INSTITUTE FOR RISK AND DISASTER REDUCTION

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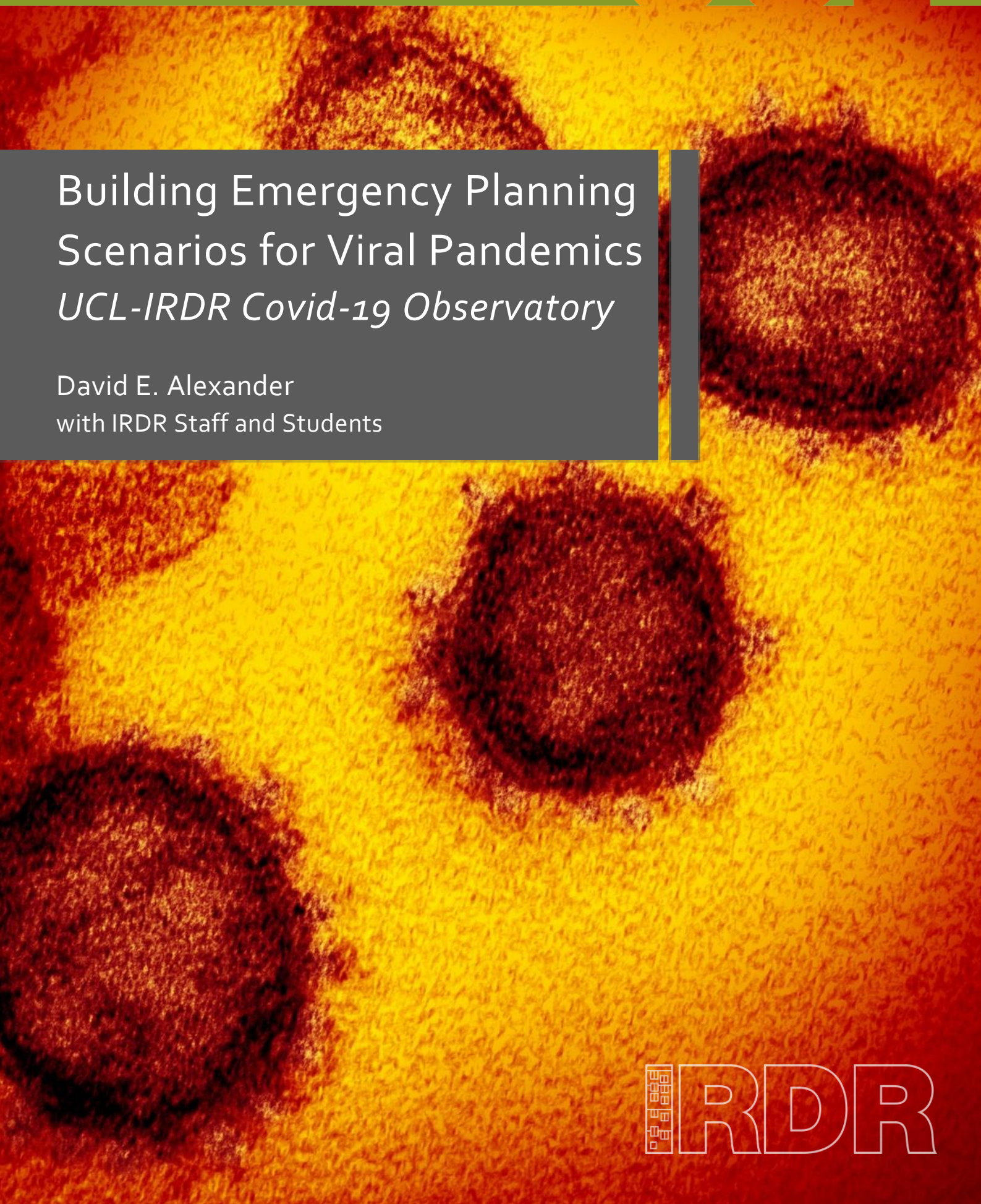
Building Emergency Planning Scenarios for Viral Pandemics

UCL-IRDR Covid-19 Observatory

David E. Alexander
with IRDR Staff and Students



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Introduction

The purpose of this report is to provide a systematic, if incomplete, record of the issues connected with the Covid-19 pandemic in order to improve the basis for future emergency planning. Like all large disasters, Covid-19 involves cascading consequences. These need to be factored into future emergency planning scenarios.

Principle: *For known and evident risks, scenarios are a necessary part of the formulation of emergency plans. They enable planners to foresee problems and create robust procedures to prepare for them in advance and confront them when they materialise.*

High-quality emergency planning prescribes what to do in an emergency and how to ramp up measures rapidly by means of prior agreements and pathways. It also teaches what should not be neglected in the response. Pandemics are recurrent phenomena. They may also be exacerbated by human misuse of environmental resources. Hence, it is important to learn from experience and incorporate the lessons into plans for future events.

A major pandemic will have a complex impact that profoundly affects the basis of ordinary life and extends into many different fields and activities. This report classifies the elements of that impact in a manner designed to act as an aide memoir for emergency planners, managers and responders. The aim is to develop a comparative overview of the issues, needs and some of the solutions that planners can apply. There are no great revelations in this work. Indeed, emergency planning is sometimes regarded as 'codified common sense', but the art of codifying is a rigorous and demanding one.

If plans are adequately formulated and maintained in advance, probably the two biggest challenges during the pandemic will be (a) how to tackle the early stages resolutely when the prevailing mood is that a major crisis is not in the offing, and (b) how to come out of drastic measures safely once the rate of infections slows.

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1. Emergency coordination and response

In designing models for dealing with a viral pandemic, emergency planners should be wary of adopting procedures created for other types of hazard. For instance, counter-terrorism threat-level models are not appropriate to the spread of a virus. The geographical aspects of terrorism are quite different to those of a pandemic. So are the direct impacts. Counter-terrorism models are a form of 'securitisation', which potentially involves all the secrecy, centralisation, authoritarianism, restrictions and criminal investigations that are common reactions to terrorist outrages, but are completely inappropriate as a means of dealing with a pandemic. A key element of the approach to an epidemic virus is public discipline. This can only be maintained if there is a strong bond of trust between the authorities who are managing the crisis and the

public whose behaviour is required to conform to a set of newly-imposed norms. Thus, the public must be involved in the process, not excluded from it.

A pandemic will require temporary measures that curtail civil liberties and need to be enforced. Policing needs to avoid under-reacting or overzealousness. The emphasis should be on cooperative efforts to ensure public safety, not repression.

The term 'social distancing' is often employed to describe the need to maintain physical separation so that people do not infect each other. It should be used with hygiene measures and personal protection equipment such as facemasks (which will probably inhibit people from passing on the disease rather than stopping them from getting it from other people). The term 'social distancing' is rather a misnomer, as what is usually needed is physical distancing coupled with social closeness, or solidarity.

1.1 Basic coordination

This section deals with governmental and intergovernmental decision making, and the essentials of emergency planning and response.

1.1.1 International or global in reference to national

Coordinated, harmonised international action is an essential part of response to a pandemic. This is necessary in order to manage the impact on disease transmission of international transfers and migrations. The World Health Organisation is the key institution of reference for technical support and the coordination of data collection.

Pandemics require concerted action at the earliest stage. At this point, it may be unclear that the outbreak of a disease will develop into a pandemic. This poses a major dilemma. Major restrictions on public activities will damage the economy and may lead to loss of public trust in the authorities, but the right measures can have a very substantial impact on reducing casualties as the pandemic spreads. Political leaders are commonly reluctant to take drastic measures in the early stages of a pandemic. However, this is precisely when such measures are most needed.

The importance of gathering timely and accurate information on the progress of the disease cannot be overemphasised. The data need to be as complete as possible and must be shared between institutions, agencies and organisations, as well as internationally. Developing a general understanding of the virus is crucial to its management. Hence, the collection and analysis of data will assume a central role in supporting decision making. Not only should data on morbidity and mortality be as robust, reliable and up-to-date as possible, other kinds of data will need to be collected, for example, demographic information about individuals who have died from the virus. In order to create profiles of risk, these data could include age, sex, occupation, ethnicity and income level. In addition, mortality and morbidity need to be monitored for patients with other health conditions, as psychological impairment, interruption of treatment or deferral of diagnostics and operations may cause these variables to increase. Generally, the best measure of the health impact of a pandemic is probably

the number of excess deaths compared to averages for the previous five years, especially if the latter are relatively steady.

Pandemics are destabilising events and there is a risk that they may cause loss of trust in international institutions such as WHO, NATO, the United Nations and the G20 group. Any withdrawal of funding for international efforts is likely to destabilise further an already precarious situation of international relations. With the tendency of governments to look inwards rather than outwards, and to close their borders in the hope of containing infection, international relations are likely to be at a low ebb. In most cases they need to be restored bilaterally, for example, not with blanket bans on international travel, but with opening up to countries where the rate of infection is lower than it is domestically. This needs to be backed by international solidarity and participation in common efforts to manage the disease.

1.1.2 National in reference to regional and local

It is clear from past pandemics that, at the national level, emergency planning is a key discipline. What is needed is a 'grand design' that regulates what takes place at the regional and local levels and allows planners at these levels an appropriate degree of freedom in their work. The limits to this freedom should be determined by national requirements (such as the need to regulate interregional travel) and the need to create a recognisably coherent national system capable of ensuring the fair distribution of resources and a 'joined-up' approach to the crisis. After that, resources should be devoted to supporting the regional response and ensuring adequate coordination and communication between regions.

If a country has its borders closed, the internal movement of people needs to be monitored and, where it leads or might lead to contagion, restricted. Health, medical and basic living needs of regions and major cities need to be monitored and steps should be taken to ensure that distribution of essential goods is fair and meets the country's needs.

Once there is a likelihood that a pandemic may occur, countries should activate their epidemiological observatories in order to collect, collate, analyse and present data on the developing situation. This should be carried out on a 24-hour cycle for the duration of the emergency.

National, and in some cases regional, management can be achieved by the imposition of temporary laws such as ordinances and degrees, according to national legal systems. These should be subject to parliamentary scrutiny. National legislation should not conflict with regional legislation. There needs to be clarity about the relative jurisdiction of laws, ordinances or edicts issued by the national government and the regions, states, departments or other intermediate tiers of government.

One of the greatest problems of managing a viral pandemic at the national level is the need to coordinate efforts taking place at the regional level. In this context, 'regional' means the tier of government that is intermediate between the national and local levels.

Conditions may be rather different from one region to another. Hence, it is logical and appropriate to put in place measures that have geographical differences. For example, 'lockdown' (see below) may be imposed where it is needed in order to reduce infection rates. Given its negative economic and social effects, lesser measures can be applied where this is not necessary. On the one hand, national and international coordination is essential to control matters that are expressed at these levels, such as interregional movement, the national distribution of goods, and international transfers of people and commodities (and, of course, the virus). On the other hand, conditions may be very distinctive in particular regions of a country and thus they may require local regulation rather than national rules. However, this must not lead to chaos or uncertainty, or a plethora of conflicting regulations.

Lockdown is the term used for the confinement of people to their homes, the limitation of public movement, and the cessation of activities that bring people into direct contact with each other. It is usually an effective means of limiting the spread of a virus, although it can have severe economic consequences and serious impacts upon the mental health of the affected population. In the influenza pandemic of 1918-1920, Philadelphia did not implement distancing measures and Seattle was much stricter in its control of public activity. Philadelphia had major outbreaks of the disease, while Seattle was able to avoid the worst.

