communities have done in protecting vulnerable people in times of need and strengthening resilience for all has been critical. Alas, forty years of neoliberalism and a decade of austerity appears to have dismantled the complex webs of connective lines and tissues braided within and between communities at myriad scales. Much has been made of the decline of community in western societies; in particular, the erosion of trust between people and depletion of social capital (a finding repeatedly confirmed by the World Values Surveys series, WVS). Responsibility for the provision of social care has shifted from families and communities to governments. When enacted without a sense of solidarity, such 'caring from a distance' can be overly transactional and can present as impoverished, disembodied, cool and detached. Countries which have both preserved strong communities and endured COVID-19 better include the Nordic countries, Australia, China, Vietnam and New Zealand. In contrast, countries that have witnessed both a decline in social trust and been especially vulnerable to COVID-19 include the United States, the United Kingdom, France, Spain and the majority of Latin American states. But most African countries are bereft of social capital and yet have weathered the pandemic better than a number of countries which report relatively healthy stocks of social capital such as India, Russia, South Africa, Saudi Arabia and to a degree Canada and Germany. Perhaps it is changing levels rather than absolute levels of social trust

and community solidarity which does most damage.

Risk = Exposure x Vulnerability (Immunity Status + Susceptibility + Preparedness) x Response

The ability of a society to cope with a hazard event is a function of competencies in the areas of disaster preparation (the quality of forecasts and early warning systems), disaster management (the readiness of emergency and humanitarian services to evacuate; provide medical support; conduct search and rescue; provide temporary shelter, distribute food supplies, and maintain law and order), and disaster recovery (the availability of resources to rebuild and repair communities and infrastructure; social insurance schemes). Wealthy societies generally have stronger institutions and superior systems of governance and are better able to engage in long-term planning. Lesser developed societies, in contrast, tend to suffer from weak and failing institutions and poorer governance, and as a consequence find it difficult to formulate and implement long-term disaster mitigation plans. So why have outcomes seemingly been inverted?

Conjecture 15: Countries with institutional capacity to give effect to disaster risk reduction plans and with effective co-ordinated emergency management have escaped the worst of COVID-19

The United Nations University's (UNU) World Risk Index identifies countries that have robust disaster management capacity; they include many countries which have borne the brunt of COVID-19 (for example Spain, Belgium, Germany, Israel, Sweden, the United Arab Emirates, Bahrain, Saudi Arabia, Ireland, Italy, United Kingdom, and the United States). Conversely, there exist countries with poor hazard management infrastructures which ought to amplify the effects of hazards (they include Afghanistan, Nigeria, Malawi, Bangladesh, Mozambique, Tanzania, Liberia, Eritrea, Vietnam, and the Democratic Republic of Congo) but which have avoided COVID-19 catastrophe. Surprisingly, prior institutional capacity and disaster management capability have not shaped COVID-19 geographies – at least in any obvious way. According to the UNU, the United Kingdom ranks 143rd most at risk on capacity to cope with an unexpected hazard or trauma and 142nd most at risk in terms of its capacity (or lack thereof) to plan and prepare ahead of time (n=180). There are no grounds to assume the United Kingdom is lacking in disaster risk management institutional capacity, resources and expertise.

Conjecture 16: Countries with well-established and high performing medical and public health services will be better able to suppress the COVID-19 pandemic; those with inadequate health care systems will suffer most

According to the WHO Global Health Care Index, the overall quality of any health care system is a product of its health care infrastructure; the number and competencies of health care professionals (doctors, nursing staff, and other health workers); the cost of accessing health care; the quality of the medicines available, and government readiness. Poor institutional capacity – in Russia, South Africa, Brazil, and Peru and to a degree the United States – helps to account for the poor outcomes endured by these countries, whilst the better outcomes witnessed in Australia, New Zealand, South Korea, Japan, Taiwan, and the Nordic countries coincide with their high performing heath care infrastructures. But countries with strong health care systems, such as Italy, Spain,

France, the United Kingdom, and to a degree India and the United Arab Emirates, have found themselves surprisingly incapacitated, whilst countries with poorer health care systems such as China, Vietnam and Nigeria have exceeded expectations. Initially unable to provide both regular health care and COVID-19 health, undoubtedly the NHS has failed to prevent a significant number of excess deaths. But capacity has been rapidly scaled; a number of emergency Nightingale Hospitals (which have been largely superfluous to date) were constructed in Spring 2020, for example, and at no point was the health care system (including high dependency and intensive and critical care units) overwhelmed to the point of crisis or collapse.

