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Information management in the early stages of the COVID-19 pandemic

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Introduction

The first news of the outbreak in Wuhan arrived in late December 2019. On 30 December 2019, a cluster of pneumonia of unknown aetiology was reported on ProMED-mail (2019), possibly related to contact with a seafood market in Wuhan, China. There were later suggestions that the outbreak occurred earlier as a result of an escape from a Wuhan virology laboratory – if this was so the need for alertness and quick action was all the greater. On December 31, the Chinese government informed the World Health Organization (WHO). By early January 2020, the first articles appeared in the ordinary and academic presses. For example, in the medical academic press, Gralinski and Menachery (2020) confirmed that the announcement from the Chinese medical community happened in early January, that the disease was very infectious and sometimes fatal, that spread within China was established and that international spread had started, in this case to Thailand from China, confirmed on January 13, as well as to Japan, Singapore, Vietnam and six other countries. The world, including the World WHO, took note. The WHO (2020a) published its first note on January 5. At this stage, the WHO did not recommend measures for travellers, only that in the case of symptoms suggesting respiratory illness during or after travel, travellers should seek medical attention and share travel histories with healthcare providers.

Searching for relevant academic articles was facilitated by academic journal publishers' decisions to make all articles on the virus available free, and the US National Centre for Biotechnology Information (2020) search engine. This revealed 63 academic articles about the virus in January (many from China) and 439 in February 2020. The risks posed by travel were identified by several authors (Table 1). Searching for non-academic items revealed thousands of January articles (the number depending on search terms) appearing in January 2020. These identified or confirmed the risks mentioned in academic articles.

Authors	Journal	Type of risk	Detail of findings
Zhao <i>et al.</i> (2020)	Travel Medicine and Infectious Disease	Domestic train travel	Correlation of spread of cases with train travel volume
Bogoch <i>et al.</i> (2020)	Journal of Travel Medicine	Air travel	Identified countries most at risk of spread from Wuhan by air travel, based on travel volume. The 20 destinations identified were all E Asian, except UAE (Dubai) and Australia (Sydney and Melbourne)
Pullano <i>et al.</i> (2020).	Eurosurveillance	Risk of importing to Europe by air	Identifies early cases in Europe (France, Germany) and identifies countries most at risk of direct importation from Wuhan as UK, Germany, France, Italy and Spain. Identifies airports most at risk (London, Frankfurt, Paris, Milan and Madrid).
Nishiura <i>et al.</i> (2020)	Journal of Clinical Medicine	Risk of global export	Documents early international spread to Asia and USA and forecasts future risk of a pandemic, suggesting need for much better public health information on case definition and documentation
Biscayart <i>et al.</i> (2020)	Travel Medicine and Infectious Disease	Risk of export by air to Latin America and from travellers bringing infection back to Latin America	Identifies risk of inbound tourists to Latin America and risk of Latin Americans travelling to China

Table 1: Examples of academic articles in January 2020 on risks of spread of SARS-CoV-2 by travel

Source: The authors

Bogoch *et al.* (2020) built on Findlater and Bogoch (2018), who summarised the history of disease spread by air travel, identifying ten previous epidemics and recommending:

- Rapid public health responses to emerging epidemics
- Public health agencies at all levels to be aware of global outbreaks and emerging threats and to have the tools to initiate rapid and coordinated responses

- Several systems to facilitate coordinated responses, including surveillance tools and methods of communication and management in different countries

However, they concluded that travel bans are unhelpful, given their economic costs, while long incubation periods of some diseases mean that screening might not work. However, their conclusions have been disproved by econometric analysis of the current pandemic, specifically for air travel (Kristin et al, 2020).

What did we know by the end of January 2020?

By January 31, the disease’s infectiousness and transmissibility were established. It was clear that stopping international spreading required closing or severely restricting international travel to/from infected countries. Our conclusion differs from that of Findlater and Bogoch (2018) because, in our view, previous travel bans were incomplete and/or late.

Thailand, Korea and Japan identified cases from China in January and acted, restricting international travel. On January 23, the WHO Situation Report identified international spreading, human to human spreading and the travel risk (WHO, 2020b), confirming it on January 31 (WHO, 2020c), but on February 29 advising against travel or trade restrictions to countries with outbreaks (WHO, 2020d). The WHO’s objectives are to declare global health threats, organize prevention efforts and provide recommendations. It has no direct authority over countries but could have done much good with an earlier and stronger warning about domestic and international travel risks and the need to restrict or ban travel. Some believe the WHO has done a good job, but still needs improvement (Economist, 2020).

Consequences of government actions

The consequences of failure to act quickly are visible in each country’s mortality rate, although there are disputes about what counts as a death from the virus and under-reporting is common. Comparisons between countries are problematic (Pueyo, 2020). Policies are very different, from early closure of borders and locking down to a more relaxed approach. Testing policies have varied. Cultures of compliance (e.g. mask-wearing, social distancing) and geographical and economic factors also differ. Some informal policies were bad e.g. in the UK, sending infected patients back from hospitals to care homes. Pueyo (2020) shows that countries that acted early had lower infection.

In analysing what happened in each country, there are four key dates (Table 2).

Term	Date	Comment
Lockdown	When first introduced	Some lockdowns began partially e.g. specific regions or activities
Border/flight closure	When first closed	Some initial closures were for one or more regions or against certain countries e.g. land borders with/flights from China or countries with early spikes
First death	When happened	Subject to mortality interpretation and honest reporting
Take off	When deaths reached or exceeded one millionth of the population.	Subject to mortality interpretation and honest reporting

Table 2: Early date definitions

Source: The authors

To understand government actions using the above dates, we built a database by country (covering 136 countries which included 98% of the world’s population) of the dates, mortality rates at time of writing (by which time all countries had passed their peak death rate in the first wave) and variables which might determine the infection spread e.g. air travel intensity, obesity, longevity, population structure, income per head, vaccination rates, corruption perceptions and distance from Wuhan. We reached these conclusions:

1. As first death is likely to be preceded by infection by around two weeks, to be effective, border closure should precede first death by (say) over 14 days, while lockdown should precede take-off (a clear sign that the disease was spreading) by over 14 days.
2. First death occurred by 15 March for 40 countries, by March 31 for 100 countries.
3. Take-off occurred by March 31 for 35 countries, by April 30 for 94 countries.
4. Countries furthest from Wuhan had higher mortality (broadly the Americas), while those nearest - more experienced in viral outbreaks - acted quickly. Africa is different, with younger populations and more isolated (with less air travel).
5. Countries with older populations had higher mortality.
6. Countries which reached take-off earlier had higher final mortality .
7. Border closures took place late – 45 countries closed borders on or after the first death and 15 did not close, while only 34 countries closed borders more than 14 days before first death.
8. Lockdowns took place late - 47 countries locked down less than 14 days before take-off, and 25 not locking down.
9. The earlier a country closed its borders and/or locked down, relative to when the first death occurred, the more delayed the take-off was and the lower the mortality.

These are generalisations but indicate the need to absorb information and act quickly. The case studies show that this did not usually take place, with slow realisation of the outbreak’s severity and piecemeal and fragmented action.

General country analysis

The country analysis covers countries where this article's authors have special knowledge and does not focus on countries with very low death rates, such as Cambodia, Laos and Vietnam, nor does it cover economic measures. Further analyses of these will be published later.

Countries with SARS experience did better. East Asian countries' experience of SARS in 2002-03 prepared them. New Zealand, Singapore, South Korea and other nearby countries formed a partnership between Prime Ministers early, to share epidemiology and factors which affected transmission rate. They controlled international travel better and had lower mortality and milder economic downturns than others. The Middle East experienced an early surge, associated with pilgrimage, and Gulf nations, which included some important travel hubs, were vulnerable. Europe became the centre of spreading, partly associated with winter holidays in Italy and Austria. Spread rates were determined by quality of reporting and contact tracing, earliness of lockdown and the population's observance of lockdown, with two catastrophic behaviours ensuring rapid spread – lack of shielding of elders and people returning home from epicentres. Surface travel was a major spreader in some countries e.g. Italy. Spread to/within the Americas followed quickly, with high mortality caused by similar reasons to Europe, but with social/economic factors e.g. crowded housing and poverty, important, as well as resistance to lockdown. However, most of Africa experienced low infection and spread rates, partly due to relatively low travel rates.