The start of lockdown needs to be managed by anticipating and controlling major population movements. Once instructed to retire into isolation, people will probably want to go to their homes or home regions. The advice in lockdown is usually to stay at one's primary residence. Lockdown can easily start with a major cross-country migration in which people who work away from what they consider 'home' return there. This can spread the disease. Ideally, people should be tested for viral infection before they travel. This may not be feasible. At least, they should be made to observe physical distancing measures while on public transport. This, however, does not control the potential spread of the disease on private transport. Epidemiological surveillance and prompt intervention with testing, tracing and personal isolation are the only means of tackling the results of the migration. Just before lockdown begins, aggregate population movements should be traced and monitored, so that predictions can be made about the future geographical spread of the disease.

There is a risk that, because of the isolation caused by lockdown, people who normally live alone may suffer and perhaps die without receiving the care they need. One possible solution is to allow 'support bubbles' in which people are allowed to associate closely with one other person or family group. If this is allowed, the people who engage in this practice should be encouraged to spell out the ground rules for collaboration and support. Conversely, it is difficult for infected people, and those who need to observe quarantine restrictions, to isolate themselves if they live in crowded accommodation or larger, multi-generational families.

1.2 Emergency planning and management

Emergency management will have to take place in the context of considerable uncertainty about the disease and its progress. To begin with, the term 'pandemic' (a large, international infection of a dangerous disease) has no precise definition. The point at which an epidemic becomes a pandemic is a matter of collective judgement. The evolution of the planning scenario will be subject to many on-going uncertainties, including the following:-

- the infectiousness of the disease and its rate of spread by contagion (the 'R' or reproduction number)
- the role and importance of asymptomatic transmission of the virus
- the proportion of infected people who die (the case-fatality rate)
- whether there will be a second or third wave of infection after the first peak
- the differential impact of the disease by ethnicity, gender and age-group (including issues of who is most exposed to the risk of infection)
- the acquisition of immunity (individual and collective, or 'herd', immunity)
- the role of an eventual vaccine (its effectiveness, rate of mass production, ease of distribution and acceptability to potential recipients)
- the relationship of the disease to environmental factors (such as air pollution and human-animal interactions)
- the role of personal protective equipment in reducing infection rates among the public.

The rate of transmission by asymptomatic carriers is particularly difficult to assess as there are no symptomatic pointers to disease carriers. Wearing face-masks may reduce it, providing the masks do not become sources of transmission in their own right.

1.2.1 Emergency planning

The three elements of emergency response are plans, procedures and improvisation. The last of these cannot be eliminated but it needs to be minimised in order to reduce inefficiency and negligence. The plans coordinate the procedures, anticipate developments that require preparedness and assign responsibilities for tasks and actions.

Emergency plans should detail how successive waves of infection would be dealt with. This means specifying and being ready to implement measures that are flexible enough to be reversed or modified according to evolving needs generated by the pandemic.

- *Operationalising emergency plans*

Emergency plans should be living documents that must be upgraded frequently. During an emergency planning provisions should be adapted to emerging needs. Before the emergency, steps should be taken to ensure that the provisions of the plans have been operationalised. For example, equipment and supplies need to be stockpiled. If this

cannot be done, then prior plans need to be laid for rapid supply (and if necessary rapid manufacture) during the emergency. Lists of items need to be drawn up with supply plans associated with each commodity.

- *Increasing the salience of emergency planning, improving its quality and getting it taken more seriously*

As pandemics are lethal and extremely expensive disruptions, it is a good idea to devote more resources to the emergency planning process. Education, training and certification of emergency planners, verification and testing of plans, extension of the planning process, and more widespread acceptance of emergency planning should be promoted. Lessons from previous experience should be recorded, codified and translated into improvements in the plans.

1.2.2 Emergency management

A pandemic will necessarily require national-level coordination. The national emergency committee should be supported by scientific committees and the national institute of health.

- *The relationship between research and practice during a pandemic*

A pandemic will probably be caused by a virus or other disease that, because it is newly evolved, has characteristics which are unknown or are poorly understood by virologists, epidemiologists and clinicians. Hence, on-going research is fundamentally important to the management of the event. National centres for disease control or institutes of health will be obvious centres for the collection and interpretation of both data and research results on the progress of the pandemic. Besides medical studies and contagion modelling, research on human behaviour will enable decisions about communication with the general public to be made in an informed manner. Hence, it is important that planning establish a proper structure for scientific advice to be given to decision makers in a free, unbiased manner. This should be a transparent process that enables dialogue and interchange with the scientific community at large. It should also fully involve experts in risk management and emergency planning. Experts may be needed in other areas, such as supply chain management. In communication processes, the relationship between evolving scientific knowledge and changes in policy should be carefully explained to the public.

- *Interpreting early warnings*

Pandemics require decisive early emergency action. This will be highly disruptive to economic and social activity and will incur substantial costs. Early warnings must be taken seriously and acted upon with immediate effect. If major changes are not to be enacted, then there should be a state of extreme readiness to impose radical measures. As these may cause substantial losses to businesses of all kinds, the legal authority to mandate the measures should be clarified before they are adopted.

- *Information management*

Plans should include adequate means of collecting and verifying information on the incidence and prevalence rates of infection, morbidity and mortality from all relevant sources. This includes care homes and places where infection is likely to be a stronger than average risk, such as dormitories.

- *Communicating with the public and dealing with the 'infodemic'*

There should be a political leader and a health sector spokesperson, both of high rank, with designated deputies in case of non-availability. Information should be clear, consistent, well explained and repeated. The principal misassumptions and rumours should be decisively refuted by the spokespersons using verified factual information.

The criteria for judging the quality of information released to the public should be centred on transparency, type and quality of evidence, justification for releasing it, accessibility and comprehension, and timeliness. Generally, there is nothing to be gained, and much to be lost in terms of public trust, by holding back, suppressing or distorting the evidence.

Section 3.3.3 deals with the problem of circulating rumours and their results in terms of antisocial behaviour. Social media are both a source of support and a problem in terms of encouraging deviance (defined as attitudes and actions that act against widely established, sensible advice and reasonable scientific consensus). One commentator noted that "the Internet is now full of amateur epidemiologists", people who perceive the science to be simpler than it actually is.

Covid-19 is difficult to characterise in terms of the number of infected people in any geographical area, the reproduction number (R, or rate of spread), transmissibility, the case fatality rate (lethality), and the future progress of the disease, which depends on healthcare, prophylaxis, testing and tracing, administrative measures (broadly defined as 'policing'), and public behaviour. Statements to the public by the authorities must reflect the real difficulties of the lack of a stable, adequate evidence base for decision making. The R number also depends on environmental factors, not merely on association between people who have the disease and those who do not.

- *Organised voluntary repatriation of foreign nationals and import of labour*

Repatriation flights may need to be organised by a coordinated effort between the national ministry of foreign affairs and the designated national carrier airline. They may need to be subsidised. Nationals abroad should be encouraged to register with the nearest embassy or consulate and information should be collected through the diplomatic network on concentrations of citizens in foreign countries who may need repatriating. At airports it may be necessary to organise social distancing, health monitoring and quarantine procedures. Safe corridors may need to be organised from airport entrance to aircraft on departure, and from gate to ground transportation on arrival.

Conversely, flights may be organised to transfer key workers, mostly in the healthcare and agricultural sectors (e.g., foreign doctors, nurses and produce harvesters). In addition to the travel requirements listed above, they need to be tested and monitored, and to be given safe lodgings that are not overcrowded or likely to be locales suited to the transmission of the disease. Hence, the two-way process of repatriation requires consular liaison and the involvement of multiple departments, for example, labour, health, transportation and foreign affairs.

- *Dealing with subsequent waves of infection*

All restrictive measures should be evaluated in terms of (a) the means by which they will be imposed, (b) the consequences of maintaining them for a prolonged period, (c) the possible procedure for lifting them, and (d) the means of reimposing them and the consequences of doing so. Difficult decisions need to be made that balance economic measures against disease containment. Generally, reopening of activities needs to be a very cautious, phased activity that maintains some social distancing and begins with those activities that pose the smallest risks. The effect of opening these activities needs to be monitored closely. As part of the planning process, statements can be prepared in advance to explain to the public why measures need to be reimposed. Reimposition should be backed by evidence in the form of infection rate data.

- *Example set by leading figures in politics and entertainment*

In the Covid-19 crisis, a number of leading figures in politics, healthcare administration and entertainment gave bad examples by not following designated rules or by making unwise statements that are unsupported by facts. The risk of such behaviour and its consequences need to be monitored so that appropriate action can be taken.

Politicians and celebrities have tried to evade the rules on lock-down and social distancing. They need to be disciplined. Those in official positions may need to be asked to resign.

Limited evidence suggests that the majority of those members of the public who follow conspiracy theories do so because celebrities have endorsed these ideas. In such cases it may be a good strategy to ask the celebrities to retract their endorsement or at least to mount an information counter-offensive. The power of false and discredited ideas to create management problems during pandemics should not be underestimated (see Section 3.3.3).

1.2.3 Communicating with the public

A vitally important planning and management provision is to predispose a robust and effective means of communicating official information to the general public. As usual, this requires the use of all available means: spokespersons, communiques, broadcasts, websites and social media. As usual, information needs to be clear, concise and repeated. The impact of the communications strategy needs to be

monitored constantly and adjustments should be made as required. Secrecy should be avoided as it tends to be counter-productive. Rumours and misassumptions should be countered with firm, reliable official advice. A dialogue should be maintained between decision makers and the general public.

Daily televised press briefings are necessary and they are probably best run by the head of emergency response (i.e., the civil protection service) together with the chief epidemiologist. Press conferences by the head of state, prime minister or other principal leader should be periodic on a lesser frequency, perhaps once or twice a week. In terms of content, all these broadcasts should concentrate on factual information and instructions. They can be used to provide synopses of the evolving situation (e.g. the rates of infection and mortality), explanations of emergency legislation and its consequences, and introductions to measures designed to support the economy and society. The information should be mirrored and amplified in official on-line sources.

Before broadcasting information, the messages should be agreed with other levels of government, such as the leaders of the intermediate (i.e., regional) tier. Conflicting official information can be severely detrimental to efforts to bring the crisis under control and ensure that public behaviour is rational and acceptable. All possible efforts need to be made to build up public trust in government. While political debate should not be stifled, it is important that it be constructive and involve all parties in the search for the best possible outcomes.

1.2.4 Other issues

- *Countering relative risk by occupation*

Evidence suggests that 'front-line' workers are most at risk of infection and death in a viral pandemic. These include carers, nurses, doctors, public transport drivers (including taxi drivers), security guards, sales assistants, cleaners, warehouse staff and delivery drivers. In part this may be because they come into contact with more sources of infection: customers, colleagues and touching infected surfaces. In part it may be because they must continue to work during lockdown and may be poorly supplied with personal protective equipment. Concerted and coordinated effort is needed to improve the safety of workers in routine and manual jobs.

- *Disaster diplomacy*

It cannot be emphasised enough that both the emergency and the recovery phase of a pandemic require concerted international action. This should involve mutual and reciprocal actions and humanitarian relief. To an extent, it can be anticipated by assessing the current state of international diplomacy and capitalising on opportunities to improve international relations for mutual benefit.

Countries have different capacities to produce emergency supplies (primarily food, medicines, and medical supplies and equipment). Bilateral gestures can create or

reinforce diplomatic links. Conversely, banning or delaying the export of, for example, face masks or ventilators, can create diplomatic opprobrium. Such measures have been used as a demonstration of power or to exert political leverage.

Mechanisms need to be agreed in advance for the funding of recovery. As countries' economies are usually dependent on foreign suppliers, markets and, perhaps, tourists, the approach very much needs to be multilateral. Thus does internationalism safeguard national interests, while isolationist nationalism is detrimental to the common good.