Conjecture 17: Health care and public health systems in Western OECD countries are designed to remediate degenerative disease and lack the institutional capacity and disaster risk management infrastructure needed to tackle airborne infectious disease

Perhaps for too long Global North governments have assumed that they had by and large completed epidemiological transition and in consequence built capacity and expertise primarily around degenerative disease (cancers, strokes, cardio-vascular disease). They could be ill equipped to respond to (re-)emerging infectious disease and disease outbreaks. Pharmaceutical companies have concentrated investment in non-communicable disease so as to access lucrative Global North markets. Certainly, Western countries have had to quickly (re)learn how to handle a pandemic – and especially one caused by the transmission of an airborne virus – in real time. But the United Kingdom continues to have a disproportionate share of world-leading infectious disease institutions and scientists, immunologists (for example, the Liverpool and the London Schools of Tropical Medicine, University of Liverpool, Oxford University) and data modellers. United Kingdom principal investigators have extensive experience of leading and participating in projects managing infectious disease outbreaks in the Global South. The United Kingdom has outstanding systems and logistics managers, including those embedded in a world-class army. Moreover, therapeutics introduced to tackle degenerative disease have proven to be effective for COVID-19. There is no shortage of talent or capability.

Conjecture 18: Countries with more experience of handling communicable disease and disease outbreaks have responded more effectively

But perhaps technical competence is different from the organic intelligence acquired through life experience. China, Korea, Hong Kong and Taiwan have had recent experience with Serious Acute Respiratory Syndrome (SARS) (2002/03) and Middle East Respiratory Syndrome (MERS) (2012) and West African countries with Ebola (including but not limited to the 2014-2016 outbreak). They have had recent experience from which they have learned much and upon which they can draw. But many OECD countries have been wrestling with HIV (AIDS) since the early 1980; MERS impacted many of these countries too and some suffered from the Swine Flu pandemic (2009/10). Moreover, it is often the WHO, UN, Western aid agencies and Global North medical volunteers who oversee pandemic management in the field in the event of an outbreak in the Global South. There is no shortage of field experience or practical wisdom.

Conjecture 19: Transition to a services-based economy and offshoring of manufacturing alongside private ownership of the means of production have reduced industrial capacity in OECD countries and increased the difficulty of speedily pivoting factories towards the production of virus-related products

Massive manufacturing capacity in East Asia has enabled the rapid production of virus-related products. The prevalence of state-owned enterprise in China in particular enabled a rapid shift in production to virus related products. And so China, South Korea, Taiwan and Vietnam have become net exporters of these products. In contrast, in the early stages of the pandemic, in North America and Europe, a paucity of capacity combined with private ownership of manufacturing plants mitigated against such agility and resulted in endemic equipment shortages (and in particular shortages of personal protective equipment for front-line health workers, ventilators, masks, ventilators, hand gel, visors, protective screens, etc.). Certainly in spring and early summer 2020, the United Kingdom lacked both supplies and a means of procuring supplies. But government contracts were issued to private manufactures who in turn pivoted to COVID-19 related products; companies such as Airbus, Dyson, Ford and Rolls-Royce for example manufactured medical ventilators, HSBC provided low interest fast-tracked loans to ventilator manufacturers with extended repayment terms, INEOS mass manufactured medical grade hand sanitisers, Armani, Prada, Zara and Yves Saint Laurent contributed surgical masks, whilst Carousel Lights mobilised its 24,000 vehicles and 700 logistics depots free of charge to help distribute critical medical and food supplies. And the United Kingdom's War Times Manufacturers Act remains as a last line of defence.