East/South Asia

With China being the origin, high awareness of the situation in the region is shown in the early reactions. Japan, an island state with a strong hygiene and low contact culture, took a different route.

China (Table 3)

Highly restrictive actions were taken in January and these controlled the spread. Severe local travel restrictions and cancellation of Chinese New Year celebrations, with the enormous mass travel involved, was a clear sign to the world, suggesting that world authorities should have monitored not just medical/health evidence but social and political evidence.

Date	Action/event
17 Nov	First possible case in Hubei province (unconfirmed)
1-10 Dec	First confirmed cases (2)
27 Dec	Hospital notified health authorities of cluster of cases of virus
31 Dec	Media notified Health authority admits 27 cases so far confirmed Passenger trains to/from Wuhan suspended
1 Jan	Seafood market where virus thought to originate closed
2 Jan	Chinese New Year celebrations cancelled nationally
20 Jan	National Health Commission confirmed human to human transmission
21 Jan	Education Ministry asks all education organisations to act Schools and universities announced closures
23 Jan	Class 1 (highest level) Response to Public Health Emergency announced Closure of tourist sites Wuhan declares lockdown
24-25 Jan	Local governments quarantine passengers from Wuhan and surrounding areas
26 Jan	Provinces extend holidays, leading to school start postponement
29 Jan	Virus spread to all provinces of mainland China. All Hubei cities quarantined
3 Feb	First evacuation flight from Wuhan to Taiwan (about 500 Taiwanese were trapped in Wuhan), but first flight found to have an infected case
4 Feb	Local governments announced closure to visitors

Table 3: Early China situation

Source: The authors

India (Table 4)

After a slow start, India was affected by a late wave, but has a relatively low mortality.

Date	Action/event
30 Jan	First case reported from China, followed by 3 more cases – all students returning from Wuhan
13-15 Mar	International sport event closure
16 Mar	Lockdown all schools and colleges
16-22 Mar	Successive bans on international flights
17 Mar	Train cancellations
19 Mar	All restaurants in New Delhi to be closed by 31 March, though food delivery to continue Ban on meetings of more than 20
20 Mar	Malls/shops in some regions closed Public examinations ended in some states
22 Mar	14 hr voluntary curfew

	Punjab lockdown Rajasthan stops public road transport Rail passenger services suspended
24 Mar	Nationwide lockdown
25 Mar	Domestic flight ban (announced 23 Mar)
27 Mar	20 villages in Punjab quarantined to limit superspread started by a Sikh preacher who had visited Italy and Germany
31 Mar	Religious event in Delhi confirmed as superspread
14 Apr	Lockdown extended until 3 May

Table 4: Early India situation

Source: The authors

Japan (Table 5)

Japan's mortality is one of the world's lowest, despite its aged population, perhaps due to strong early government response, cultural habits of wearing face masks, washing hands using sanitizing solutions and avoiding physical contact (bowing).

Date	Action/event
15 Jan	Government confirmed first outbreak in country, a citizen who had returned from Wuhan
27 Jan	Virus designated by government as "infectious disease", allowing infected patients to be compulsorily hospitalized
30 Jan	National task force announced, run from Prime Minister's office
31 Jan	Return of Japanese citizens from Wuhan prioritized (took place 29 Jan to 17 Feb)
1 Feb	Travel restriction on foreigners who had visited Hubei (extended to Zhejiang on 12 Feb)
5-14 Feb	Testing capabilities strengthened
27 Feb	All schools closed until early April
13 Mar	Amendment to Special Measures Act, allowing area governors to enforce lockdowns
11 Mar	Confirmation of virus from citizens returning from Europe and US, but virus slightly different from Wuhan virus
1 Apr	Government concludes that despite rapid increases in cases in major urban areas, Japan not on course for size of outbreak in Western countries
7 Apr	One-month state of emergency for Tokyo and other major cities, extended to all country 16 April
10 Apr	Social, recreation and education facilities closed, or opening hours limited

Table 5: Early Japan situation

Source: The authors

Australasia

Australasia was identified early on as being vulnerable to infection due to travel patterns and migrant communities and acted early. New Zealand, a sparsely populated small island state, saw the opportunity for avoiding the virus. Australia, like many countries with low initial infections, is suffering a second wave with higher mortality.

Australia (Table 6)

Australia's initial response was among the most successful. From a daily peak of over 400 new cases, the rate fell to fewer than 20. National and some state governments enforced strict lockdown measures. Cruise passengers were a special threat.

Date	Action/event
25 Jan	First confirmed case identified in Victoria, a man returning from Wuhan
31 Jan	Foreign nationals returning from China required to have spent 2 weeks in third country before being allowed in
24 Feb	24 Australians infected on Diamond Princess cruise ship - 8 sent to Darwin for 2 weeks quarantine
27 Feb	Prime Minister activated Health Sector Emergency Response Plan for virus
29 Feb	After Queensland case of infected person returning from Iran, government extended enforced quarantine to people returning from Iran, requiring 2 weeks in third country before being allowed in
16 Mar	Victorian Premier Daniel Andrews declared state of emergency until 13 April
18 Mar	Human biosecurity emergency declared by Governor-General
20 Mar	Australian borders closed to non-residents
21 Mar	Social distancing imposed State governments started to close 'non-essential' services
25 Mar	284 passengers (440 by 30 March) from Ruby Princess liner tested positive by 31 March 5 died National COVID-19 Coordination Commission (NCCC) established by Prime Minister, for strategic advice
01 Apr	Western Australian Government introduced intrastate travel restriction
15 Apr	A Western Australian became the first to be jailed for breaking self-isolation

Table 6: Early Australia situation

Source: The authors

New Zealand (Table 7)

New Zealand's success in controlling coronavirus disease 2019 (COVID-19) was due to its strategy of speedy testing, contact tracing and isolation, while rigorously adhering to public health guidance.

Date	Action/event
28 Jan	Ministry of Health set up National Health Coordination Centre.
30 Jan	Infectious and Notifiable Diseases order into effect, requiring health practitioners to report any suspected cases
3 Feb	Entry from China banned for foreign travellers, but New Zealand citizens, permanent residents and family entry allowed
16 Mar	Self-isolation for all arrivals from abroad, except arrivals from Pacific islands Large gatherings banned
23 Mar	Schools closed

Table 7: Early New Zealand situation

Source: The authors

Europe

Europe became the first remote epicenter of the disease, starting with Italy, the main source for infections for other European countries, where severe vulnerability was associated with older adults. The UK resisted travel restrictions for some time, and Sweden resisted lockdown. Both paid a price in higher mortality.

Austria (Table 8)

Austria's public information dissemination was late, although the government was aware of increased infection all around and used information from neighbouring states, especially Germany. The Corona Commission, with representatives of Austrian states, experts and federal representatives, made technical recommendations to regional policymakers, covering reduced public transport, international and regional travel bans, public events or social distancing and face mask usage.

Date	Action/Event
27 Jan	First limited testing policies for citizen with symptoms and/or essential worker
24 Feb	Announcement of telephone information hotline and launch of information campaigns Testing policy changes: doctors decide on testing and if a case is suspicious
25 Feb	First 2 cases confirmed – returnees from Lombardy
1 Mar	Ischgl Ski resort identified by Germany and Nordic countries as hotspot
2 Mar	European Congress of Radiology cancelled planned Austrian conference – poorly communicated by government Travel ban for few countries
10 Mar	Large outdoor events cancelled Children ordered to stay at home (by 15-17 March) Arrivals from Italy restricted Population asked to restrict social contact
13 Mar	Ischgl in quarantine
15 Mar	Ban on public gatherings of more than 5 people Lockdown of Tyrol (ski region)
16 Mar	Only essential visits outside homes Non-essential stores and education institutions closed Reduced public transport, for key workers only Public gatherings and events terminated
3 Apr	Further travel restrictions on international and regional movement
6 Apr	Face masks compulsory in stores
14 Apr	Face masks compulsory on public transport, with distancing
19 Mar	Further public information campaign

Table 8: Early Austria situation

Source: The authors

France (Table 9)

France was a European epicenter.