- *Management and safeguarding of migrants and refugees*

Refugees, asylum seekers and migrants are at the bottom of the social scale. In various parts of the world they are concentrated in large camps or are simply abandoned with little means of support. Camps may be precarious places where social distancing is impossible and there is little, if any, equipment for personal protection. This situation intensifies during a major international emergency such as a pandemic. There is thus the potential for a major outbreak of the virus in the camps, from where it could be transmitted to the host country and beyond. As medical and economic resources are devoted en masse to domestic needs, migrants are neglected.

Although public opinion is unlikely to afford migrants any priority during conditions of scarce life-saving materials, there are sound reasons for devoting resources to containing infection in refugee camps. Moreover, as a matter of human rights, migrants need to be protected against aggression if they are viewed as having brought the disease with them. It is in no one's interest for them to be treated as scapegoats.

- *Effect of a major disaster of another kind superimposed on pandemic crisis and lock-down*

Disaster management and response generally need close contact, not social distancing. The overlay of a disaster of a different kind onto a pandemic crisis can be severely problematic. Hospitals will already be dealing with surges of patients, funds and emergency responders will be in short supply, international solidarity may be attenuated (especially in the face of a potential global food supply shortage). Emergency supplies may already be available, but they may also be already committed to pandemic action. Shelters for the homeless or evacuees need to be redesigned to stop the spread of disease.

- *Policies on, and effects of, international solidarity*

See the section on disaster diplomacy, above. Countries in the midst of dealing with pandemic problems may be reluctant to prioritise, or even practise, international disaster relief. Even with an international declaration of disaster, responses to non-pandemic calamities (e.g. hurricanes, earthquakes, major floods) are likely to be restricted. Countries need to develop a more autonomous approach to disaster response and relief.

- *Simultaneous impact of other kinds of disasters*

In the modern world disasters occur at the rate of almost two a day, or 600-700 a year. It is therefore highly likely that somewhere in the world another kind of disaster will occur during the pandemic emergency. While pandemics require strict imposition of physical distancing, other forms of disaster need close contact. Although, because of the pandemic, certain kinds of emergency supplies will be readily available, funds for international and national action will be lacking, emergency responders will be otherwise engaged, and there may be competition for relief goods and services. When mass casualty events occur, it is unfortunately likely that hospitals will already be dealing with surges of patients. Shelters for the homeless or evacuees may need to be redesigned to maintain distancing and stop the spread of disease. As a result of these issues, the response to a hurricane, earthquake or other disaster of natural origin is likely to be significantly different, and more challenging, under pandemic conditions with respect to what it would be under normal conditions.

1.3 Voluntarism

Activities related to pandemics require a great deal of labour. Generally, there is a strong desire to "do something useful". This can lead to a surge in voluntarism.

1.3.1 Spontaneous

The present century is one in which spontaneous voluntarism needs to be replaced by the organised kind. However, a pandemic is such a large crisis that it may be capable of creating a very big, broad disaster subculture. The result will be the formation of numerous emergent groups and a generalised desire to participate. Spontaneous volunteers can help with hospital work, distributing food to the elderly and housebound, transporting vital goods, and so on. Questions to be considered are whether any such groups need to be controlled - or limited - by emergency regulations, whether volunteers are putting themselves at risk, what personal protective equipment (PPE) they require and how they will obtain it. Emergency actions should include compiling data on spontaneous volunteers, their achievements and any risks involved (including the risk that they might spread the disease).

1.3.2 Volunteer organisations including those that are incorporated into the civil protection system

Fully constituted volunteer organisations that are incorporated into the civil protection system are the way of the future. The aim is to ensure that they are trained, equipped and have a role to play in emergency planning, management and response. The organisations can be assigned tasks and given a place at table in situation rooms for daily conferences on responding to the emergency. They are also an important source of contact with the general public.

1.3.3 Managing donations

There may be a substantial propensity to support certain key institutions, particularly in the health sector. This may require management of donations and possible relief appeals with care, good record keeping and transparency.

1.4 Welfare

In the literature and in public life there seems to be a reluctance to define the concept of welfare. A simple working definition is "the provision of care to a minimum acceptable standard to people who are unable adequately to look after themselves."

1.4.1 General overhaul and strengthening of the welfare system

Austerity and certain political ideologies have led to the slimming-down of welfare systems in those societies that are able to provide them. In a pandemic, the consensus in society will be that they need to be strengthened, perhaps considerably. Plans can be made in advance by identifying groups of people who will be vulnerable to the social and economic effects of a pandemic and arranging to provide support for them.

During pandemics or other major public health emergencies, a particular problem is represented by people who live alone, especially if they are poor and live in precarious circumstances. Planning needs to confront the risk that such people will die of neglect because their predicament is overlooked and they have no public visibility or support networks.

1.4.2 Continuity of income

Measures will be required to support people who lose their income due to suspension of trade and other activities. This need can be calculated in advance by estimating it from economic data on employment patterns.

1.4.3 Shelter

Measures may be needed to ensure fairness in the provision of housing, which is a basic human right. Where necessary, hotels can be requisitioned (with appropriate compensation) to house transient populations. Selected school and university dormitories should be kept open to deal with residual housing needs among students. Social distancing should be enforced. The provision of housing should be carefully monitored.

- *Moratoria on evictions*

People who live in rented accommodation may face eviction because through loss of income they can no longer pay the rent, or because their contracts are ending, or because their landlords deem them to be a health risk. Legal measures will be needed to ban evictions for the duration of the crisis period. With stalling of the real estate

market, most renters and people in the process of moving or seeking a home will be unable to find one. If measures to prevent eviction are lifted too soon, then significant numbers of renters may find themselves homeless.

- *Homeless people*

In line with the increased emphasis on welfare, homeless people will need to be accommodated in an appropriately socially distanced manner. If a lock-down is instituted in order to reduce infection rates, then the homeless must be removed from the street by providing them with a safe and dignified alternative.

1.4.4 Assistance for people with disabilities

The presence of a pandemic should not result in the degradation of measures to support people with disabilities. Certain kinds of disability require that people, for example those with autism, are regularly taken for exercise outside. This must be allowed for in lock-down provisions. Plans should ensure the continuity of support for all categories of disability, and for the carers of people with severe disability. If this involves infringing lock-down measures, then exceptions should be granted. People who are deaf are potentially disadvantaged by home working when there is an emphasis on oral communication. People with disabilities should not be disadvantaged in the workplace because of extra requirements for space or physical distancing.

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2. Health and medical

This is, of course, the primary sector in any economy and the first focus of emergency planning. It will be afforded maximum priority.

2.1 Health sector preparedness

2.1.1 On-going health sector planning, simulation and deriving lessons

Detailed plans should be made in advance to tackle the medical and healthcare problems caused by a pandemic.

In terms of estimating impacts, pandemic casualties are notoriously difficult to count. First, the number of people who are infected without manifesting symptoms can only be loosely estimated. Secondly, people who die outside hospitals or designated places of care may be inadvertently excluded from the statistics. Thirdly, the virus may be a contributory factor in many deaths, but not necessarily their determinant. Perhaps the best measure of the human toll of the pandemic is the number of excess deaths compared with a running mean for the same period (perhaps three months) over the last five years. With lockdown, there may be reductions in deaths and injuries on the roads. On the other hand, there may be more injuries at home, as well as greater illness and more premature death among people whose (non-virus) conditions are not

adequately treated due to reductions in the general medical capacity of hospitals. Hence, there may be a tendency, justified or not, to include some 'background mortality' in the virus death statistics, but changes in aggregate human behaviour and general healthcare provision will cause regular patterns of morbidity and mortality to be substantially disturbed. Finally, statisticians and data compilers should endeavour, as far as possible, to distinguish between people who are asymptomatic carriers of the disease and those who later develop symptoms. This, of course, may be difficult to do.

2.1.2 Health service preparations

Plans should work out how hospitals and national and regional health services will provide massive surge capacity. If this involves, as it probably will, building temporary wards and hospitals, the sources of building supplies, medical equipment, furnishings, utility connections and personnel should be planned in advance in like with a forecast of possible needs under realistic pandemic scenarios. The locations of field hospitals should be designated in advance.

Care workers may require psychological support as well as adequate rosters and personal protective equipment.

- *Stockpiling of PPE, medical equipment and drugs*

A pandemic will involve massive increases in demand for personal protective equipment (PPE, principally masks, gowns, overalls, gloves and visors or goggles), medical devices such as ventilators or machines that induce positive airway pressure, and drugs such as antivirals and anti-inflammatory medicines. These should be stockpiled in advance and sources of renewed and increased supplies should be identified and agreed in advance. Improvements to the tracking of medicines and medical supplies can help reduce waste and increase stockpiles. Hence, the supply problem is as much one of supply chains and inventory as it is one of manufacturing and sourcing.

- *Accelerated manufacturing and distribution*

By planning, arrangements can be made in advance with pharmaceutical companies, laboratories, design studios and manufacturing concerns to produce equipment on an accelerated basis. Volumes of production can be estimated in advance.

- *Waste disposal*

Disposable personal protective equipment poses a potentially severe problem of contaminated waste. For example, disposable face-masks contain layers of plastic, and plastic is present in many kinds of disposable gown and overall. Increased use of disinfectants and hand sanitizer will inflate the demand for plastic bottles. Arrangements are needed to collect items safely. Contaminated material can be incinerated and other plastic recycled. A much better approach is to prefer reusable equipment that can be washed and sanitized. Once it reaches the end of its use cycle

it, too, needs to be disposed of safely and ethically. A national system for collecting and dealing with PPE waste may need to be designed and implemented.

Comments on the production, distribution and use of vaccines are given in Section 2.3.1.

2.2 Managing the health system

Health systems will need a greater degree of national coordination and management than they do in normal times. The objectives should be (a) to ensure a fair distribution of scarce resources, (b) to identify where shortages occur and rectify them, and (c) to ensure that the geographical spread of infection is countered as much as possible.

2.2.1 Capacity

- *Availability of intensive care beds*

This is the essence of the surge capacity problem. Intensive care beds cannot be improvised and hence arrangements must be made in detail to increase their number when required. This will involve transfers between hospitals and setting up new intensive care units. Central accounting is essential on a daily basis in order to know the distribution of patients and intensive care needs.

- *Safety in medical facilities*

Pandemics can put doctors, nurses and other hospital workers at extreme risk of infection, illness and death. It is essential that detailed plans be made to supply medical facilities with personal protective equipment in adequate quantities, with full continuity of supply: gowns, masks, goggles or visors, surgical gloves, sanitizers, overalls, etc. Sources of supply should be identified in the plans and arrangements should be made to guarantee the continuity of supply during the crisis. During the crisis it will be important to monitor and, as far as possible, reduce nosocomial transmission (the spread of the disease in hospitals).

- *Setting up of temporary hospitals, and their roles*

Existing covered space can be requisitioned in order to create temporary hospitals. Plans should designate such buildings in advance and, where necessary, arrangements should be made to lease or rent them for the duration of a future emergency. The buildings should be large enough to allow expansion of the facility and should be accessible to ambulances and supply vehicles of all kinds. There should be space near entrances to unload patients and supplies. Plans should consider the design of temporary facilities, who will construct them and how they will be equipped. Arrangements should be made with builders and suppliers before the crisis.

Temporary hospitals will probably play a greater role in ensuring the continuity of general medicine than absorbing pandemic patients. Nonetheless, they will need

isolation facilities and stringent measures to limit the transmission of infection. In many scenarios, temporary medical facilities will probably not be fully utilised. However, before dismantling them, the likelihood of a subsequent wave of infection should be taken into account. It may therefore be necessary to prolong their life even if they are severely underutilised.