Risk = Exposure x Vulnerability (Immunity Status + Susceptibility + Preparedness) x Response

Conjecture 20: COVID-19 geographies arise from variations in the efficacy of government's public health responses: those that have gone hard and gone early have enjoyed greater success in the suppression of the virus

In spite of their exceptional resources, infrastructures, and capacities, European and North American countries have failed to match their much poorer counterparts in terms of proactive and proportionate remediating actions. The Oxford COVID-19 Government Response Tracker (OxCGRT) includes a Government Stringency Index which assesses the severity of the lockdowns which have been introduced (based upon measures of school closures; workplace closures; cancellation of public events; restrictions on public gatherings; closures of public transport; stay-at-home requirements; public information campaigns; restrictions on internal movements; and international travel controls). Toying with ideas of herd immunity, the United Kingdom deferred the decision to impose a national lockdown until March 24th (later than other countries) and paid an early penalty. Since then, it has sustained without interruption various levels of restrictions (including further local and national lockdowns). It is difficult to weigh the efficacy of this approach. Cases and deaths per capita would surely have been intolerable if lockdowns had not occurred. But were they enough? The United Kingdom aligns with many countries which have endured extraordinarily high levels of cases and deaths per capita, notwithstanding severe and protracted lockdowns. Japan (and to a lesser degree Sweden) in contrast avoided comprehensive lockdowns and yet recorded comparatively fewer cases and deaths per capita. Of course lockdown is a

blunt instrument and the WHO advocates for strategies based upon the principle of learning to live with COVID-19. More bespoke approaches – very early and severe lockdowns, following by normalisation, tempered with intermittent precision and local lockdowns – have proven effective for China, Vietnam, New Zealand, Australia, South Korea, Singapore and Norway. The United Kingdom has retreated into lockdowns in part as a consequence of its failure to implement an effective track, test and trace strategy and its late (July 24th 2020) introduction of mandatory mask wearing in public places. Whilst it improved its overall positivity test rate (tests which returned positive, indicating the presence of the disease) from its peak of 30% in early April 2020 (data for PCR testing only), the United Kingdom continued to exceed the WHO recommended rate of <5% until early May 2020 and in Autumn 2020 the rate rose back above 8%. For most of the period testing has been confined to those with symptoms and targeted groups. Notwithstanding the development of a much vaunted and extraordinarily expensive (£37bn) NHS COVID-19 contact tracing app, contact tracing too has largely been ineffective. Of the 4Ts (testing, track and trace, and treatment), OECD countries have demonstrated strength only in treatment, but even here they have suffered from equipment shortages. Democratic Sinic East Asian nations are best in class. Taiwan is the gold standard for contact tracing, South Korea has set the global benchmark for testing methodologies, and Japan is leading the world in the treatment for pneumonia. China and Vietnam, meanwhile, have presided over very stringent but effective lockdowns. Supressing COVID-19 clearly depends upon early and severe lockdown measures followed by rapid-response track, test and trace practices. The United Kingdom has been unable to escape the former because it has lacked a strategy to deal with the latter.

Conjecture 21: COVID-19 geographies will be inflated in countries which fail to provide meaningful income support, affordable finance and debt relief

The Oxford COVID-19 Government Response Tracker (OxCGRT) charts the scale and impact of the 'emergency' social and economic benefits which countries have extend to their businesses and citizenry. At least on this measure, the United Kingdom scores very well. With respect to income, from late March 2020, Chancellor Rishi Sunak has presided over a generous furlough scheme; this scheme has been extended to the end of September 2021 and has provided workers (including those self-employed) with variously 70-80% of their normal wage. In addition, the British government has introduced a broad package of debt relief supports (enabling sabbaticals on loan repayments, preventing key services from being cut off to households in arrears, and banning evictions). Finally, low interest state loans and grants have been provided to companies deemed to be worthy of investment to enable them to bridge until the roll-out of a vaccine. Few countries have matched the United Kingdom's furlough policies, the breadth of its debt relief programme and the generosity of its support to business. Social and economic supports have been extended to September 2021.