Date	Action/event
2 Dec	On 2 December, a man was admitted to a hospital in Colmar. On 7 May, the medical imagery department claimed he had been positive for COVID-19. His December thoracic scan was one of several identified as typical of COVID-19 - the earliest on 16 November
27 Dec	A man was admitted to Avicenne Hospital and tested for influenza, which came back as negative. On 3 May, the hospital said that a retest of his December sample had come back positive for COVID-19
23 Jan	Air France suspended flights from and to Wuhan and cut flight frequency to/from Beijing and Shanghai
24 Jan	First COVID-19 case in Europe confirmed, a French citizen who arrived in France from China on 22 Jan
24 Jan	France's Minister says that risks of propagation are extremely low – she resigned on 16 February
5 Mar	Ban on gatherings of more than 5000 people in enclosed spaces
10 Mar	Ban on all gatherings of more than 1000 people
11 Mar	The government named 11 prominent scientists to a committee to advise on scientific matters pertaining to the epidemic in France.

14 Mar	Ban on all gatherings of more than 100 people
17 Mar	Lockdown begins

Table 9: Early France situation

Source: The authors

Germany (Table 10)

Germany recorded its first case early, after a woman from Wuhan travelled to a car parts manufacturer in Bavaria. A few days earlier, a health ministry spokesman classified the virus as a very low health risk, less dangerous than SARS. However, early tracing allowed identification of the spread, but Germany was one of the last countries to close some borders. Germany's strong health care system ensured a strong focus on data collection and analysis. Social distancing measures and rules were driven mainly by Robert Koch Institute (RKI) analysis and epidemiological results, regularly communicated to citizens. Each state had flexibility in working with these policies, in line with their infection rate and disease severity (Wieler *et al.*, 2020).

Date	Action/Event
22 Jan	Government announced that risk is low, and no travel advisories needed
27 Jan	First case in auto parts manufacturer, associated with Wuhan contact Government announced it will record cases, but wider spread of virus is low risk, according to the RKI
24 Jan	Public Information Campaign started, warning citizens to be vigilant, but not panic Corona Crisis Team established by government
29 Jan	Masks sold out Pilots of flights from China to monitor health of passengers, who must complete contact document
01 Feb	Public Health Department asked all healthcare officials to report suspected cases within 24 hours
12 Feb	Further public information campaigns initiated
13 Feb	Health Minister argued against single EU states restricting China travel and measuring temperature of inbound passengers
24 Feb	Health Minister confirmed epidemic had arrived, with possibility of Italian-type situation
25 Feb	Outbreak associated with Italian outbreak
26 Feb	Some states announced partial school closings – not all educational levels Government decided not to restrict travel to/from Italy
27 Feb	Stricter procedures for air travellers from infected areas
28 Feb	Suspected case on Lufthansa plane, all flights to China suspended Further international flight restrictions
13 Mar	Most federal states closed schools
14 Mar	More workplaces closed,
16 Mar	Bavaria declared state of emergency, starts lockdown
17 Mar	RKI raises threat level to High
18 Mar	Travel with rest of EU restricted, but flights from Iran still allowed
20 Mar	Bavarian curfew
22 Mar	Gathering of more than 2 people forbidden, social distancing required
31 Mar	First German city required masks wearing in public places
1 April	Flights from Iran ended

Table 10: Early German situation

Source: The authors

Greece (Table 11)

Greece was vulnerable due to the poor state of its health system and economy and dependence on tourism, so acted quickly. The Greek Orthodox Easter posed problems due to volume of travel and social/family behaviour. It remains vulnerable due to tourism.

Date	Action/event
26 Feb	First confirmed case in Greece, a woman who had visited Northern Italy Other early cases included travellers from Italy and a group of pilgrims to Israel
27 Feb	Carnival festivities cancelled School trips abroad cancelled
28 Feb	Schools closed when contact suspected
9 Mar	All school trips banned, all sporting event to have no spectators Suspension of all flights to/from northern Italy Orthodox Church announced that communion cannot spread virus
10 Mar	Schools and universities closed
12 Mar	Olympic flame lit in Ancient Olympia with a handful of VIP guests
12-13 Mar	Cafes, bars, restaurants, shopping centres, museums, playgrounds and sports facilities shut
14 Mar	Suspension of all flights to/from Italy
16 Mar	Daily televised briefings from health ministry began Two villages quarantined Borders closed with Albania and North Macedonia

	All religious worship suspended
18 Mar	Restrictions applied to migrant camps Borders closed to all non-EU nationals (along with all EU states), except for emergencies
19 Mar	Turkey closes land border with Greece Hotels closed
22 Mar	Restrictions on movement imposed Certification required to authorise movement
23 Mar	Passenger flights to UK suspended All transport connections with Turkey closed
28 Mar	Flights to Germany and Netherlands suspended
31 Mar	Curfews imposed on certain municipalities
15 Apr	Passenger flights to some other EU countries suspended

Table 11: Early Greece Situation

Source: The authors

Italy (Table 12)

Italy was the first large European country to suffer a severe epidemic and became an epicentre for Europe.

Date	Action/event
30 Jan	Prime Minister announced closure of direct air traffic from China, but no measures on indirect arrivals
31 Jan	6000 people blocked off Civitavecchia port on a cruise ship with 2 suspected cases. National Institute for Infectious Diseases director stated that risk of person to person transmission is very low
1 Feb	State of emergency
21 Feb	First Italian case discovered in Lombardy, northern Italy Schools, offices and shops are closed.
22 Feb	Government decree, effective next day, closed two "red zones" in Lombardy, with checkpoints Lombardy universities closed 50,000 people in Lombardy isolated - people are asked to stay at home
23 Feb	Schools closed in 6 regions of northern Italy Head of Civil Protection stated that there is no data suggesting that Italian epidemic is a pandemic
Feb 27	Idea that unjustified alarmism had arisen takes hold - public figures argue for relaxation of restrictions Mayor of Milan relaxes restrictions
5 Mar	Closure of schools throughout Italy
8 Mar	Lombardy and 14 other northern provinces declared "red zone", banning on entry/exit and local movement New decree valid from 9 March until 3 April, with citizens informed first by online newspapers rather than official sources, triggered flight of people from Lombardy, before decree became operational, spreading virus to all Italy
9 Mar	Decree of 8 March extended to all Italy, banning travel, prohibiting gathering in public places or places open to public, closing cultural venues, sports games to be held without spectators, bars closed early
11 Mar	Decree with further restrictions
21 Mar	Closure of all non-essential factories
22 Mar	Unions claim more closures needed

Table 12: Early Italy situation

Source: The authors

Russia (Table 13)

The Russian situation was described in a Lancet (2020) article. The public health system in Russia has long experience in the control of infectious diseases such as plague.

Date	Action/event
21 Jan	Tourism providers and tourists asked to take extra precautions when traveling to China and not to travel to Wuhan Tourists to seek medical help if presenting symptoms Tourists to take into consideration virus prior to planning a trip
24 Jan	Advice against tourism to China and requirement to cancel future planned trips
30 Jan	2615-mile China-Russia border shut
28 Jan	5604 Russian tourists in china Only return flights from China taking place Tourists may take advantage of free early return prior to Feb 4
27 Feb	Tourists in affected regions to take all safety precautions and not to leave hotels Tourism providers halt sales of travel packages, allowing full refunds and cancellations
25 Mar	Constitutional referendum postponed
30 Mar	Lockdown begins, with no journeys to work
11 April	Digital pass system introduced in Moscow

Table 13: Early Russia situation

Source: The authors

Spain (Table 14)

Spain was a European epicentre. Its devolved government system meant that initial decisions were made by the governments of Autonomous Communities. As the pandemic spread in March, the national government declared a state of emergency and instituted one of Europe's strictest lockdowns - citizens could only leave home for essential business, shopping and medical reasons.

