Feedback from operational stakeholders who manage or respond to outbreaks is that they are often too busy to review literature or obtain relevant background information to assist them with acute response. Unlike a traditional analytical outbreak investigation report, ***Watching Briefs*** *are intended as a rapid resource for public health or other first responders in the field on topical, serious or current outbreaks, and provide a digest of relevant information including key features of an outbreak, comparison with past outbreaks and a literature review. They can be completed by responders to an outbreak, or by anyone interested in or following an outbreak using public or open source data, including news reports.*

Watching brief

Title	**Wuhan novel coronavirus 2019nCoV – update February 7th 2020**
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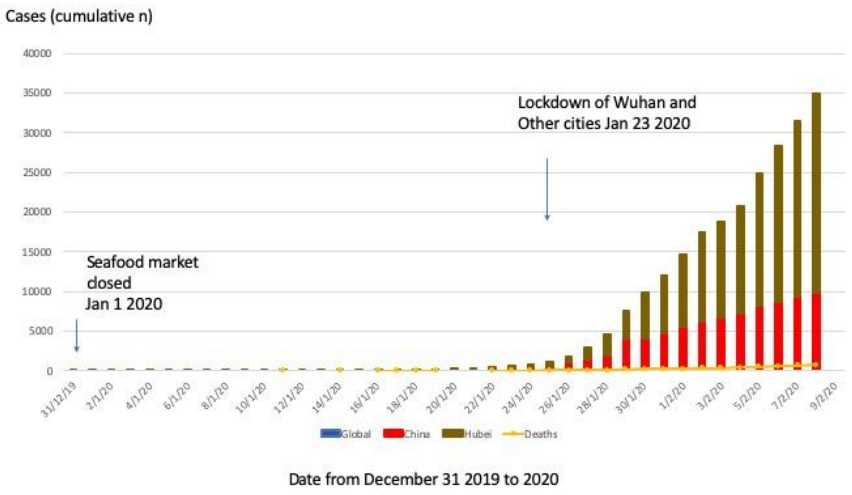
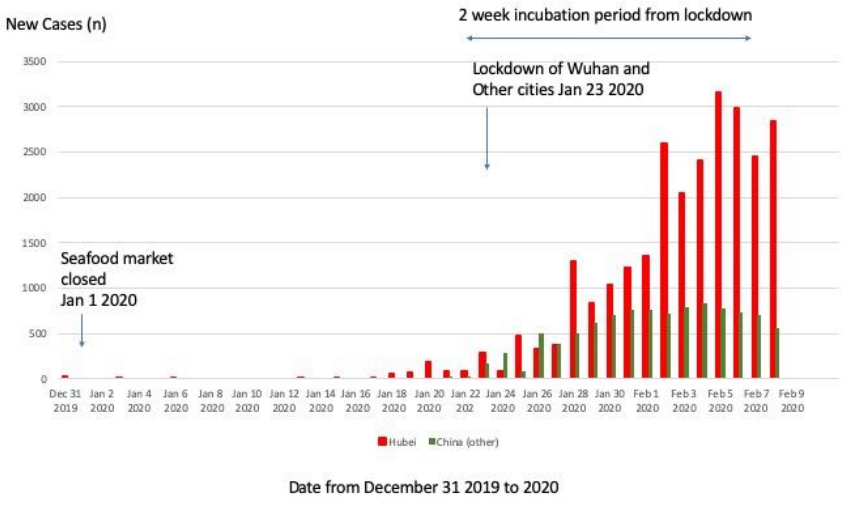
Date of first report of the outbreak	First symptoms in confirmed case on December 1st 2019.(1) WHO notified on 31 December 2019.
Date of report	First report January 24th 2020. Updated January 29th 2020.
Disease or outbreak	Novel coronavirus 2019nCoV
Origin (*country, city, region*)	Wuhan, Hubei, China
Suspected Source (specify food source, zoonotic or human origin or other)	Unknown. Coronaviruses arising from bats can have intermediary animal hosts. Snakes have been implicated in one study(2), but the evidence for this is weak, and genetic analysis shows the virus is closely related to SARS, suggesting a mammalian source such as bats.(3) At least 35 environmental samples from the Huanan Seafood market in Wuhan were positive for the virus, but not in the wild animal section, but in the seafood section. Based on phylogeny, the virus is not from seafood or fish.
Date of outbreak beginning	December 2019. The first exposure among confirmed cases at a seafood market in Wuhan was reported on December 1st 2019.(1) The index case did not have exposure to the seafood market. The first cases may have occurred around December 8th 2019.
Date outbreak declared over	Ongoing on February 7th 2020
Affected countries & regions	China (31165 cases) Singapore (30 cases) Thailand (25 cases) Japan (25 cases)

	South Korea (24 cases) Hong Kong (24 cases) Taiwan (16 cases) Australia (15) Germany (12) USA (12 cases) Malaysia (12 cases) Vietnam (10 cases) Macau (10 cases) Canada (7) France (6 cases) UAE (5) India (3) Philippines (2) UK (2) Italy (2) Russia (2) Finland (1) Sweden (1) Sri Lanka (1) Nepal (1) Nepal (1 case) Cambodia (1) Spain (1) Belgium (1) Finland (1) Cruise ships (>61 cases)
Number of cases and deaths	31477 cases (302 cases outside of China) and 638 deaths on February 7th 2020; the majority of deaths (618) have been in Hubei province.