2.2.2 Supporting care homes

Some forms of virus have a disproportionately large impact upon the elderly. In such cases, care homes are likely to be major sources of mortality. Plans should take this into account as a high priority for intervention. Arrangements should be in place for full epidemiological reporting from care homes on a daily basis and rapid collation and mapping of the data. The homes should be supplied with regulations for the limitation of infection and dealing with cases, with personal protective equipment and with infection control products such as sanitizer liquids and gels. In monitoring, the situation in care homes should be linked with that in nearby hospitals in order to coordinate the intake of elderly or infirm patients who need immediate medical treatment. Visits to care homes should either cease or be strictly controlled. In order to avoid spreading the virus from one facility to another, staff should be limited to work in only one care home. Where possible, if outbreaks occur in a care home, staff who work with infected patients should not work with those who show no symptoms. It is important to remember that many staff members in care homes engage in close-contact nursing that poses a high risk of transferring infection.

Transferring patients from hospitals to care homes in order to free up beds in the former is a risky strategy that can lead to major uncontrolled outbreaks of the disease in the latter. It should not be done without full arrangements for and supervision of isolation facilities. The spread of infection in care homes can be very difficult to control. Moreover, if care home staff start to fall ill and be constrained to absent themselves from duty, reduced staffing under emergency conditions can compound the difficulties of keeping the situation under control. Care homes should be priority targets in virus testing programmes, with repeated testing and special measures to control outbreaks.

2.2.3 Medical ethics

The main concern of medical ethics is to ensure that life-saving treatment is given on a fair and non-discriminatory basis to those who need it most at times when there is a severe shortage of medical resources. Experts in this field should be co-opted and asked to present strategies on the basis of projections of supply-and-demand scenarios. The national epidemiological observatory should include a facility for monitoring medical ethics and correcting any unfairness in the system. Ethical issues are likely to reach a peak when a vaccine against the virus is available but in short supply. Plans need to be drawn up and kept current to ensure that the distribution is fair and rational.

Emergency plans should identify in advance which organisation and experts will manage medical ethics during the crisis. Usually, this will be the national institute of

health, centre for disease control and prevention, or similar organisation, and its experts.

2.2.4 Digital health

Data tracking apps, also known as 'automated contact-tracing apps' are computer programs designed to alert people when they are in the proximity of someone who has had the virus, process known as 'exposure notification'. They differ from symptom trackers, which are apps that are able to codify and communicate people's symptoms. Both functions are likely to be available on Android and Apple operating systems for mobile telephones. Contact tracing is most effective in the early stages of a pandemic than at later stages where the community is self-isolating, but the apps are more likely to be available at later stages, in response to emerging demand for solutions to the tracing problem.

Generally, to be effective, contact-tracing apps require enough people to download and use them, which may be something like 80 per cent of mobile telephone users in a given area. This begs the question as to whether their use is made voluntary or is compulsory. Under more authoritarian regimes, they can be used to find people who violate mandatory quarantine measures.

Symptom-trackers can be used as a form of 'digital passport' to indicate that people are allowed, for example, to board public transport. However, this presupposes that there is some means of authenticating and verifying freedom from symptoms or from infection with the virus. All apps are liable to error if 'false positives' are registered.

Potentially unresolved questions of citizens' rights are associated with these digital applications. To protect rights, in terms of transparency, open source code should be used and policies on data collection, storage and usage should be clearly articulated. To prevent misuse, data should be destroyed after the crisis. Individuals should be protected against the misuse of personal data, and against abuse by being identified as potential carriers or spreaders of the disease. The apps will probably use Bluetooth or Global Positioning System. The former allows a little more protection from abusive or invasive uses of the technology by unauthorised people or organisations. Finally, digital health apps are probably quite vulnerable to conspiracy theories.

2.3 Role of medical research and epidemiology

During a pandemic, national and international resources will be devoted in large quantities to (a) analysing the virus in order to learn more about it; (b) monitoring the developing process of infection, hospitalisation, and recovery or death; (c) devising means to limit the spread of the disease; (d) developing and trialling palliative drugs such as antivirals; (e) developing medical equipment for the treatment of severely ill patients; and (f) creating, testing, trialling and mass producing vaccines.

2.3.1 Vaccine and antiviral research, creation, trialling and mass production

Governmental support will be necessary for laboratories and key workers who are involved in appropriate virological research and the quest for a vaccine. Liaison with pharmaceutical companies will be needed with special reference to the eventual mass production of drugs and vaccines. This will be an international problem and it will require planning at the international level. As there are likely to be various, or many, initiatives in medical research, they will need to be coordinated in order to maximise their efficiency.

2.3.2 Epidemiology: testing, tracing, investigation of contacts, record keeping

The national epidemiological observatory should coordinate, in a capillary manner, the collection of data from regions, hospitals, clinics, care homes, ambulance services and other sources. Rapid analysis of data will be necessary with the issuance of situation reports, by convention at midday every day of the crisis. The aim should be to obtain as complete a picture of the progress of the emergency as possible in terms of the incidence and prevalence of morbidity and mortality, recovery rates, the geography of infection, medical coping capacity, and the influence of traits in public behaviour upon the rate of infection. The impact of infection control measures such as lock-down must be carefully assessed.

One of the most important lessons of Covid-19 is that a comprehensive and firm early response to a developing pandemic is highly beneficial in terms of lives saved. This is expensive in terms of its impact on the economy and public liberty. For planning purposes, governments should study the question of liability and, through temporary or permanent legislation, create conditions that loosen the constraints upon early action.

Testing and tracing of the contacts of the carriers of infection are highly effective ways of limiting the spread of a pandemic virus. Emergency plans need to concentrate on developing, in advance, the means of massively increasing the rate of testing (of infection, of antibody production) among key workers (in hospitals, ambulances, care homes, public transport, etc.) and tracing the paths of infection.

Bringing testing, tracing and care into the community is one way of limiting potentially intolerable pressure on hospitals once a pandemic breaks out. Plans should provide a model for extending these activities into areas of high infection.

2.4 General medicine and healthcare

A pandemic will cause a massive surge in the need for hospital care. Physicians and nurses will be diverted from other tasks to cope with the influx of infected patients. Wards will be closed or have their designation changed. Elective surgery will be cancelled or postponed, probably indefinitely. It is essential that patients with major health concerns not be abandoned as a result of the pandemic. Some of their care will

probably take place in temporary or field hospitals. They should be fully included in the healthcare planning scenario.

2.4.1 Continuity of general medicine, especially cancer treatment

Medical transportation, hospital stays, diagnostics and treatment must still be provided to patients who are suffering from conditions other than those related to the pandemic. This is particularly important for cancer patients, as any delay in treatment may cause the disease to advance to the stage at which it is no longer treatable. Continuity of care needs to be planned in advance by apportioning scarce medical resources according to criteria of medical ethics and triage. Patients without virus symptoms may be reluctant to attend hospitals for fear of becoming infected with the virus.

A pandemic may slow down the assessment of patients ('clients') and provision of care in social assistance as well as the medical field.

2.4.2 Family planning

A pandemic is likely to be associated with changes in the birth rate. It is important that these not be inadvertent and the subject of hardship. Special consideration of the impact of a pandemic on women is given in Section 5.3.1, below.

- *Access to services*

There is a significant risk that a pandemic will lead to the closure of family planning clinics and associated support services. Measures to maintain the continuity of such services should be planned in advance.

- *Continuity of prophylactic supplies*

Covid-19 apparently led to a world-wide shortage of condoms. This could lead to surges in the birth rate and sexually transmitted diseases, although this risk may be offset by the effects of physical distancing. Plans need to ensure continuity of prophylactic supplies.

2.4.3 Medical-environmental research

Pandemics are most likely to be zoonoses, with the transmission of disease from animals to humans. The paths by which this process occurs are complex and not fully understood. However, it appears that mismanagement and overexploitation of the environment play a significant role, as well as dietary habits. Government policy should encourage the scientific investigation, at national and international levels, of the means by which infections are created and transmitted, with an emphasis on the environmental dimension.

- *Effect of air pollution on immunity and survival after infection*

There are increasing indications that high levels of air pollution have a significant effect on mortality, through their negative effect on the lungs and the immune system. Lockdown and reductions in public transport and civil aviation will drastically reduce air pollution, but the effects are long-term ones. Pandemic protection is one reason for increasing measures to control air pollution in cities and megalopolises.

2.5 Mortuary arrangements, funerals and body disposal

Mass fatalities require specific planning. Large numbers of deaths in a pandemic will put intolerable strain on mortuary and autopsy capacities. Lockdown will inhibit funerary rites. Plans should coordinate the process of dealing with mass fatalities. This may require mass burial, accelerated throughput in crematoria, and special procedures for death certification and the transport and storage of bodies. In extremis, cold storage and refrigerated trucks may have to be used, although this is likely to lead to public opprobrium. Temporary mortuaries may be needed and plans should consider how to construct them, where to set them up and how to fulfil their working requirements. Liaison with family members is an important part of this process. Standards of death certification need to be maintained, but procedures may need to be streamlined.

3. Critical infrastructure and information technology

A major pandemic will cause far-reaching changes in the use and importance of critical infrastructure. For various types of infrastructure, maintenance will be reduced during the pandemic and during the aftermath there will be a backlog of maintenance tasks to complete. Hence, a pandemic is likely to have a negative impact on the functionality and reliability of infrastructure. For the various categories, the scenario can be summarised as follows.

- *Electricity and gas, water and wastewater disposal:* industrial use will decline substantially and domestic use will increase. There will be continuing volatility in the energy market.
- *Food:* food supply chains and networks will be under strain, with changes in patterns of demand.
- *Fuel:* demand for petroleum products will decline during lockdown.
- *Health:* this will be the sector that undergoes the biggest changes, as detailed elsewhere in this document.
- *Transportation:* a drastic reduction in journeys will occur during lockdown, with prioritisation of goods distribution and the journeys of key workers. In cities, there will be a peak in 'active travel' (walking and cycling), but urban landscapes may not be well designed to accommodate it.
- *Communications:* there will be a huge increase in on-line communication and corresponding reduction in face-to-face meetings. Rumour, donations and social movements will be spread through social media, government communication and news media will assume a vital role.
- *Finance:* welfare functions will replace many profit-making enterprises.

- *Government:* people will look to government at all levels to manage the situation competently.
- *Emergency services:* these will be under strain as they struggle to respond to the situation. They will require personal protective equipment, increased funding and logistical support, perhaps with the addition of volunteer labour.

3.1 Critical infrastructure

3.1.1 Staffing levels of critical infrastructure

Absenteeism, illness and mortality will diminish staff complements in the running of critical infrastructure. Commercial companies such as food distribution services and supermarkets will take on temporary labour. Plans should ensure that operators of public transport receive enough personal protective equipment or are adequately segregated from the public.

3.1.2 Supply chains, food, medical supplies

It is vital that the supply of food, pharmaceuticals and medical equipment be maintained. This requires support to production and manufacture, transportation and distribution, and sales. International transfers of goods need to be maintained. This may require reorganisation of shipping, air freight, customs and port facilities. It may also require diplomatic negotiation to avoid the effects of protectionism. The effects of 'panic buying' are discussed in Section 5.2.1.

Under normal conditions, supply chains tend to be lean in order to promote efficiency. During a pandemic they may need to be reinforced and given more redundancy in order to improve their resiliency. Disruption of supply chains creates the opportunity to consider how to improve sustainability and resiliency in the long term.

Shops that have the right to remain open during a lockdown may nevertheless close if they are located in areas which customers are unable or unwilling to frequent.

Providers of basic goods to the public should be encouraged to share data in order to help regulate supply and demand across the food and medicine sectors.

Rigidity in the supply chain may mean that producers are unable to respond adequately to changes in the pattern of demand. When restaurants and schools close due to the imposition of lockdown, it may be difficult to redistribute the sale of food to markets and supermarkets or directly from the farm or factory to the public. Producers, wholesalers and retailers may need help with planning changes to the supply chain. Food supply chains need to be robust as the commodities are perishable. Steps need to be taken to ensure that the robustness is maintained through a country, not merely in privileged regions.