Conjecture 22: The extent of COVID-19 deaths in long-term care homes (LTCH) in European and North American countries points to their moral failure to protect vulnerable elderly groups

In OECD countries, at the peak of the first wave (May 2020), COVID-19 linked deaths in long-term care homes (LTCH) or of care home residents constituted 50% or

more of all COVID-19 deaths; with Canada, Belgium, Spain and Ireland recording the most concerning levels. Recognising the death of long-term care home residents as one of the great 'policy disasters' of the pandemic, World Health Organization Director-General, Tedros Adhanom Ghebreyesus, has called attention to the moral bankruptcy which appears to have led some governments to deprioritise the elderly in triage methods. There is insufficient data to assess the plight of care home residents in non-OECD countries; this does not stop us from concluding that neglect of the elderly and a government failure in their duty of care to those relying upon state protection as they enter the final years of their lives, has played a central role in the high rates of COVID-19 cases and deaths recorded in the United Kingdom.

Conjecture 23: Weakened by populist governments, the West has failed to show Global leadership and this failure to step up has boomeranged back and caused self-harm

The United States' America First policy and its drift towards populism and isolationism under the Trump presidency rightly or wrongly deprived the world of global leadership, partnership and cooperation at a critical moment. The United Nations and the World Health Organization have lacked the support necessary to step into the void. In the absence of United States stewardship, China is posturing as a global leader in waiting. But tensions between the United States and China have threatened to escalate into a trade war and neither are likely to emerge from the pandemic especially emboldened or in a way which will shift the balance of world power. Countries cannot tackle global problems with local actions; coordinated global solutions are required, for hazards brewing elsewhere today will inexorably become hazards for us tomorrow. By withdrawing from the international community and persisting with isolationism, the United States rendered itself more vulnerable. In spite of its protestations to be a globalising project, Brexit Britain risks doing likewise.

Conjecture 24: As we reach the end of the pandemic cycle, new COVID-19 geographies will emerge as a reflection of the ownership and distribution of safe and effective vaccines

Vaccine development has enabled the West to recover lost ground in an instant. The United Kingdom has not only led the development of one of the first vaccines to be approved for 'emergency use' (the Oxford AstraZeneca COVID-19 vaccine), but has also presided over a world-leading vaccination programme; with over 50% of the total population (as of May 21st) having being vaccinated, it is surpassed only by Israel. Nevertheless, in its haste to protect the United Kingdom population, the government has largely ignored its COVID-19 Vaccines Global Access (COVAX) commitment to disburse vaccine supplies ethically on a global basis.

Data sets consulted to inform the analysis

FACTOR	SOURCE OF DATA
1. Total population	Population estimates (for 2020) from the **United Nations Population Division** (United Nations Population Prospects 2019)
2. COVID-19 cases & deaths	COVID-19 cases, deaths and rates per million from **Johns Hopkins Coronavirus Resource Center**, European Centre for Disease Prevention and Control (ECDC) and the World Health Organization (WHO). **Our World in Data** - https://ourworldindata.org/coronavirus: • COVID-19 cases per million (09/04/2020) Wave 1 UK peak (7-day average) • COVID-19 deaths per million (14/04/2020) Wave 1 UK peak (7-day average) • COVID-19 cases per million (18/11/2020) Wave 2 UK peak (7-day average) • COVID-19 deaths per million (28/11/2020) Wave 2 UK peak (7-day average) • COVID-19 cases per million (09/01/2021) Wave 3 UK peak (7-day average) • COVID-19 deaths per million (23/01/2021) Wave 3 UK peak (7-day average)
3. COVID-19 fatality	Case Fatality Rate (CRR) data (the number of confirmed COVID-19 deaths as a ratio of confirmed cases) from **Johns Hopkins Coronavirus Resource Center**.
4. Global Connectivity (DHL, k-core)	Global Connectedness Index calculated by **DHL 2020** to measure the globality of a country or the breadth and depth of global flows of people, goods, capital and information through a country expressed in per capita terms. A higher connectedness rank implies a more globalised country at the nexus of global economic circuits. Shulgin et al., 2019 **Network approach** to countries' global connectivity rates - **k-core for 2010**. Trade in goods (from United Nations COMTRADE database), trade in service (the trade in service database accumulated from OECD, Eurostat, United Nations, and IMF), accumulated stock of bilateral FDI (foreign direct investment from United Nations COMTRADE database) and accumulated stock of migrants (from UN).