Date	Action/event
31 Jan	First confirmed coronavirus case in Spain, detected in a German tourist in the Canary Islands, who was in contact with people who had travelled to China
12 Feb	Largest technological conference in the world due to take place in Barcelona, Mobile World Congress, cancelled because major tech companies withdraw Health authorities declared that there was no risk
19 Feb	2,500 Valencia fans travelled to Milan, in Italy's Lombardy region, to watch football match
25 Feb	Cases linked to Lombardy reported Around 700 guests at a Tenerife hotel isolated after Italian tourist tests positive Madrid reported first case
26 Feb	Spain advises citizens not to travel to China, Japan, South Korea, Iran, Singapore and northern Italy. Risk level raised from low to moderate First community infection in Seville
7 Mar	Far-right Vox party annual rally in Madrid, women's rights rallies and many sports events held throughout country
9 Mar	Autonomous governments announced measures to control the pandemic President of Community of Madrid declared closure of educational establishments for 2 weeks.
10 Mar	National government announced suspension of flights between Italy and Spain and of all events involving over 1,000 people in Madrid, La Rioja and Vitoria.
14 Mar	15-day state of emergency declared, banning movement except to buy food, medicine and to work Bars, restaurants and shops selling non-essential items shut
28 Mar	Lockdown tightened - all non-essential workers to stay at home.

Table 14: Early Spain situation

Source: The authors

Sweden (Table 15)

Sweden did not impose lockdown but kept much of its society open. Sweden's constitution protects freedom of movement, preventing peacetime lockdown. The constitution prohibits ministerial rule, so politicians overruling advice from their agencies is rare. It mandates that government bodies (here the Public Health Agency - PHA), must initiate actions in accordance with Swedish law, making the state epidemiologist a central figure. Having an expert agency almost completely in control without political involvement made Sweden very different.

Date	Action/event
Jan 30	The virus may have reached Sweden in December 2019, when several people were in contact with someone who had travelled to Wuhan and later tested positive for antibodies, but there is no evidence of further spread from these. The first case was confirmed in a woman who came to Sweden from Wuhan on 24 January
Feb 26	Second confirmed case is a man who returned from northern Italy
Feb 27	PHA states that further cases are all related to travel to high-risk zones, particularly Italy, especially during the one-week spring break in late February, but also from other countries, such as the UK, US, Netherlands and France
10 Mar	PHA raises risk assessment of community spread from moderate to very high, the highest level
11 Mar	The government passed a new law at the request of the PHA, limiting freedom of assembly by forbidding gatherings over 500 people and limiting long-distance travel within the country, as bigger events attract visitors from all over the country
13 Mar	Epidemic is in all regions, so focus moves to delaying spread and protecting elderly, by encouraging right behaviour by individuals, but definitely not trying to achieve herd immunity
18 Mar	PHA recommends avoiding travel, including Easter holiday travel, and the population in general observed this, as shown by travel bookings and mobile phone use
27 Mar	Ban on public gatherings lowered applied to gatherings of over 50 people, including some but not all leisure, shopping and public activities

Table 15: Early Sweden situation

Source: The authors

United Kingdom (Table 16)

The UK was late to act but was clearly aware. The public communication of the UK government has been severely criticised (Ashton, 2020)

Date	Action/event
29 Jan	First reported cases
21 Jan	First meetings of Scientific Advisory (SAGE) and of Civil Contingencies Committee, known as COBRA, chaired by Minister of Health. Scientific advisors upgraded risk of the virus from 'very low' to 'low'

28 Jan	Foreign Office advised against all but essential travel to China
31 Jan	First two cases confirmed
28 Feb	UK Minister for Health launched public information campaign giving advice on how to react to suspected cases and guard against infection
3 Mar	Prime Minister held first coronavirus press conference
23 Mar	Lockdown announced

Table 16: Early UK situation

Source: The authors

Gulf states

The Middle East was vulnerable given high volumes of pilgrimage, the air transport hubs in the Gulf, and war/upheaval in several states, preventing government action. In Gulf Cooperation Countries (GCC), decisions and actions were shared among the GCC countries

Bahrain (Table 17)

A national team was formed in February with senior executives from government entities covering medical, tourism, civil aviation and transportation sectors, to examine precautionary measures and recommend government decisions. It relied on analysis and WHO directions. Decisions were partly centralised, partly decentralised (Topirceanu *et al.*, 2020).

Date	Action/event
12 Feb	Ministry of Interior barred entry of foreign nationals who visited China. Citizens of Bahrain and GCC region are subjected to medical screening
25 Feb	Ministry of Transportation and Telecommunication suspended flights for 48 hrs from Dubai and Sharjah Ministry of Foreign Affairs temporarily barred Bahraini Citizens from travelling to Iran
26 Feb	Civil Aviation Affairs department reduced regional flights and extended temporary suspension of incoming flights from Dubai and Sharjah
27 Feb	Government Executive Committee suspended all schools for 2 weeks Ministry of Justice and Islamic Affairs suspended all pilgrimage travel (Hajj and Umrah) in line with directions of Saudi Arabia Civil Aviation department suspended all flights to and from Iraq and Lebanon
28 Feb	Ministry of Interior banned all large public gatherings including wedding, graduation ceremonies etc.
5 Mar	Government Executive committee announced that school employees allowed to return to work from 8 March but extended suspension of studies for 2 more weeks until 29 March
10 Mar	Ministry of Foreign Affairs temporarily banned non-essential travel
15 Mar	Ministry of Transportation and Telecommunication cut number of flights and suspended arrival visas from 18 March (except for diplomats)
17 Mar	Government Executive Committee introduced these measures: All employers to encourage remote working Retail stores and shopping complexes to operate normal hours but with social distancing All cinemas and sport halls such as gyms and swimming pools closed Limited restaurants and cafes to take out only Testing for all incoming passengers and requiring 14 days' self-isolation Suspended study in all education establishments, with staff working remotely
19 Mar	Ministry of Health Directive for individuals to only visit health centres for medical appointments, to book appointments online or via hotline number
19 Mar	Sunni Endowment Directorate closed all its events halls from 21st March. Friday prayers suspended in all mosques, but Mosques open for daily congregational prayers.
19 Mar	Civil Service Bureau introduced teleworking for 50% of government employees, alternating every 2 weeks
21 Mar	King directed public authorities to enable employee-mothers to telework
22 Mar	Ministry of Interior banned public gatherings exceeding 5 individuals
3 Apr	Civil Aviation Affairs department allowed all nationalities to transit through Bahrain International Airport, but entrance to Bahrain restricted to Bahraini citizens and residents and travellers with prior permissions.
6 Apr	Wristbands paired with smartphones issued to allow tracking of those on home quarantine
8 Apr	Minister of Industry, Commerce and Tourism confirmed private facilities will remain closed
9 Apr	Minister of Interior required visitors to public places and stores to wear face masks
22 Apr	Social distancing applied to Ramadan, with instruction to refrain from attending festivities

Table 17: Early Bahrain situation

Source: The authors

Kuwait (Table 18)

Kuwait acted a little later than others in the GCC.

Date	Action/event
24 Feb	First cases (from Iran)

12 Mar	Government decreed public holiday for all public sector, employees to return March 29
13 Mar	Closed all Islamic activities including Mosque Friday Prayers
13 Mar	Digital tracing application launched to ensure self-isolation and provide information
19 Mar	All education providers closed until August
22 Mar	Holiday for public sector employees extended another two weeks 11 hrs curfew until further notice
6 Apr	The government extended curfew by 2 hrs until further notice
9 Apr	Ministry of Interior deported all illegal workers
20 Apr	Public sector holiday extended until 28 May

Table 18: Early Kuwait situation

Source: The authors

Oman (Table 19)

Oman was late to act but was aware.

Date	Action/event
15 Mar	All education providers closed until further notice
16 Mar	All borders closed following strict decisions: Issuing of all tourist visas suspended Citizens banned from non-essential travel All passengers arriving from ports must quarantine and use self-tracing application to ensure self-isolation All expats banned from entry
18 Mar	All public transport suspended except cargo flights
31 Mar	Termination of Omani employees banned in private sector
1 Apr	Commercial and leisure activities closed or restricted
8 April	Movement in Muscat banned – 10-22 April – checkpoints to enforce.
20 Apr	Lockdown extended until 8 May, with strict measures to control lock down situation in Muscat

Table 19: Early Oman situation

Source: The authors

Saudi Arabia (Table 20)

Saudi Arabia, with key holy Islam sites, acted relatively early.