3.1.3 Shipping

Port activities are likely to diminish as a result of lockdown. However, certain functions need to be enhanced rather than curtailed.

Cruise ships may contain several thousand passengers and members of the crew. As they are all in close proximity, there is a higher than average likelihood that a virus will transmit aboard such ships. As a preventative measure, cruises should be banned at a relatively early stage of the crisis. Where cruise ships need to dock and disgorge their passengers, quarantine facilities are needed. This will overburden local resources in port cities. If passengers disembark without quarantine, they will need to be traced, as they could be spreaders of infection. As many cruise ships carry 'flags of convenience', they risk being regarded as one one country's responsibility. For example, it is unlikely that a major cruise ship with 4,000 passengers on board will dock and disembark in Liberia or Panama. Moreover, once a disembarkation port has been found, passengers and crew of different nationalities will need transportation in order to be repatriated. This requires coordinated planning between cruise ship operators and national consular services or foreign ministries.

Generally, quarantine aboard cruise ships is not effective if there is any incidence of the virus therein. There may also be mental health issues if it is impossible to disembark cruise ships (their crews and staff, if not the passengers) for long periods of time.

Similar considerations exist with respect to foreign tours by naval ships. These are the responsibility of the Ministry of Defence of the home country. Prompt action is required to stop the spread of infection aboard, as well as the spread of infection from ship to shore.

3.1.4 Civil aviation and space

- *Airline suspensions and bankruptcy*

Pandemics are associated with drastic changes in the pattern of travel. Air transportation is one of the principal means by which viruses can be spread from one country or region to another. Hence, suspension or curtailment of international and some domestic air travel is likely to be necessary. Airlines with substantial cash reserves or access to capital may furlough their workers and mothball their aircraft. Other airlines will probably go bankrupt unless they are kept alive with public funding.

National air carriers, where such exist, can be used for systematic repatriation flights for citizens who are stranded abroad during lockdown. These need to be planned by the foreign ministry in consultation with the airlines, airports and travel operators. In terms of limiting the risks of diffusion of the virus, this may mean keeping open only larger airports and ensuring that physical distancing is observed within them.

National carriers or low-cost airlines may be co-opted to bring temporary or seasonal workers to a country to assist in harvesting crops, delivering essential goods or working in healthcare (see Section 3.2.1). This may need to be coordinated by liaison between consular services in the departure and destination countries.

Given the profound changes that a pandemic can cause to civil aviation, planning policy should consider how to support the resurrection of air transportation at the end of the crisis phase. Liaison with ICAO and IATA is recommended. Public opinion about air travel may change as a result of cleaner air and quieter environments during cessation of flights.

Under international air transportation charters, the cancellation of flights as a result of the pandemic should require that passengers have their ticket prices refunded. Airlines will tend to resist this or make the process difficult, perhaps offering travel vouchers in lieu of monetary compensation.

- *Risks associated with satellite operation*

Satellite operators are likely to be stretched because of staff absences due to sickness and the need to move to alternative secondary command locations. While operators are distracted, there may be an increased likelihood of satellite collisions that cause major increases in space debris

3.2 Agriculture and food supply

Although a pandemic would not destroy food supplies, these would be affected by impacts upon labour supply, transportation and distribution, and patterns of demand.

3.2.1 Labour to harvest crops

In many parts of the world, seasonal migrant labour is used to harvest crops. Closure of national borders, severe restrictions on immigration, lockdown and its effect on movement within countries may cause the supply of agricultural labour to dry up. Crops may go unharvested. Measures need to be planned to ensure that this does not happen. Charter flights and special immigration arrangements can be used for agricultural workers. They would then need health testing, monitoring and epidemiological surveillance. Where agricultural workers live in dormitories, these should not be allowed to become places of incubation of the pandemic virus. Planners should asses seasonal agricultural labour needs and endeavour to ensure that they are supplied.

3.2.2 Disruption of food supply chains

Plans may also be required to ensure the continuity of warehousing, transportation and distribution of agricultural produce. Special bilateral arrangements may be needed for international transportation of produce or livestock. Generally, international food supply is likely to be more problematic than its domestic equivalent, but the latter will

nevertheless require adequate manpower in production, manufacturing and supply chains.

So-called 'wet markets' (i.e. of live animals) may need to be shut down of regulated to avoid zoonosis.

Legal regulation of the food supply chain may be needed to suppress profiteering where shortages of basic goods are likely to develop.

During a pandemic there will be major changes in patterns of demand. Besides hording (so-called 'panic buying--see section 5.2.1), closure of restaurants and canteens will alter demand for food ingredients. This will mean that some producers will see food commodity prices fall to uneconomic levels. With modern, complex supply chains, it may be impossible to adapt to these changes over the short term, which will mean that food has to be destroyed or not harvested. Fishing vessels may not put to sea, producers may be unable to sell foodstuffs and frozen food stores may quickly reach capacity.

3.3 Information technology

During lockdown, information technology and the Internet will assume great importance. The proportion of people who manage to work from home will more than double compared with ordinary times. A much larger proportion of people will look to Internet-based sources for information and guidance. One possible consequence of this is degradation of broadband response as a result of too many users logging onto limited capacity. This may mean slow response, interruption of connections or slow download rates.

3.3.1 Role, capability and performance of on-line platforms and apps

In the absence of face-to-face encounters, on-line meetings and webinars will be very important. This will boost the prestige and usage of companies that provide on-line platforms. It is important that data protection be maintained with the increase of usage. Apps will be created to assist with the management of infection risks, hospital surges and other contingencies. These also will require scrutiny regarding the sharing of private and personal data. Loopholes in regulation should be investigated and closed promptly.

Education is one of the sectors that will be most affected by the switch to digital provision. It is dealt with in Section 7, below.

The services sector of the economy will substantially increase its use of distributed working and distance provision. It will need to be the subject of surveillance to ensure that realigned activities are fair to clients and customers. Moreover, use of digital services at home can lead to potential invasions of privacy through sharing of data and digital access.

There is an open question over the extent to which digital commerce should be regulated. Warehouses need to observe infection control and personal protection measures. Where distribution chains are under duress, it may be necessary to restrict them to essential goods for a time during the crisis and thus delay the delivery of inessential items.

3.3.2 Managing the 'digital divide'

There is a substantial risk that sectors of the population with poor or no access to computers and broadband connections will be severely disadvantaged. This needs to be taken into account in planning. Improved supply of the digital means of communication may be needed, along with viable alternatives to on-line participation. From educational activity to the filling in of official forms, the need for equity needs to be taken into account when providing digital means. Perhaps it may be possible to provide access points, distribution of free equipment or the funding of assistants.

3.3.3 Deviancy

Lockdown and the transition to digital working and socialising involve significant risks of deviancy.

- *Role of social media in spreading rumour, conspiracy theories and encouraging bad behaviour*

The advent of social media has led to radical changes in the balance of power in providing information. It is now possible for unfounded rumours and conspiracy theories to acquire very substantial momentum, with serious consequences. For example, each generation of mobile telephone technology seems to inspire conspiracy theories. The installation of 5G technology has given rise to the unfounded supposition that it causes the Covid-19 virus, and that it is part of a conspiracy to weaken the population. As a result, in the UK more than 100 cellular telephone masts have been attacked and damaged. This has cut communications to hospitals, ambulance services, emergency telephone lines, sick people and their relatives. Resolute public information measures need to be planned in order to counteract rumour and conspiracy theories. Police involvement is also necessary.

Social media are also likely to be a source of false claims about miracle cures. Once again, if these are supported, or simply relayed, by people in prominent positions in public life, they can gain credibility. Social media providers may be persuaded to take down false information about cures, but they must also confront the question of how to maintain freedom of speech.

On a more positive note, in Covid-19 the emphasis on a frantic search for a vaccine has apparently weakened support for people who are opposed to mass vaccination. Besides the pandemic virus, this may have beneficial effects regarding various communicable diseases which rely on vaccination to keep them under control, such as measles.

- *Cyber-attacks and bot influencers*

A pandemic crisis can be seen as weakening national defences. It will therefore probably be exploited by exponents of 'cyber warfare'. This can involve using robotised disguised messaging and telematics viruses in denial of service attacks, infections of computer systems designed to bring them down, and attempts to undermine national efforts to manage the crisis by unduly influencing public opinion. People involved in cyber defence should be designated as key workers. The overall cyber-attack situation should be constantly monitored. The pandemic may reduce the number of cyber-security professionals who are at work and at the same time increase demand for their services. Ransomware attacks on the financial sector are a particular risk during a pandemic.

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4. Economics

The economic and social impacts of a pandemic are obviously profound at all levels, from household to global.

4.1 Fiscal impact and national economy

Reductions in tax revenues are likely to be accompanied by unprecedented demands on national financial resources. Full economic planning is needed in advance of the crisis phase.

4.1.1 Effects on national productivity

General productivity will fall in most sectors. This will of course reduce tax revenues. Lock-down measures need to take into account the possibility of reopening certain industries and activities early if social distancing can be maintained along with working conditions. However, much also depends on the pattern of demand, which may be depressed if, for example, foreign customers are not economically active. On a smaller scale, lack of childcare may reduce the productivity of parents whose primary duty is to look after their offspring.

During a pandemic, industrial production and commercial productivity, and the behaviour of businesses will need to be monitored closely. Where remedies are possible, they will have to follow and, as far as possible, correct the patterns of flexure in the economy. As widespread insolvency of businesses is a possible result of the crisis, cushions may be needed in legal procedures and financing provisions.

- *Mass unemployment*

Furloughs, lay-offs and redundancies will accompany the cessation of activities by companies. This will particularly affect the tourism, transportation, real estate, manufacturing and entertainment sectors, but also many others. Unemployment

support measures will need to be widened considerably. It taking this measure, is important to ensure that no groups with urgent needs of this kind "fall through the net". Certain cohorts of the self-employed may fall into this category. During a pandemic and its aftermath, payments to the unemployed need to be comprehensive and prompt. This will not only reduce suffering, it will probably reduce the chances of social unrest and disaffection.

- *Remedial economics*

Increases in borrowing and taxation will be needed in order to fund remedial measures. Financial support for workers, businesses and industries will be needed. Estimates of needs will have to be made and frequently revised.

- *Inverse multiplier*

Locally and regionally, there is likely to be a strong inverse multiplier effect. For example, in areas that have substantial reliance on tourism, other economic sectors may suffer from the reduced circulation of money. Strong monetary policies will be needed in order to stabilise the stock market, keep inflation under control and prevent the depreciation of the national currency.

4.2.1 Fiscal effects

Significant changes are likely in the circulation of money. Increases in electronic transactions will accompany a reduced desire to handle cash. Electronic transaction systems must be capacious and robust enough to handle the increased traffic.

- *Reduced tax revenues and increased national debt*

Management of national debt may become problematic as a result of the increases in demand for government-sponsored welfare coupled with loss of tax revenues associated with reduced remand for, among other things, vehicle fuel and consumer goods. Although demand may surge at the end of the crisis, it is unlikely to compensate for losses during the crisis period.

4.2 Localised economic impacts

Despite the globalisation of trade, the economic impacts of a pandemic are unlikely to be distributed evenly around the world or within individual countries. This means that planning will be required for the fair distribution of the economic burden caused by the pandemic.

4.2.1 Profiteering

Profiteering is an ethical risk in both buoyant and depressed sectors of the economy. For example, manufacturers of facemasks may reap large profits from the huge demand for them. Conversely, shortage of air transportation may mean that air carriers

charge very large sums of money for tickets on the few remaining flights. Governmental regulation of prices may be required in the name of public welfare. Alternatively, enterprises can be commandeered in order to provide goods or services at equitable prices as public goods.