5.	**Population density**	**United Nations Population Prospects 2019**
6.	**Urbanisation**	Urbanisation rates (% of population living in an urban area) calculated from World Urbanisation Prospects 2018. **United Nations World Urbanization Prospects 2018**
7.	**Global Climate Risk**	**Germanwatch**: https://germanwatch.org/en/19777 - Global climate risk index and rank 2018 - to what extent countries and regions have been affected by impacts of weather-related loss events (storms, floods, heatwaves etc)
8.	**Obesity**	% of population obese-body mass index (BMI) greater than 30.0 - calculated for 2018 using data from NCD Risk Factor Collaboration **WHO** Prevalence of obesity among adults BMI ≥30 (crude estimate) (%) - https://www.who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-obesity-among-adults-bmi-=-30-(crude-estimate)-(-)
9.	**DALY - Diabetes, Asthma, COPD cardiovascular disease**	% of all **Disability Adjusted Life Years (DALY)** lost to three co-morbidities related to COVID-19 (Chronic Respiratory Disease, Diabetes, Cardo-vascular disease, asthma, and COPD) in 2017 calculated using data from the Institute of Health Metrics (IHME) **WHO Global Health Estimates 2019** https://www.who.int/healthinfo/global_burden_disease/en/ **Recommended citation:** Global Health Estimates 2019: Disease burden by Cause, Age, Sex, by Country and by Region, 2000-2019. Geneva, World Health Organization; 2020.
10.	**HALE at birth**	**Health Adjusted Life Expectancy (HALE)** (healthy years of life a person can expect to live in a given society, taking into account both years of life lost due to premature mortality and years of healthy life lost through morbidity – for 2017) calculated using data from the Institute of Health Metrics (IHME) **WHO The Global Health Observatory** Healthy Life Expectancy (HALE) at birth (years) https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-ghe-hale-healthy-life-expectancy-at-birth
11.	**YLD**	Years of Life Lost to Disease (YLD) or years of full healthy life forfeited due to morbidity among those > 70 years of age per 100 of the population > 70 years of age calculated using data from the Institute of Health Metrics (IHME)

	WHO Global Health Estimates 2019. A comprehensive and comparable assessment of mortality and loss of health due to diseases and injuries for all regions of the world. https://www.who.int/healthinfo/global_burden_disease/en/
12. Population living in slums	**The World Bank**, 2018. Population living in slums (% of urban population)
13. BCG Policy & TBC incidents	Bacillus Calmette-Guérin (BCG) vaccination policy by country from the **World Atlas of BCG Policies and Practices** (2nd Edition) 2017.
14. Population structure (median age, 65+)	Population estimates (median age and % of the total population > 65 years of age for 2020) from the United Nations Population Division **United Nations Population Prospects 2019**
15. Inequality (WID Palma, GINI)	**The Palma Index** is especially useful as a measure of inequalities which arise at the extremes of society (higher and lower). The greater the score, the higher the inequality. WID Palma Index of Inequality (for 2017) calculated from the **World Inequalities Database** (WID). **HDRO Palma Index of Inequality** (for 2019 or nearest year) based on the **World Bank** World Development Indicators database **Gini Index of Inequality** (for 2020 or latest available date) from the **World Bank** (with omitted countries Yemen and Saudi Arabia from the CIA Factbook 2020). Income inequality: Top 10% income share divided by bottom 40% income share = Palma index - https://wid.world/data/ Key indicators: Top 10% share and bottom 40% share (UN SDG), all countries, selected years range: 2019
16. Poverty ($5.50; $3.20; $190)	Poverty rate (for 2019 or latest available date) from the **World Bank** (calculated using the US$5.20 at 2011 PPP International Poverty Line). **The World Bank** - % of population < than $5.50/$3.20/$1.90 per day - Poverty headcount ratio at $5.50/$3.20/$1.90 a day (2011 PPP) (% of population)
17. Handwashing facilities	Population with basic handwashing facilities 2017 or latest available date **WHO** The Global Health Observatory https://www.who.int/data/gho/data/indicators/indicator-