Date	Decision/event
6 Feb	Travel ban to China
27 Feb	Entry banned for Umrah (pilgrimage) and tourism
28 Feb	Entry banned from GCC to Mecca and Medina.
2 Mar	First case, from Iran via Bahrain
7 Mar	All sport to be without spectators
8 Mar	Suspension of study until further notice Qatif Governorate sealed off, as all infections there
9 Mar	Travel to countries with confirmed outbreaks banned
12 Mar	Suspension of travel, all land borders closed Suspension of weddings and venue events
14 Mar	Suspension of all activities, sports events, private sports centres, cultural and entertainment activities Suspension of international flights to/from Saudi Arabi
15 Mar	Shutdown of shopping malls, restaurants, cafes and parks Only take away and delivery services allowed
16 Mar	Public sector workplaces closed for 16 days excluding health, military and security Female beauty salons and barbershops closed
17 Mar	Public and private sectors ordered to work from home
17 Mar	Suspension of all prayers in mosques including Friday prayer allowing only calls to prayers
18 Mar	Suspension of private sector workplaces for 15 days
20 Mar	Suspension of international and domestic flights, buses, taxis, and trains
23 Mar	Curfew from 7pm to 6am for 21 days
6 Apr	24-hour curfew in many areas

Table 20: Early Saudi Arabia situation

Source: The authors

United Arab Emirates (UAE) (Table 21)

The United Arab Emirates started early too. An interesting aspect was unblocking digital remote working aids e.g. Skype.

Date	Decision/event
23 Jan	Abu Dhabi and Dubai airports screen temperatures of arrivals from China
29 Jan	First case, Chinese woman from Wuhan on holiday

3 Feb	Suspension of all flights to/from China, except from Beijing
25 Feb	Suspension of all flights to/from Iran
3 Mar	Suspension of all education Institutions
4 Mar	Spectators banned at football matches
5 Mar	Ministry of Health asks citizens and residents to avoid travel
13 Mar	Remote working for government employees Suspension of all flights with Italy, except Rome
14 Mar	Suspension of all air flights to/from Lebanon, Turkey, Syria and Iraq Suspension of entry visas
15 Mar	Suspension of public cultural sport and entertainment activities
16 Mar	Suspension of weddings, condolence ceremonies, social gatherings and prayer in mosques, oratories and houses of worship Call on citizens abroad to return home urgently
19 Mar	Permits suspended for foreign workers
20 Mar	Suspension of entry of GCC citizens until pre-check mechanism approved.
23 Mar	Government asks public to stay home except for absolute necessity Suspends all inbound, outbound passenger flights, transit of airline passengers for two weeks Shut down all non-essential commercial establishments
24 Mar	Digital meeting apps unblocked Private sector advised to implement remote working
26 Mar	Night curfew and widespread disinfection
29 Mar	Remote working implemented in public and private sectors

Table 21: Early UAE situation

Source: The authors

Latin America

Latin America has been one of the worst affected regions in mortality. In May it was described by the WHO as the new epicentre of the pandemic. Government responses have varied greatly from Peru's implementation of strict measures to Mexico's and Brazil's more ideologically driven response. Economic inequality and lack of investment in health systems have been big drivers in the spread of the pandemic in many Latin American countries.

Argentina (Table 22)

Initially, the government was confident that measures taken to warn Argentinians travelling to affected areas would keep the country safe, but the virus arrived in March, leading to early and strict country-wide quarantine. Buenos Aires was the chief focus of infection while elsewhere control was relatively successful.

Date	Action/Event
22 Jan	Argentina warned those travelling to China to avoid those with acute respiratory illnesses and places with farm or wild animals, advising use of masks, well ventilated rooms and avoid places with many people
4 Feb	Cruise ship <i>Diamond Princess</i> quarantined in Japan - among the passengers was the first Argentinian diagnosed
3 Mar	First case - a man returning from a February trip to Italy
6 Mar	Workers and school children who return from affected zones (China, South Korea, Japan, Iran, Italy, Spain, France and Italy) requested to undertake 2 weeks' voluntary quarantine
7 Mar	A 64-year old with underlying health conditions who had returned from Paris was country's first death
20 Mar	Obligatory quarantine declared throughout the country
14 Apr	Use of masks compulsory for those using public transport and interacting with the public

Table 22: Early Argentina situation

Source: The authors

Brazil (Table 23)

By August 2020, Latin America's most populous country had over 100,000 deaths. The country's leader had described coronavirus as a bit of a cold. There were more than 100 international introductions of the virus, mainly from Europe, in late February and early March, so by then international travel restrictions would have been too late (Johns, 2020). Brazil's response was piecemeal, at State and municipality level, as the federal President resisted measures that would affect the economy.

Date	Action/Event
28 Jan	Government announced that it was investigating a suspected case in Belo Horizonte
27 Feb	First case in Latin America confirmed, a businessman returning from northern Italy
12 Mar	The president's press secretary tested positive for the coronavirus
13 Mar	Recommended that all those travelling to Brazil should self-isolate for at least seven days on arrival
17 Mar	First death Partial closure of border with Venezuela The State of Santa Catarina orders state of emergency and closure of all but essential businesses All transport and public events were suspended

18 Mar	Several states and municipalities introduced restrictions
21 Mar	After 40% rise of cases in two hours, the State of São Paulo ordered a lock down

Table 23: Early Brazil situation

Source: The authors

Chile (Table 24)

By the end of August, Chile had the tenth largest number of COVID-19 cases in the world. Chile underestimated the threat and suffered severely later.

Date	Action/Event
7 Feb	Health Ministry announced health alert
3 Mar	First recorded case - a Chilean who honeymooned in Southeast Asia
16 Mar	Ministry of Health suspended face-to-face teaching at educational establishments up to university level Several universities suspend face-to-face tuition
19 Mar	National plebiscite on Constitution, due to take place in April, postponed until April
21 Mar	First death recorded in Santiago
22 Mar	Night-time curfew declared for whole country

Table 24: Early Chile situation

Source: The authors

Mexico (Table 25)

Mexico has one of the world's worst mortalities, perhaps three times greater than official statistics (Webber, 2020). Mexicans were first told that masks were unnecessary. Mexico has not opted for widespread testing and tracing. The virus's arrival coincided with a national austerity plan, which cut an already under-resourced public health system (Sánchez Talanquer, 2020). The mortality rate in public hospitals was two to three times greater than in private ones, despite the president's insistence that the public health system performs well (Sánchez Talanquer, 2020). The President blamed unhealthy, obese Mexicans for the high death-rate rather than government errors (*La Jornada*, 2020).

Date	Action/Event
9 Jan	Travel advisory issued about travel to/from China
22 Jan	Secretariat of Health issues a statement declaring that coronavirus no danger to Mexico
30 Jan	National Committee for Health Safety assembled a <i>Preparation and Response Plan</i> in event that pandemic spread to Mexico
28 Feb	First 3 cases confirmed. All had travelled to Italy
6 Mar	First daily press conferences held by government health scientist lead
14 Mar	All sporting and civic events in schools cancelled Easter break to begin earlier, starting March 20 and finishing April 20
22 Mar	Cinemas, bars, theatres, nightclubs and museums closed Several states banned incoming flights from areas with high incidences of infection
30 Mar	National health emergency declared. All non-essential activities suspended Citizens over 60 and those with serious underlying conditions must stay at home and everyone else urged to stay at home as much as possible
31 Mar	School closures extended to end April

Table 25: Early Mexico situation

Source: The authors

Peru (Table 26)

Peru took early drastic measures to try to slow the pandemic, but its efforts were compromised by the high rate of tourism, a poor health system and social and economic factors, so later Peru had the world's worst death-rate per million people (Lawler, 2020). 71% of workers survive via the informal economy, with no income unless they work; 38% have no bank account, leading to overcrowding in banks as Peruvians gathered to collect state assistance. Around 40% of Peruvian homes have no fridge, so families shop often at markets - spreading infection (De la Quintana, 2020).