4.2.2 Cash-flow, liquidity and debt problems of individuals and companies

Many enterprises operate at the margins of economic security. They are likely to be bankrupted by problems of cash flow, lack of liquidity or debt. Suppliers and customers in the same situation may defer or default on payments. Governments must decide how much support to give to businesses to alleviate such problems.

- *Excessive cost of funerals for the low-paid and unemployed*

In developed countries, funerals and cremation or interment are potentially too expensive for the low-paid or unemployed to afford. It may be necessary to provide subsidies for basic rituals and procedures, and also enhanced procedures for the disposal of the dead when no one is responsible for them. Temporary burial may be needed during the crisis phase. Crematoria may need to deal with many more bodies than they usually do.

4.3 Sectoral impacts

Not only will the economic impacts of a pandemic be distributed unevenly in a geographical sense, they will also fall disproportionately on different sectors of the economy.

4.3.1 Travel sector

During the crisis phase of a pandemic, a minority of travel will become essential and the majority will be judged unnecessary. Policing measures may be needed, as part of lockdown procedures, to ensure that people do not travel for spurious reasons. As a result there will be drastic changes in travel patterns.

On trains and aircraft, reductions in services may make social distancing very difficult. Meanwhile, many staff may be laid off. Sales of vehicle fuel may undergo a slump as fewer people travel by car, and those who do so travel shorter distances.

The impact of a pandemic on civil aviation is likely to be severe. Initially it will lead to mothballing of aircraft, reduction in airport and air traffic activity and laying off of staff. After a prolonged crisis, there may be drastic reorganisation of the industry and patterns of demand may change, perhaps permanently, in ways that are difficult to predict. Economic and business forecasting require constant revision of the developing scenario.

4.3.2 Tourism sector

Tourism is an extremely large and widespread economic sector that is particularly susceptible to the impact of a pandemic. The impact will be felt in ground, air and sea travel, hotel and restaurant usage (the hospitality industry) and access to attractions, which will be closed during the lockdown. Seasonal and permanent employment will probably disappear for the duration of the crisis. The scale of revival at the end of the crisis period is difficult to predict, but it is likely to be slow.

Hotels may be requisitioned, at cost, temporarily to house people who are displaced by the pandemic. Air transportation may be co-opted to provide repatriation flights. Train, bus and coach services will need to be kept going in order to provide transportation to key workers, although their use by other members of the public should be discouraged or banned.

4.3.3 Entertainment and sports sectors

There will be drastic changes in the entertainment and sports industries. All forms of public mass meeting will need to be abandoned from a very early stage of the crisis. There may be substantial opposition to this, but sporting matches, concerts, plays and films are ideal places for the transmission of a virus. Preventative measures will be absolutely necessary. Meanwhile, demand for on-line and television services will soar.

Artistes can have a significant impact on public morale. They can also be opinion leaders. Their cooperation in measures taken to keep the public safe should be actively sought.

4.3.4 The advertising sector

As patterns of consumption will change, so demand for advertising will adapt to what is happening. Many advertisers will be willing to embed public service messages in their commercial content and can be co-opted to do so.

4.4 Other economic impacts

The infection and incapacitation or death of medical staff a result of their work may require that survivors or bereaved families are compensated from public funds.

The life insurance costs of a pandemic may be very high and may threaten the financial stability of insurance companies, depending on how many policy holders die during the emergency. Another insurance issue relates to unoccupied buildings. If these are not adequately monitored, and if incursion by thieves or vandals, or other sources of loss and damage occur, insurance companies may endeavour to refuse to reimburse the losses. Monitoring may prove difficult when a general lockdown is imposed.

People who were already working on low income, or were on governmental income support, may be pushed further into poverty when work opportunities are curtailed by

lockdown and changes in consumer behaviour. This may increase national inequality, as at the same time some high-income groups may profit from the crisis by manipulating capital for personal gain.

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5. Social and psychological

The social and psychological effects of a pandemic will be profound. On the one hand, there will be an accession of the so-called 'therapeutic community', with a consensus on what is socially acceptable and valued by the majority. On the other hand, there will be outbreaks of deviant and criminal behaviour, and some attempts to defy regulations. To an extent, the pattern of social changes can be anticipated and prepared for. The social response scenario functions in parallel to the medical-epidemiological and economic scenarios.

5.1 General social effects

The majority of people are likely to follow government advice in a responsible manner. The advice, however, needs to be clear, consistent and repeated frequently.

5.1.1 Overcrowding and infection risk

Population density is clearly related to the risk of the spread of a virus. This relationship acts at various scales, from the level of individual households to that of regions of a city. In many instances, little can be done to reduce overcrowding. However, areas where it is known to occur can be targeted for increased testing, tracing and care in the community activities.

Mass gatherings are potential 'infection bombs'. They need to be banned at an early stage of the pandemic and prevented from occurring spontaneously during the emergency. One tactic that can be employed is to work with the organisers of mass gatherings (religious, sporting or entertainment events) to propose alternative forms of celebration which do not involve physical gathering. Although in the early stages, sports teams will not meet through fear of sharing infection, as the risk ebbs, sporting events can be played in empty stadia and televised.

5.1.2 Position of the low-paid as key workers who are especially vulnerable

Warehouse workers, delivery drivers, cleaners and other low-paid workers may be especially vulnerable to infection. This is because they may be unable to avoid social contact and may be poorly supplied with personal protective equipment (PPE). Some may also lack access to healthcare services. Plans can take this into account. For example, such workers can be identified as a sector and supplied with PPE.

The effect of increased exposure by low-paid workers may be to cause ethnic minorities to have a higher rate of infection than does the ethnic majority.

5.1.3 Gender effects

It is highly probable that, whatever the virus and its rate of spread, in a pandemic there will be uneven effects between the sexes. It is therefore important to plan to reduce the level of discrimination wherever possible.

- *Disproportionate impact on women*

Some pandemic viruses appear to be less lethal in women than in men, while others do not discriminate. Regardless of this, in many pandemic situations, women are likely to bear a heavier burden than men. Managing households, dealing with children who cannot go to school (with effects upon female employment) and keeping the domestic economy going are burdens that women are likely to bear in a disproportionately heavy manner.

- *Gender-based violence*

Pandemics have been linked with increases in violence to women. Policing needs to be enhanced and police forces acquainted with needs. Shelters, counselling and other forms of protection need to be included in the planning process.

5.1.4 Limiting the impact of the pandemic on ethnic and cultural minorities

The relationship between increased risk, low pay and ethnicity was mentioned in Section 5.1.2.

There is a tendency in pandemic situations for certain people to link the crisis to ethnicity. For example, if it is deemed that a pandemic originated in China, there may be 'reprisal' attacks on people of oriental appearance. Policing practices need to take account of this risk. Politicians need to avoid stigmatising any group or country, as this may have a follow-on effect with members of the general public.

5.2 Behavioural traits

Lockdown and other measures taken to limit the spread of infection will have substantial effects on aggregate human behaviour.

5.2.1 Major changes in consumer behaviour

When limitations on activity are imposed, patterns of consumption are bound to change, however, in a broadly predictable manner.

- *On-line commerce*

Inability to procure goods and services in person will cause people to turn to ordering them on line. This will increase the role of delivery and probably cause shortages in the availability of the means of delivering goods.

Home delivery by supermarkets may become very important. Demand is likely to exceed supply very considerably, which should induce the suppliers to develop rules for rationing the service so that it prioritises the vulnerable, such as the elderly and housebound. This is, of course, also a form of on-line commerce.

- *'Panic buying'*

The early stages of a pandemic are likely to be characterised by hoarding and a run on many basic supplies. The more that certain goods become scarce, the more they are sought. Pasta, bread, flour, rice, toilet paper and canned vegetables are examples of goods that may be hoarded. Checks on the ability of supermarkets to satisfy or regulate demand are probably warranted. It appears that social media will play a significant role in encouraging so-called 'panic buying', as people use the media to air their concerns about perceived shortages. This may need to be the subject of an "information counter-offensive" in favour of regulating demand.

5.2.2 Deviancy (cf. Section 3.3.3)

While it is likely that the majority of people will behave sensibly, deviancy is also likely to some degree. It requires both legislative measures (i.e., adequate sanctions) and policing. The latter needs to have carefully written guidelines as the public will react negatively to perceived excesses in police behaviour. In some cases, this could give rise to episodes of unrest.

- *Rumour, vandalism, dissent and transgressive behaviour*

Rumour and vandalism are dealt with above in Sections 1.2.2 and 3.3. Some form of transgressive behaviour are linked to the spread of rumour and misassumption (fake news, false causality) on social media, while others are not. One of the most common forms of transgressive behaviour is violation of the conditions of lockdown. This may involve unnecessary journeys (for example, from main residences to second homes at the seaside or in the mountains). Alternatively, it may involve organising parties, sports meetings or even funerals in violation of lockdown regulations. Policing must deal with such cases in order to ensure that they do not proliferate.

- *Racism, blame and scapegoating*

Presumed carriers or spreaders of disease may be targeted and attacked, physically, verbally or on line. These may include people from particular countries or regions of the world and health workers such as nurses and doctors. The disruption caused by a pandemic may also act as an excuse for an upsurge of racism. Decisive action is

needed. Stigma against people deemed to be at high risk needs to be counteracted with a mixture of information and policing.

The question of eviction of people from lodgings is dealt with in Section 1.4.3, above. It requires legislation to put a temporary moratorium on evictions.

5.2.3 Behavioural constraints

One of the most difficult and delicate problems that those who make emergency plans to deal with pandemics must face is the imposition of constraints upon normal behaviour.

- *Success or failure of social distancing and restrictions*

Social distancing is a vital means of limiting the spread of a pandemic virus. This may mean imposing a partial or total lock-down by constraining people to remain at home unless they are key workers travelling between home and workplace, or on business, or they are procuring food, or they can demonstrate that their journeys are otherwise essential.

In advance of a pandemic, planners can design measures for imposing lock-down and quarantine, and forms for self-certification of travel. Quarantine is likely to involve physical isolation of people for one or two weeks, until they are deemed to be no longer at specific risk of infecting others. This may require registration and surveillance. In some cases it could require the authorities to provide lodging and subsistence for the stated period.

It is a good idea to institute a human factors observatory in order to monitor patterns of behaviour. This can act as a barometer regarding public compliance with regulations and levels of dissatisfaction. It may also help predict any situation that could lead to mass violations on the basis of rising social tensions. In this whole process, it is important that leaders set a good example and present policies that are logical, consistent and firm.

A behavioural factors observatory may be able to judge the moment at which social distancing restrictions have created social tensions to the extent that the restrictions can no longer be maintained, if this ever occurs. With added knowledge of the social situation, and people's attitudes and perceptions, it may be able to propose solutions.

- *Authoritarianism, human rights and the policing function*

To give way to authoritarianism is not a correct response to the upheaval caused by a pandemic. The passing of emergency measures should require due procedures and proper parliamentary scrutiny, with all the checks and balances that that requires. A difficult path has to be steered between promulgating measures that are Draconian and those that are too lax to achieve the desired result of limiting infection and mortality and bringing the pandemic crisis to an early end. The dilemma embraces questions of

what measures to impose, when to impose them and when to lift them. In considering these issues, the possibility of subsequent waves of infection and the slow epidemiological recovery from the pandemic need to be taken into account.

The response to a viral pandemic necessarily requires limitations to be placed on people's normal activities. As some measure of deviant behaviour and non-observance is inevitable, this requires legal instruments (laws, ordinances, decrees or edicts), policing powers and sanctions (fines and potentially arrest, prosecution and detention). The principal goal of these is to ensure public safety. Libertarians may argue that these powers have gone too far; authoritarian and opportunistic governments may be tempted to abuse the powers they have assumed. From an emergency planning and management point of view, the question can be simplified to one of what represents an appropriate, proportionate and broadly acceptable response to a given risk situation.