	details/GHO/population-with-basic-handwashing-facilities-at-home-(-)
18. Safely managed sanitation services	Population using safely managed sanitation services (%) 2017 or latest available date **WHO** The Global Health Observatory https://www.who.int/data/gho/data/indicators/indicator-details/GHO/population-using-safely-managed-sanitation-services-(-)
19. Human development (and inequality adjusted HDI)	**UNDP 2020** (United Nations Development Programme) - Human Development Report 2020.
20. Trust in others	Trust in government (at 2018) measure from the OECD % of the population *'How satisfied are you with how the political system is functioning in your country these days?'* On the scale from 1 to 10, 1 means not satisfied at all and 10 means completely satisfied.
21. Trust in Government	Trust in government (2017-2021) measure from the World Values Survey WVS Wave 7 (Q57). *'How satisfied are you with how the political system is functioning in your country these days?'* On the scale from 1 to 10, 1 means not satisfied at all and 10 means completely satisfied.
22. Trust in neighbourhood	WVS Trust in neighbourhood (Q59) % of trust completely + somewhat (2017-2020)
23. Democracy	Democracy Index 2020: In sickness and in health. A report by the **Economist Intelligence Unit**.
24. Leadership	**WVS** World Values Survey Wave 7 (2017-2020). Results in % by country weighted by w_weight. "*Having a strong leader as a way of governing your country who does not have to bother with parliament and elections."* % of very/fairly good (Q235)
25. Satisfaction with political system	**WVS** World Values Survey Wave 7 (2017-2020). Results in % by country weighted by w_weight. *"Political system: Having a democratic political system as a way of governing your country"* % of very/fairly good (Q238) **WVS** World Values Survey Wave 7 (2017-2020). Results in % by country weighted by w_weight. *"How satisfied are you with how the political system is functioning in your country these days?"* (Q252 mean)

26. Central Government Spending	OECD Central government spending (Health) 2020. Total, % of GDP, 2020 or latest available https://data.oecd.org/gga/general-government-spending.htm
27. UNU World Risk	**United Nations University** World at Risk Index – score for vulnerability for 2019.
28. Quality of health care	**Our World in Data**: Healthcare Access and Quality Index (2015 or latest available date) https://ourworldindata.org/grapher/healthcare-access-and-quality-index?tab=chart
29. Hospital beds	**The World Bank** - for 2019 or latest available date (2010 onwards) - # of hospital beds per 1000 people. https://data.worldbank.org/indicator/SH.MED.BEDS.ZS
30. Physicians	**The World Bank** - for 2019 or latest available date (2010 onwards) - # of physicians per 1000 people. https://data.worldbank.org/indicator/SH.MED.PHYS.ZS
31. LTCF deaths	COVID-19 deaths in Long Term Care Facilities (LTCF) as a proportion of all deaths at May 25th 2020 (or within two weeks prior). Collected variously and triangulated with respect to **World Health Organization**. Coronavirus disease (COVID-2019) situation reports and Comas-Herrera A, Zalakaín J, Litwin C, Hsu AT and Lemmon E, Mortality associated with COVID-19 outbreaks in care homes: early international evidence International Long-Term Care Policy Network, CPEC-LSE, 26 June 2020 update.
32. Containment & Health	Containment and Health Index (lockdown and testing/tracing measure) from the Oxford COVID-19 Government Response Tracker (**OxCGRT**).
33. Government Response Stringency	Government Response Index (overall government response), Containment and Health Index (lockdown and testing/tracing measure), Stringency Index (measure of stringency of lockdown), and Economic Support Index (measure of the range and scale of emergency financial/fiscal/tax supports to extended to companies and workers) from the Oxford COVID-19 Government Response Tracker (**OxCGRT**).
34. Positivity rate	Positive Test Rate data (the number of positive tests as a ratio of the total number of tests) from WHO.

	Our world in data (# of tests done compared to # of tests positive - anything above 5% bad) 08/01/2021
35. Vaccination development	Primary country of ownership of vaccine development from **New York Times COVID-9 Vaccine Tracker.**
36. Vaccination rate	**Our World in Data** - https://ourworldindata.org/COVID-vaccinations

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