Date	Action/Event
6 Mar	First confirmed coronavirus case in Peru, detected in a Peruvian returned from Europe
14 Mar	Declaration of 15-day quarantine Ban on all travel within, in and out of the country Financial package announced to help workers on low wages
18 Mar	Curfew introduced: citizens unable to leave home between 8pm and 5am except for exceptional reasons

Table 26: Early Peruvian situation

Source: The authors

North America

North America has rivalled Latin America for catastrophe, but largely for different reasons. Canada and The US were quite similar.

Canada (Table 27)

Canada's situation was compromised by Canada's involvement in WHO advice.

Date	Action/Event
7 Jan	Chief Public Health Officer of Canada states no evidence of person to person transmission
17 Jan	Canada Border Services Agency (CBSA) states plans in progress for airport signage to raise awareness, but risk to Canadians is low, with no direct air connections to Wuhan, and no plans for screening
23 Jan	The federal Minister of Health states that 5-6 people are being monitored for signs of the virus
25 Jan	First identified presumptive case in Canada, a man who travelled between Wuhan and Guangzhou before returning to Toronto on January 22 Government warned against non-essential travel to China and particularly to Hubei Federal health officials stated that the risk in Canada was low
Jan 26	Dr Theresa Tam, member of WHO advisory group, maintained there is no evidence of person to person spreading and that risk to Canadians is low
1 Feb	Government's position remained that it would be discriminatory to exclude travellers from China
3 Feb	Health Minister denounced spread of misinformation and fear across Canada Tam endorses WHO position advising against travel restrictions
26 Feb	Health Minister recommended citizens stockpile food and medication, to be prepared
4 Mar	Prime Minister asks Cabinet Committee to manage federal response

Table 27: Summary of early Canada COVID-19 decisions

Source: The authors

USA (Table 28)

The US has greatly decentralized authority, and some citizens resist federal government control.

Date	Action/Event
31 Dec	Center for Disease Control and Prevention (CDC) became aware of cases in China and began developing reports for the Department of Health and Human Services (HHS)
3 Jan	CDC Director Robert Redfield was notified by a counterpart in China of spread in Wuhan He notified HHS Secretary, who shared the report with National Security Council (NSC)
6 Jan	CDC Director offered in a letter to Chinese officials to send team of CDC scientists to assist China, but China did not accept offer for several weeks
8 Jan	CDC issued first public alert
20 Jan	CDC said 3 US Airports are screening First US case reported in US citizen traveling from Wuhan, China, to home in Washington state
22 Jan	President received first public question from reporter regarding whether he was concerned about the coronavirus. He responded that it was totally under control, with only one case from China
29 Jan	White House Coronavirus Task Force announced, including senior officials such as acting White House Chief of Staff and others at HHS, CDC, and US State Department
31 Jan	HHS declared public health emergency and imposed mandatory 14-day quarantine for US citizens who visited Hubei Province in China in previous 2 weeks and began denying entry of non-US nationals who had travelled to China in preceding 2 weeks - the first such travel restriction by US in over 50 years
29 Feb	Authorities announced first coronavirus death in US
2 Mar	Coronavirus cases in US reach 100, including 48 from repatriated citizens from Wuhan or Diamond Princess cruise ship
13 Mar	US President declared coronavirus a national emergency
13 Mar	US administration issued travel ban on non-US citizens Americans who visited 26 European countries within 14 days of coming to US People traveling from UK and Republic of Ireland exempt
15 Mar	CDC recommended no gatherings of 50 or more people in US
19 Mar	California became first state to issue stay-at-home order, mandating residents to stay at home except to go to essential job or shop for essential needs Order instructs health care systems to prioritize services to those who are sickest

Table 28: Early USA COVID-19 situation

Source: The authors

Country summary

The above case studies demonstrate a variety of information interpretation and decision-making practices, from denial to early realistic appraisal and action. Few of them can be said to be a model of focus and clarity. The important learning from the case studies is how long it took many countries to reach decisions about border closures and lockdowns, with some countries resisting for some time. Managing this situation requires a clear typology of states of awareness and action in each country. In our analysis, most countries would have rated red, in a simple red-amber-green rating.

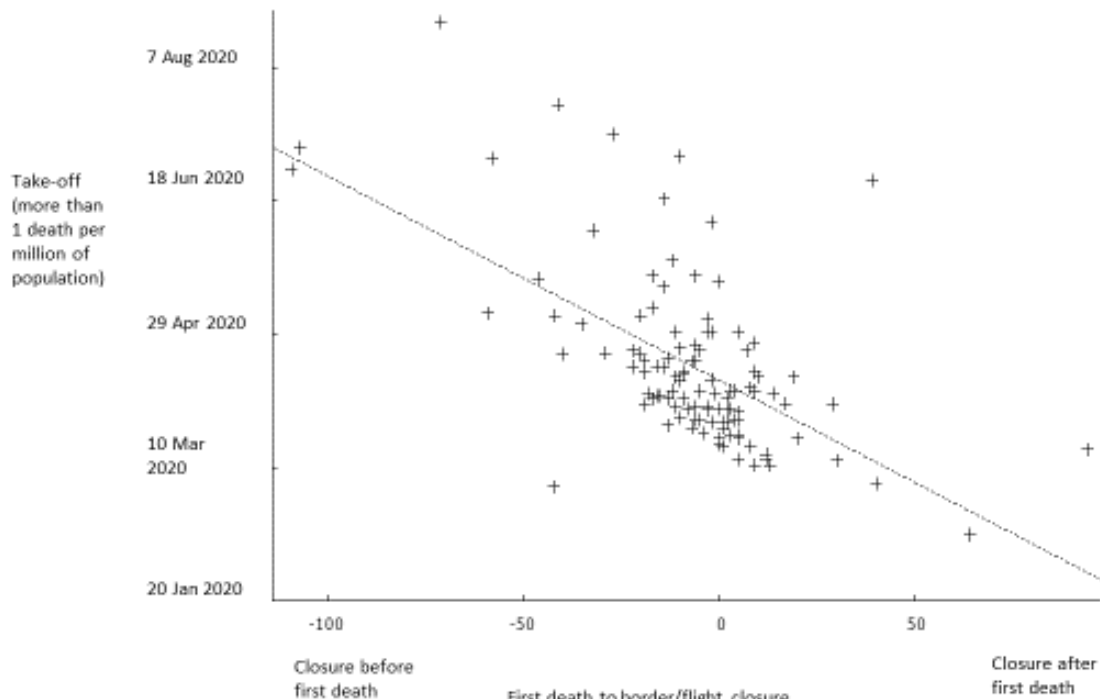


Figure 1: Relationship between flight/border closure and epidemic take-off
 Source: The authors

The most telling graph is a simple one (Figure 1), which shows, over the whole database of 136 countries, the relationship between date of take-off (when deaths exceeded one in a million of the population) and the gap between first death and border closure. It shows a clear relationship. There are many other variables, but this one variable explains over 35% of the variance in the take-off date. The earlier a country closed the border, the later it reached take-off. Those on the top left closed borders/flights early and experienced later take-off, while those on the bottom right did the opposite. The dotted line shows the line of best fit. If we take the date of first death outside China as the date for border/flight closure, this seems to have been on 2 February in the Philippines (a Chinese man from Wuhan), making this when global borders should have started to close. On our evidence, only three countries did it early enough (Mongolia, Papua New Guinea and Nepal), and all have very low mortalities.

Advice and decision-making

Many case studies show confused interpretation, slow decision-making, and poor results, The prevalence of zoonotic viruses (Sheraz, 2020; Woodrow, 2012), through animal contact or laboratory experimentation, indicates continued risk, so better use of information in an outbreak's early stages is needed to ensure risk mitigation. About 1.7 million unidentified viruses of the type known to infect people may exist in mammals and water birds and any could be the next pandemic's source, perhaps more lethal and faster spreading than SARS-CoV-2 (Settele *et al.*, 2020).