Generally, policing can be used to stop people from travelling and from associating in groups. To do this, available personnel must be sufficient. Staff absences in police forces may weaken enforcement, and mass violations may be incapable of being policed without the use of unreasonable force. Generally, it is important to try to maintain good relations between members of the local community and the forces of order. Nevertheless, people who harbour the virus need to be stopped from infecting others. Deliberate attempts to do so represent assault at the highest order, because they may involve a risk of death. Deterrents such as fines and sanctions should be proportional to the likely impact of the violation to which they are applied.

Where there is a risk that powers may be used in a manner that seems excessive, they can be subject to legal and political scrutiny.

- *Social cohesion*

Pandemics can be highly stressful for all concerned. As time wears on, isolation, sickness, mortality, unemployment and other issues may weaken the bonds of society. Possible effects include increases in racist and xenophobic behaviour, scapegoating and social unrest. Many different aspects of life may be subject to negative effects, including future career prospects, educational opportunities, sense of community and general satisfaction with living conditions. Many people are likely to suffer job loss, reduction of income and reduced access to educational and social opportunities. Some will have the added burden of increased caring responsibilities.

5.3 Psychological issues

The drastic changes wrought by a major pandemic will reach almost all areas of modern life. They will thus have a profound impact on the collective psyche of a nation, an ethnic group, a neighbourhood and individual people.

5.3.1 Psychological impacts on the general public

The early response to a developing pandemic is likely to be classed as 'normalcy bias', the tendency to believe in the least threatening future scenario. This may devolve into cognitive dissonance if it begins to clash with the developing reality of the disease. Hence, the initial response is likely to be disbelief, with criticism of actions taken, followed by fear and demand for more action. People may become depressed or agitated, depending on whether their predominant psychological response is passive or active. There may be a tendency to dream more vividly. Psychological support and assistance are important but difficult to furnish remotely. However, the 'therapeutic community' will develop and ensure that there is both a greater consensus on social values and more tendency to offer assistance to people in need.

Despite the positive psychological effects of the emergency, those linked to the concept of 'therapeutic community', people are likely to be anxious, frustrated, depressed, angry, desperate or bored by the stringent conditions of lockdown and the curtailment of normal activities. The conditions and routines that anchor normal life will be substantially upset and the result may be a proliferation of negative psychological reactions. Efforts to maintain or boots collective morale are thus very important during lockdown.

Substantial contrasts will emerge between socially laudable decisions and actions, and those that are divisive or destructive. Those who are volunteering and helping neighbours will this contrast with those who are unnecessarily sacking or exploiting workers, or evicting tenants.

With the emergence of a 'therapeutic community', it is not clear whether there is likely to be an increase or a decrease in suicide and murder rates. There will be a greater consensus on the common good, but also greater social tensions. Increases in domestic violence are likely, but also increases in concern for neighbours. Nevertheless, isolation, debt and unemployment do lead to a potential suicide risk, which needs to be countered by alertness and support measures.

Restrictions on hospital visits, physical association and funerals may increase people's susceptibility to mental health issues. These in turn may have economic impacts when people are dealing with grief or depression and are unable to return to work.

5.3.2 Psychological impacts on the authorities

In many respects, key decision makers will simply react to the crisis in a similar manner to members of the public, with the exception that they are likely to be privy to far better and more extensive sources of advice. However, the initial reaction to a developing pandemic is likely to be a tendency to underestimate its potential to disrupt society and the economy. This is understandable, but unfortunate, as a pandemic requires firm decisive action, particularly in its early stages when opportunities are available to limit its spread (which will otherwise occur exponentially). Leadership needs to be clear, consistent and patient. Leaders need to act on the basis of advice from the best, most

reliable sources in the medical, epidemiological, commercial, economic and socio-psychological sectors.

- Psychological impact on carers

The process of applauding carers and front-line workers during a pandemic is somewhat controversial. In positive terms, it is a means of showing appreciation and is cathartic for a population under stress. In negative terms, many carers are uncomfortable with being labelled 'heroes' and some may fear that the acclamation diverts attention from the real problems they face, such as shortage of personal protective equipment. Carers are likely to suffer high levels of stress due to the dangerous conditions, pressure of tasks and long hours in service each day. This can be mitigated by arranging to provide adequate personal protective equipment, planning to ensure that work environments and procedures are as safe as possible, and making arrangements for psychological support.

5.3.3 Trust in government

The quality of leadership during the crisis is likely to determine the degree of trust in government held by the population and thus the level of compliance with the measures that are imposed. A further factor is the degree of trust that existed before the crisis. Levels of trust can be increased by fair, clear, decisive leadership and good, consistent communication.

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6. Justice and crime

A pandemic is also likely to have a profound impact on public security and compliance with both existing laws and those promulgated during the crisis.

6.1 Justice

The pandemic will require extra policing powers to ensure that lockdown and social distancing rules are observed. A powerful argument that can be used to induce the public to comply is that lives depend on controlling infection.

6.1.1 Infection control and potential revolt in prisons

Prisons have substantial potential to spread infection. They tend to be overcrowded, may have poor quality facilities and allow little scope for distancing or segregation of prisoners. Warders and other staff are also at particular risk of catching the infection. Failure to control it may result in riots and intramural violence. Few options are available to prison governors or the government ministry to which they answer. One of these is to release prisoners before they have finished serving their sentences. This is understandably likely to be unpopular with the general public and the police.

6.1.2 Reduced functioning of law courts and trial by jury

Trial by jury becomes difficult in a pandemic, although arrangements can be made to conduct it by remote link. This is often used by courts for the trial of defendants who cannot be moved from their prisons or witnesses who cannot be present in court. Hence, it is not without precedent. As court proceedings are essentially social activities, they will be strongly affected by social distancing measures. The effect of deferring criminal trials needs to be assessed.

In managing a pandemic emergency, the policing function involves balancing the need for public protection against the need to uphold people's fundamental rights.

6.2 Crime

Although the advent of the so-called 'therapeutic community' may create a social environment that is somewhat inimical to ordinary patterns of crime, the severe disruption of society and its activities presents a number of opportunities for criminal activity, of which the greatest are for organised crime syndicates.

Pandemic conditions have been associated with increases in cyber-attacks and the circulation of child pornography. Criminals may assume, one hopes wrongly, that the authorities' attention is diverted to other matters. However, cyber security personnel may be in short supply during the crisis, and cyber criminals may know this.

As detailed elsewhere in this report, a pandemic may cause serious economic hardship as a result of changes in patterns of consumption and closure of enterprises during lockdown or as a result of reduced demand. This may lead to a surge in usury.

Criminal activity may concentrate on scarce and prized commodities. Consequently, there is a risk that bulk consignments of personal protective equipment and hand-sanitizer may be pilfered or subject to speculative sale or resale.

6.2.1 Opportunities for organised crime

A mafia is a form of 'anti-state'. In order to recruit members, mafia groups may offer benefits to people in need that the state is unwilling or unable to provide. These include handouts, subsidies, loans and employment opportunities.

Modern mafias are investment syndicates that derive their capital from a mixture of extortion, control of illicit activities and legitimate investment of laundered money. Through not paying taxes they have great liquidity and can finance legitimate activities more easily and of better terms than can legitimate sources of capital. This is particularly true of the construction industry and building trade. Although pandemics do not involve the kind of destruction and reconstruction provoked by, for instance, earthquakes or hurricanes, the construction industry may be one of the first to restart after lockdown. Measures need to be planned to monitor and counteract mafia

involvement. Likewise, the vast efforts at procurement of medical supplies and goods need to be free of mafia involvement.

6.2.2 Fraud

A major pandemic situation provides numerous opportunities to practise fraud. Online shopping, courier services, online dating, Internet auctions, insider trading, copycat fund-raising pages, mule bank accounts and insecure video conferencing are all potentially involved. Most of these kinds of fraud are associated with security breaches and scams related to home working and ordering goods and services on the Internet. The popularity of these practices during a pandemic crisis offers increased opportunities to fraudsters. Phishing emails may be adapted so that they relate to the virus situation.

Goods that are in high demand, such as facemasks, gowns and medical equipment may be subject to false orders, pilfering or illicit sales.

6.3 Litigation and legislation

Most decision making that causes disruption to normal activities risks a backlash in the form of lawsuits. Decisions that may have increased the rate of infection and mortality are even more likely to be the subject of post hoc legal investigation and attempted prosecution. General lockdown involves loss of income on a truly vast scale: so does the cancellation of major events. If there is any scope for arguing that the measures were not entirely necessary, there may well be a legal backlash. Conversely, failure to impose measures quickly enough, with the result that a high death toll could be judged partially preventable, could also be the subject of legal action. Temporary legislation can sometimes be used to protect a government against unreasonable litigation, but parliaments and assemblies need to scrutinise it before approval in order to ensure that it maintains the principle of accountability.

A country's basic law on civil protection needs to be comprehensive, well-formulated and robust enough to deal with the impact of a pandemic. At the planning stage, it should be reviewed in this light. Specifically, emergency powers need to be reviewed in terms of their compatibility with human rights legislation. what level of curtailment of civil liberties is acceptable? Is lockdown denying children their education? Emergency powers should not become the new norm.

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7. Education and culture

7.1 Education - general

Education is the motor of a modern economy and it is likely to be profoundly affected by a pandemic. Whether and when to close schools is a decision that must depend on the pattern of infection of the pandemic and considerations about the effect of childcare on the employment of parents. If children are not among the groups that are most

vulnerable to the virus, they may nevertheless be carriers who can transmit the infection. School staffs may also be at risk from any decision not to include schools in social distancing measures. On the other hand, inability to provide childcare may mean that parents are constrained to stay at home rather than go to work. Some may lose their jobs as a result.

7.1.1 Move to on-line teaching and examinations, and the standards question

Social distancing means that a radical reorientation of educational methods may be needed. On-line and televised teaching is possible, but care has to be taken not to impose the 'digital divide' and disadvantage children who do not have home access to a computer and broadband. In transferring examinations to an on-line format there is a significant risk that qualifications will be cheapened. Pupils may be judged, for instance, on aggregate past performance rather than how they would fare in a future examination. When on-line examinations are held, cheating may be difficult to control. Examinations held under virus lockdown conditions may be difficult to equate with those of previous years for the purpose of, for example, access to higher education or competitive entry to employment.

It is generally found that the impact of a pandemic on children's education is greatest among pupils who are already educationally disadvantaged. In terms of fairness and welfare, this aspect needs to be investigated and as far as possible corrected. If pupils have to share computers or tablets with parents who are working from home, they may be disadvantaged by such arrangements and may require support if they can be given computing hardware by their schools. Parents who are endeavouring to work from home may find that they are spending too much of their working time supervising their children's education.

7.1.2 When and whether to shut down or reopen schools

The decision to keep schools open or shut them down is related to considerations about the spread of the disease, continuity of education, and continuity of employment for parents and school staffs. It is accepted that social distancing will be difficult to maintain in schools, but home education involves difficult challenges. A national curriculum can partially be delivered by television, but once again if computers and broadband Internet are used, there is a 'digital divide' risk for deprived families. Providing on-line examinations that qualify pupils to leave school and progress to work or higher levels of education involves particular challenges of delivery, standards and fairness.

7.2 Universities

All universities are likely to suffer profound effects as a result of a pandemic. Smaller universities and colleges (especially those with enrolments of under 5,000 students) seem to be more likely to lay off or dispense with staff than larger ones do.

7.2.1 Loss of revenue from overseas students and fall in enrolments

A global lock-down and drastic reductions in air transportation will reduce enrolment of overseas students, and possibly also domestic ones. Foreign students are a major source of revenue for many universities. As a matter of continuity, they can be accepted into 'virtual' education with on-line courses, but there are issues over how much they can be charged for such services in relation to fees for on-site courses. Moreover, foreign students who are already engaged in their studies may require pastoral care if they remain stranded in the country in which they are studying. Failure to look after their interests may cause hardship for the students as well as public relations problems for universities.