In emergency management, decisions must be made quickly, using the best information available at the time, rather than using complex scenarios with various assumptions. In the 1917-19 flu pandemic, locking down early was vital. St Louis' quick response, limiting activity within 48 hours of the first case, helped halve its death rate relative to Philadelphia, which waited two weeks (National Institutes of Health, 2007). In the UK, many scenarios were produced, confusing a government that declared its intention to rely on scientific advice.

The scientific advice received by most governments was not necessarily wrong but was often late and may not have focused on the right things, e.g. on the consequences of the infection arriving rather than how to stop it arriving. In many countries, advice was based on health – not economic forecasts. These came later when the cost of lockdown became clearer. Within two weeks of the first news arriving, economic and social analysis of options must take place. Governments do not need just medical and behavioural experts to handle such threats. They need multidisciplinary teams - scientists, technologists – medical/health, computing and telecommunications, economists, public administrators, futurologists, historians, statisticians, sociologists, political scientists, industrialists, lawyers, media experts, psychologists, perhaps even philosophers experienced in detecting the use of language to bend the truth and the existence of governance problems. These experts can quickly get to grips with what is happening, estimate the consequences of different scenarios, and advise governments on how and when to act. These people should be mainly practitioners, with a leavening of academics, rather than the other way around. They must be in touch with international and

national realities, including keeping a close eye on the economic and social systems that create zoonotic epidemics (Sheraz, 2020). The likelihood of more frequent, serious and costly pandemics, their linkage to socio-economic, environmental and ecological factors, and the misallocation of detection resources to areas where they are least likely to arise, has been recognised for some time (Jones *et al.*, 2008), but action to improve early response seems not forthcoming.

There was also a classic risk management failure – many governments were not combining information from different sources (information pooling) or using ideas and techniques from the different sources and experts mentioned above. The failure of many national and world health systems, in the face of the need for a highly reliable response (La Porte, 1996; Roberts, 1989, Roberts and Rousseau, 1989, Weick and Sutcliffe, 2001) is paradoxical, given that much of the work on high reliability organizations has been in health (e.g. Chassin and Loeb, 2011).

International organization, or disorganization?

The case studies show that most countries made up their own mind, re-inventing policies, with occasional cooperation and pooling of information. It is not clear which international organizations can coordinate response, or whether there should be an assigned organization.

Such infections are white swan (certain to occur, timing uncertain), not black swan events (Inayatullah, 2020), so what should we do at the earliest stages? Ignoring weak signals is dangerous in cases like COVID-19, as Ramos *et al.* (2020) identify, indicating that the risk of another pandemic is too serious to be just added to risk lists of international organizations, and that “anticipatory governance” is required, including identifying weak signals, cross-departmental learning and collaboration, citizen engagement, innovations, investment, deeper understanding of wicked problems, a capacity to adapt quickly, ecosystem mobilization and assembling resources..

The record of most governments and public administrators has been poor, suggesting that we should ask whether the sourcing and interpretation of information about potential pandemics should be left to government or international bodies, and whether it should be centralised or not. East Asian countries have very centralised decision-making in such matters and acted quickly. The current system is a “low reliability system”, when it should be high reliability (Day *et al.*, 2018; Sanders, 2020), applying particularly to early stage detection (Inayatullah, 2020). The Swedish case illustrates some of the issue relating to democracy and centralised policy, while Ostrom (Pennington, 2013) warns us against too much centralised power.

Writing in September 2020, it is easier for us to say what was known and not known, and what should have been given attention at the earliest stage, than it would have been at the time. However, it is clear that the most important issue relates to paying attention to and interpreting “weak signals” and also how to obtain consensus that a) a weak signal exists and then b) that a weak signal has turned into a strong signal (Haeckel, 2004). These issues are hard to resolve when weak signals change into strong signals quickly. In military intelligence, the time between weak and strong signal has collapsed from months or even years to minutes or even seconds now. In this pandemic, it is a matter of days, or at most weeks. The key problems are avoiding “crying wolf” - false positives and false negatives. The weak signals of a possible pandemic emerged in late December 2019 (possibly earlier) and early January 2020 but were strong by January 31, though not acted on quickly enough. Perhaps early economic analysis of the options of quick versus slow action might have triggered stronger and earlier reactions.

Lessons for next time

The lessons for next time (and there will be a next time) seem to be straightforward, as follows:

1. When a new highly infectious and fatal virus appears, particularly if it infects while symptoms are hidden, the country where the virus has appeared should lock down locally and nationally, with contact tracing, and all travel to and from that country should be stopped, as testing at borders is unlikely to reveal virus imports
2. All flights/borders with countries with any cases should be closed
3. Every country should prepare stocks of basic personal protective equipment for citizens and comprehensive personal protective equipment for health workers
4. Once a virus appears in a country, full lockdown with contact tracing should be implemented immediately, and all vulnerable people should be shielded.
5. Pandemics may be too serious a matter to be left to global organizations. They are a matter for national governments at the highest level

Further research and work required

These are the main areas where further research and decision-making is required

1. Feasibility of early complete border closure and lockdown
2. Mechanisms of within-country spreading and how these can be mitigated
3. Reliability of world health reporting and how to improve it and ensure that improvement is implemented.

References

Ashton, J. (2020), “The pandemic of coronavirus: tackling the latest plague”, *Journal of the Royal Society of Medicine*, Vol. 113 No. 3, pp. 123-124.

Biscayart, C., Angeleri, P., Lloveras, S., Chaves, T., Schlagenhauf, P. and Rodríguez-Morales, A. (2020), "The next big threat to global health? 2019 novel coronavirus (2019-nCoV): What advice can we give to travellers? – Interim recommendations January 2020, from the Latin-American society for Travel Medicine (SLAMVI)", *Travel Medicine and Infectious Disease*, Vol. 33, p. 101567.

Bogoch, W., Thomas-Bachli, A., Huber, C., Kraemer, M and Khan K. (2020), Pneumonia of unknown etiology in Wuhan, China: potential for international spread via commercial air travel", *Journal of Travel Medicine, Medicine*, Vol. 27 No. 2, taaa008

Chassin, M. and Loeb, J. (2011), "The ongoing quality improvement journey: next stop, high reliability", *Health Affairs*, Vol. 30, No. 4, pp. 559-568.

Day, R., Demski, R., Pronovost, P., Sutcliffe, K., Kasda, E., Maragakis, L., Paine, L., Sawyer, M. and Winner, L. (2018), "Operating management system for high reliability: Leadership, accountability, learning and innovation in healthcare", *Journal of Patient Safety and Risk Management*, Vol. 23 No. 4, pp. 155-166.

De la Quintana, J. (2020), "La paradoja peruana: ¿por qué es tan elevada la cifra de contagios de covid-19 en Perú?", available at <https://cnnespanol.cnn.com/2020/06/01/la-paradoja-peruana-por-que-es-tan-elevada-la-cifra-de-contagios-de-covid-19-en-peru/>, (accessed 7 September 2020).

Economist (2020), "The world needs a better World Health Organization", *The Economist*, 12 September, available at <https://www.economist.com/international/2020/09/12/the-world-needs-a-better-world-health-organisation>

Findlater, A. and (accessed 12 September 2020). Bogoch, I. (2018), "Human mobility and the global spread of infectious diseases: a focus on air travel", *Trends in Parasitology*, Vol. 34 No. 9, pp. 772-783.

Gralinski, L. and Menachery, V. (2020), "Return of the Coronavirus: 2019-nCoV", *Viruses*, Vol. 12 No. 2, pp. 135-143

Haeckel, S. (2004), "Peripheral vision: Sensing and acting on weak signals: Making meaning out of apparent noise: The need for a new managerial framework", *Long Range Planning*, ol. 37, No. 2, pp. 181-189.