Increasingly, universities make use of staff without permanent contracts. Many of these are at risk of losing their employment during the pandemic crisis as their institutions seek to reduce their expenditure in order to remain solvent. There is the beginning of a consensus in the university world that a human-centred employment policy will benefit universities in the long run more than one based purely on economics. Human (i.e. intellectual) capital will remain the principal resource of universities.

7.2.2 Prioritising research related to the pandemic

Universities and research institutes with expertise in the medical, epidemiological, microbiological or virological fields will tend to prioritise them during the crisis. Many laboratories and research facilities will temporarily close, but not those that conduct research that is directly relevant to the emergency, for example on the development of medical equipment, vaccines, or palliative medicines. An important challenge relates to the need to join up initiatives and coordinate them into national and international strategies.

7.2.3 Research boom and how to make sense of and use it

A national pandemic observatory should also maintain an overview of research initiatives in the country in question and how they develop during the crisis. This is quite a challenge because there is likely to be an enormous surge in research efforts connected to the pandemic with respect to all the categories listed in this report. One might talk about 'research overproduction', as many initiatives will be duplicated and many will be ignored by a potential readership that is overstretched. Research briefings and digests will also abound and to an extent, with careful collation, these can sort out the messages derived from research that are directly useful to the management of the crisis.

When pandemics are caused by emerging diseases involving a mutation of previous viruses, there will be a large measure of scientific uncertainty. This will include the lethality, transmissibility, rate of infection, symptoms, clinical behaviour and susceptibility to treatment of the disease. Decision makers will have to accept that decisions must be made on the basis of, at best, *constrained uncertainty*. Distilling the

results of research in order to enable them to guide policy involves gauging the level of uncertainty and presenting it in an honest and transparent manner.

7.3 Cultural institutions

Especially in the arts, faith-based and intellectual fields, cultural institutions embody the collective memory of nations and groups of people, as well as their history, spirit and morale. Their roles as tourist attractions and 'cultural ambassadors' are also vitally important. The 'cultural economy' exists at all scales from local to global and it is likely to suffer profound impacts during the pandemic crisis.

7.3.1 Financial survival of cultural and intellectual institutions

Art galleries, museums, archaeological sites, theatres, cinemas, parks and other attractions will have to close during lockdown in order to ensure social distancing. This will severely affect their revenue and will involve furloughs and lay-offs of staff. This may threaten the survival of institutions as financially solvent concerns. It is not clear to what extent the post-crisis rebound will restore their fortunes, but a long period of closure will clearly be highly damaging to their finances.

7.3.2 Mitigating the impact of suspension of cultural activities

Continuity of cultural activities during a pandemic crisis can have an important impact upon the morale of the general public. Many institutions will endeavour to maintain contact with their usual patrons by means of on-line offerings. For example, 'virtual tours' of museums and galleries will be popular. While such initiatives will allow some staff to work from home, they are not usually revenue-generating activities. It may be important to maintain some sort of continuity for recurrent seasonal festivals and commemorations. Ceremonies can be broadcast from empty rooms, wreaths can be laid at deserted monuments, and people can be encouraged to celebrate or commemorate in physical isolation.

7.3.3 Faith-based institutions

Normal rites of religious observance will have to be curtailed during lock-down. Some of them can be broadcast by television, digital file or live-streaming from empty churches, temples or mosques. Pastoral care will remain important and indeed be in greater demand than usual, given the many challenges that people will be facing during the crisis. However, it will have to be provided according to appropriate social distancing rules. Charity functions such as feeding the hungry and caring for disadvantaged people will also be thrown into high relief but must also observe social distancing. In some cases, religious buildings such as churches, temples or mosques, may be turned into temporary mortuaries. Regardless of their uses, they should be sanitised before reoccupation.

Faith-based institutions represent important constituencies among the general public. Time and time again they have proved to play important roles in disasters, in bringing

relief, mobilising people and providing a listening post for people's troubles and grievances. Their leaders should be integrated into the emergency management process for pandemics.

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8. Recovery

This report shows that, despite its evident complexity, the scenario for a major pandemic is well developed. However, the scenario for the recovery process is much less clear. The influenza pandemic of 1918-1920 took about five years to recover from, although it should be borne in mind that the world was also recovering from the many depredations of the First World War.

As a pandemic may come in waves, policy-makers, planners and managers must bear in mind the likelihood that measures will have to be reimposed. Therefore, physical and organisational structures created to deal with the emergency should not be dismantled until it is reasonably certain that there will not be a resurgence of the disease. Regulations should be conditionally pending, so that they remain valid if measures have to be reimposed. Public information should be honest and forthright about the possibilities--or probability--of a new wave of the disease.

Generally, recovery from lockdown and the economic stringency that it involves will have to take place cautiously in stages. Essential shops, businesses and distribution networks will remain open and functional throughout the emergency. Categories of business can be allowed to reopen with codified and certified physical distancing measures in place. For example, bookshops and clothing stores may be early reopeners. School reopenings can be staged for pupils of different ages, with evaluation of their impacts. The epidemiological observatory should carefully monitor the effects of successive reopenings.

How to end lockdown is one of the most difficult problems associated with managing a viral pandemic. Adapting the British Government's "five tests for ending lockdown" during Covid-19, first, the health system must be able to cope with the influx of patients. Secondly, there must be a sustained and consistent fall in the death rate. Thirdly, the rate of infection must decrease to manageable levels. Fourthly, the supply of personal protective equipment and virus tests must be judged adequate to meet current and future demand. Finally, changes in the regulations should not lead to a resurgence of the disease. Clearly, several of these criteria will be difficult to establish with any degree of certainty.

In the healthcare sector, the aftermath of a viral pandemic will be prolonged as hospitals and clinics deal with a substantial backlog of patients whose treatments have been deferred.

Shortage of financial reserves and liquidity will affect the ability of businesses to survive the pandemic. As patterns of consumer demand will change radically during the crisis, a minority of businesses will increase their profits and a majority will suffer. The

recovery from a major global pandemic is likely to be a slow and intermittent process that takes several years, perhaps five or more. Local or larger resurgences of the disease may lead to the reimposition of lockdown. Continued risks of infection may mean that many businesses cannot operate at full capacity, and in any case, demand for their products or services may be depressed for a long time. Moreover, businesses may need to adapt to permanent changes. These may involve factors such as the 'greening' of the economy, or they may accelerate pre-existing trends to different patterns of preference and consumption. Unfortunately, adaptation usually requires monetary resources. Hence, access to credit and financial support will be important to the stability of the business world. This should include measures that enable businesses to conserve skilled workforces during periods of unavoidable furlough.

International and interregional transfers of people cannot be prevented for a long period of time. Hence, particular care will have to be taken at airports and ports to monitor the health of arriving passengers and crews, as well as workers in such installations. In the early stages of recovery, testing, tracing and quarantine will need to have a focus on airports and ports to ensure that the disease is not spread from them again.

'Immunity passports' are digital or printed records given to people who have been tested for the presence of the virus, or of antibodies against it, to show that they are not unwell and are unlikely to pose a risk of passing on the disease. The principal uses of these documents would be for boarding public transport, where people must sit close together, going into other potentially crowded environments, and visiting places that are particularly at risk, such as care homes. As most pandemic viruses are new mutations, during the crisis there may be considerable uncertainty about their vital characteristics. This brings the concept of an 'immunity passport' into question. How accurate are the tests for immunity? If it is acquired, how long does immunity last? How long before people should be retested? The concept bears some similarity to the vaccination record (also sometimes denominated 'passports') that are common currency internationally, but it does not have the same validity for infection and antibody tests as it does for tried and tested vaccines with a well-known ability to provide immunity. There is a risk that the widespread use of 'immunity passports' could lead to social divisiveness if citizens with them are granted more privileges than those without them.

In many situations, migrant workers live in cramped and unhygienic accommodation. These are the people, usually from poorer countries or backgrounds, who work as labourers in the construction and agricultural sectors. As with refugees in camps, measures need to be taken to ensure that their movement, accommodation and participation in society is not a source of the resurgence of the disease. Their right to healthcare and testing should be guaranteed.

Recession is an almost inevitable outcome of a global pandemic. Keynsian stimuli will be needed for a considerable time as unemployment rates soar and patterns of consumption and demand fluctuate. Considerable effort needs to go into rebuilding national economies, and this can be a time to modernise an economy and equip it to

cope with the challenges of the 21st century, such as transitioning to low carbon emission and coping with the many effects of climate change. The economic dislocation may cause structural unemployment (unfilled jobs in fields where there are too few qualified applicants). This may require specialised programmes to retrain the unemployed. Concurrently, entrepreneurs may need support in order to regenerate business, and it should be acknowledged that some changes to national and local economies may be permanent.

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9. Brief Conclusion

This report contends that the planning scenario for viral pandemics is complex but fully capable of being formulated, although it will contain a large measure of uncertainty. Experience with Covid-19 has enabled us to update knowledge of the effects of previous pandemics on modern society at all scales. If uncertainties cannot be limited, they can at least be understood and thus constrained in order to provide the firmest possible basis for decision making.

Where a threat or hazard is known, emergency plans should be based on scenarios of what is likely to happen. A scenario is a means of investigating a range of possible future outcomes. It enables us to foresee needs and prepare to meet them, rather than relying on inefficient forms of last-minute improvisation.

An emergency plan is only as good as its implementation. In the event of a pandemic, the uncertainty in the behaviour of the disease means that plans must be flexible to start with and then adapted to circumstances as these evolve. This underlines the role of planning as a process rather than an end.

Select Bibliography

During the first three months 2020, scientific and scholarly articles on the Covid-19 pandemic were published at the rate of 67 a day, with signs that the rate would increase substantially as time wore on. A representative bibliography is already impossible to construct. Hence, the following includes merely a small selection from among many useful works.

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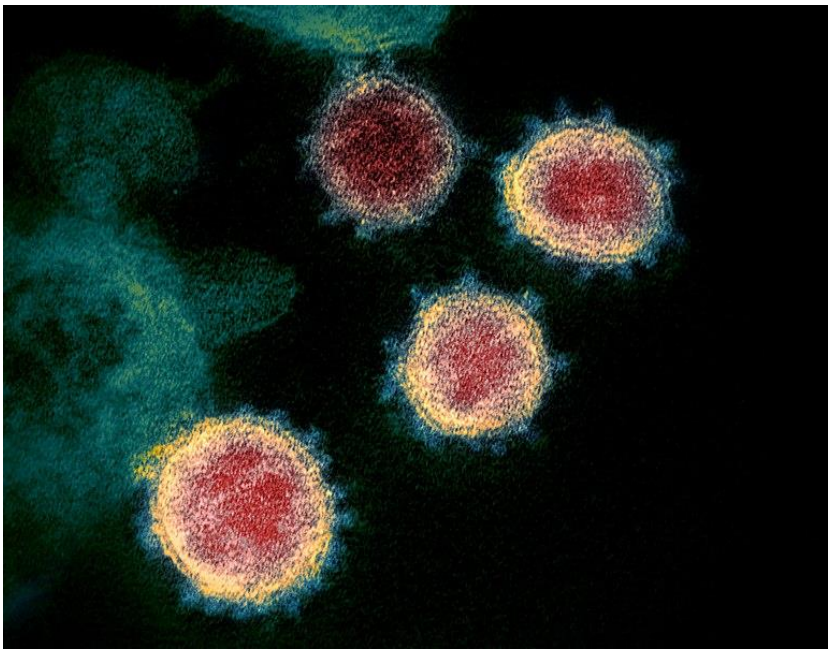

Image: The microscopic view of the virus which causes Coronavirus disease. Source: NIAID (Wikimedia Commons).

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