Inayatullah, S. (2020), "Neither a black swan nor a zombie apocalypse: the futures of a world with the Covid-19 Coronavirus", *Journal of Futures Studies*, available at: <https://jfsdigital.org/2020/03/18/neither-a-black-swan-nor-a-zombie-apocalypse-the-futures-of-a-world-with-the-covid-19-coronavirus/>, (accessed 7 September 2020)

International Society for Infectious Diseases (2019), "Undiagnosed Pneumonia – China (Hubei): Request for Information", *ProMed Mail*, 30 December. Brookline, Mass., available at <https://promedmail.org/promed-post/?id=6864153>, (accessed 7 September 2020).

Johns, S- 2020 " COVID-19 in Brazil: Research reveals how epidemic spread across country", *Imperial College, London*, available at <https://www.imperial.ac.uk/news/200453/covid-19-brazil-research-reveals-epidemic-spread/>, (accessed 7 September 2020).

Jones, K., Patel, N., Levy, M., Storeygard, A., Balk, D., Gittleman, J. and Daszak, P. (2008), "Global trends in emerging infectious diseases", *Nature*, Vol. 451(7181), pp. 990-993.

Krisztin, T., Piribauer, P. and Wögerer, M (2020), "The spatial econometrics of the coronavirus pandemic", *Letters in Spatial and Resource Sciences*, <https://doi.org/10.1007/s12076-020-00254-1>

La Jornada (2020), "Por enfermedades crónicas, Covid-19 'nos pegó más'": López Obrador, available at <https://www.jornada.com.mx/ultimas/politica/2020/07/25/por-enfermedades-cronicas-covid-19-201cnos-pego-mas201d-lopez-obrador-6087.html>, (accessed 7 September 2020).

La Porte, T. (1996), "High reliability organizations: Unlikely, demanding and at risk", *Journal of contingencies and Crisis Management*, Vol. 4 No. 2, pp. 60-71.

Lancet (2020). Salient lessons from Russia's COVID-19 outbreak, *Lancet*, 395(10239): 1739, available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7272151/>, (accessed 7 September 2020).

Lawler, D. (2020), "Peru now has the world's highest coronavirus death rate", *Axios*, available at <https://www.axios.com/countries-with-highest-coronavirus-death-rates-5dd89c65-bdb7-4ba7-ad87-3737520911cd.html> (accessed 7 September 2020).

National Centre for Biotechnology Information (2020). US National Library of Medicine, Bethesda, MD, search engine available at <https://www.ncbi.nlm.nih.gov/pmc>, (accessed 7 September 2020).

National Institutes of Health (2007), "Rapid Response was Crucial to Containing the 1918 Flu Pandemic", News Releases, April 2, available at <https://www.nih.gov/news-events/news-releases/rapid-response-was-crucial-containing-1918-flu-pandemic> (accessed 7 September 2020).

Nishiura, H., Jung, S., Linton, N.M., Kinoshita, R., Yang, Y., Hayashi, K., Kobayashi, T., Yuan, B. and Akhmetzhanov, A. (2020), "The extent of transmission of novel coronavirus in Wuhan, China, 2020", *Journal of Clinical Medicine*, Vol. 9, p. 330

Pennington, M. (2013), "Elinor Ostrom and the robust political economy of common-pool resources", *Journal of institutional Economics*, Vol. 9 No. 4, p. 449-468.

Pueyo, T. (2020), "Coronavirus: Should we aim for herd immunity like Sweden", *Medium*, June 9, available at <https://medium.com/@tomaspueyo/coronavirus-should-we-aim-for-herd-immunity-like-sweden-b1de3348e88b> (accessed 7 September 2020).

Pullano, G., Pinotti, F., Valdano, E., Boëlle, P.Y., Poletto, C. and Colizza, V. (2020), "Novel coronavirus (2019-nCoV) early-stage importation risk to Europe" *Eurosurveillance*, Vol. 25 No. 4, p. 2000057.

Ramos, A., Uusikyla, I and Luong, N. (2020), "Triple-A governance: anticipatory, agile and adaptive", *Journal of Futures Studies*, available at: <https://jfsdigital.org/2020/04/03/triple-a-governance-anticipatory-agile-and-adaptive/> (accessed 7 September 2020).

Roberts, K. (1989), "New challenges in organizational research: high reliability organizations", *Industrial crisis quarterly*, Vol. 3 No. 2, pp. 111-125.

Roberts, K. and Rousseau, D. (1989), "Research in nearly failure-free, high-reliability organizations: having the bubble", *IEEE Transactions on Engineering management*, Vol. 36, No. 2, pp. 132-139.

- Sánchez Talanquer, M. (2020), "La letalidad hospitalaria por Covid-9 en México: desigualdades institucionales", *Nexos*, available at <https://datos.nexos.com.mx/?p=1625> (accessed 7 September 2020).
- Sanders, K. (2020), "British government communication during the 2020 COVID-19 pandemic: learning from high reliability organizations", *Church, Culture and Communication*.
- Settele, J., Diaz, S. and Brondizio, W. (2020), "COVID-19 Stimulus Measures Must Save Lives, Protect Livelihoods, and Safeguard Nature to Reduce the Risk of Future Pandemics. Expert Guest Article", 27 April, *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Service*, available at <https://ipbes.net/covid19stimulus>
- Sheraz, U. (2020), "Exploring Foresight, Epidemiology and the Coronavirus Pandemic", *Journal of Futures Studies*. Available at <https://jfsdigital.org/2020/04/07/exploring-foresight-epidemiology-and-the-coronavirus-pandemic-with-dr-peter-black/> (accessed 7 September 2020).
- Stone, M., Aravopoulou, E., Evans, G., Aldhaen, E. and Parnell, B. (2019), "From information mismanagement to misinformation—the dark side of information management", *The Bottom Line*, Vol. 32 No. 1, pp. 47-70
- Topirceanu, A., Udrescu, M., & Marculescu, R. (2020). Centralized and decentralized isolation strategies and their impact on the COVID-19 pandemic dynamics. *arXiv preprint arXiv:2004.04222*, available at <https://arxiv.org/pdf/2004.04222.pdf> (accessed 7 September 2020).
- Webber, J. 2020. Mexico reports "catastrophic" 60,000 COvid-19 deaths, *Financial Times*, August 23, available at <https://www.ft.com/content/fc83004a-769f-49b3-9f7c-9d5fd840d31f> (accessed 7 September 2020).
- Weick, K. and Sutcliffe K. (2001), *Managing the Unexpected - Assuring High Performance in an Age of Complexity*, San Francisco, CA, USA: Jossey-Bass
- Wieler, L., Rexroth, U. and Gottschalk, R. (2020), *Emerging COVID-19 success story: Germany's strong enabling environment: Exemplars in Global Health*, available at <https://ourworldindata.org/covid-exemplar-germany>, accessed 12 September 2020
- Woodrow, G., 2012. How can the threat of new and emerging infectious diseases be reduced? *Journal of Futures Studies*, 16(4), pp. 117-124.
- World Health Organization (2020a), *Pneumonia of unknown cause – China. Emergencies preparedness, response, Disease outbreak news*, available at <https://www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/> (accessed 7 September 2020).
- World Health Organization (2020b), *Novel Coronavirus (2019-nCoV) Situation Report - 3 23 January 2020*, available at https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200123-sitrep-3-2019-ncov.pdf?sfvrsn=d6d23643_8 (accessed 7 September 2020).
- World Health Organization (2020c), *Novel Coronavirus (2019-nCoV) Situation Report - 11 31 January 2020*, available at https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200131-sitrep-11-ncov.pdf?sfvrsn=de7c0f7_4 (accessed 7 September 2020).
- World Health Organization (2020d), *Novel Coronavirus (2019-nCoV) Situation Report - 40 29 February 2020*, available at https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200229-sitrep-40-covid-19.pdf?sfvrsn=849d0665_2 (accessed 7 September 2020).
- Worldometer: Coronavirus (2020), *Covid-19 Coronavirus Pandemic*, available at <https://www.worldometers.info/coronavirus/> (accessed 7 September 2020).
- Zhao, S., Zhuang, Z., Ran, J., Lin, J., Yang, G., Yang, L. and He, D. (2020), "The association between domestic train transportation and novel coronavirus (2019-nCoV) outbreak in China from 2019 to 2020: a data-driven correlational report", *Travel medicine and infectious disease*, Vol. 33, p. 101568.