Clinical features	Fever, dry cough, malaise, lethargy, shortness of breath, myalgia are the commonest symptoms.(1) Less common symptoms are headache, productive cough and diarrhoea.(1) Mild cases may present with a common cold like syndrome, whilst severe cases may develop severe acute respiratory syndrome and pneumonia. An early report indicates 32% of cases have underlying chronic disease.(1) According the WHO situation report on January 24th, 21% of cases in China have a severe illness. On January 26th, about 16% of cases (324/1975) have severe illness. Ground glass opacities in the lung fields are reported on chest radiograph.(3) The incubation period had been variously reportedly between 1-2 weeks, possibly as short as 3 days(3). Reports from China indicate the incubation period could be 1-14 days. The mean incubation period is 5.2 days, but can be up to 2 weeks(4). Diagnostic tests have been developed, including RT-PCR and serology.(3) The viral load is higher in the lower respiratory tract than the upper, so throat swabs are unreliable and sputum samples are more likely to be positive.(3) A case in Australia reportedly was negative on multiple throat swabs but eventually positive on sputum. Early clinical studies show a rise in a range of inflammatory cytokines.(1,3)
Mode of transmission	Coronaviruses are respiratory viruses, so can be found in the respiratory tract. The 2019nCoV has been isolated from lower respiratory tract specimens.(1) One study showed that higher viral loads are present in the lower respiratory tract compared to the upper respiratory tract, and throat swabs may be negative while sputum samples positive.(3) Transmission is unknown yet but the lower respiratory tract predilection suggests airborne transmission is possible. SARS was transmitted by droplet, contact and airborne spread, including aerosolization from floor to floor in buildings. Initially, most cases appear to have been part of a point source outbreak, assumed to be from an animal source, with most cases localised to Wuhan and the initial outbreak linked to a fish market with other live animals. There has been confirmed person to person spread, including two families in Wuhan(2) and Guangdong(3), and a single case which infected 14 health workers. SARS was transmitted person-to-person, especially in the hospital setting. Person-to-person spread has been widely reported in several countries now, with small outbreaks in Germany and Singapore. The first travel-related spread outside of China occurred in a South Korean woman who travelled to Thailand. MERS CoV has mostly been sporadic, with some person-to-person spread and nosocomial outbreaks. Two new papers published confirm person-to-person transmission.(1, 3) China now confirms transmission during the incubation period, although published data are unavailable at present. Children may also be shedding virus while asymptomatic.(3). It is possible the surge in cases since January 18th could be partly due to increased travel for New Year, as well as asymptomatic person to person transmissions through children and young people. China has reported evidence of asymptomatic transmission, and an initial report of the German outbreak suggested asymptomatic transmission, but has subsequently been questioned. The best estimate to date of the R0 is from a study which used date of symptom onset (not date of reported cases) to estimate R0 as 2.2.(4). Other modelling studies have used date of reported cases, which contain uncertainty because of reporting bias as well as lags and surges in reporting which do not reflect illness onset date. The difference in the epidemic curve when using reporting date versus symptom onset date is illustrated in the WHO situation reports, which show both for cases outside China (see Figure 2 and 3).

Epidemiology	Cumulative cases are shown in Figure 1 and the epidemic curve (new cases) in Figure 2. There is uncertainty in the data, with different sources providing different case counts, and there is likely to be under-ascertainment of cases in the most severely affected region, Hubei. Most cases are adults. A publication of the first 41 cases in Wuhan show 73% are male.(1) This is similar to the male predominance of MERS CoV. Most cases have been over 40 years of age. The median age is reported to be 49 years.(1) Anecdotal reports that people with chronic conditions are more at risk, and an early report of the first 41 cases shows 32% had chronic diseases.(1). A few cases have been reported in children at this stage, a 2 year old in the Guangxi region, a 9 month old baby in Beijing and two newborn infants who appear to have been infected. One study reports an asymptomatic child in an infected family, with typical ground glass chest radiograph abnormalities.(3) This suggests children may transmit infection while asymptomatic. The majority of deaths have been in people aged >60 years, but fatalities are reported in younger people. Most, but not all the early cases in Wuhan has exposure in the seafood market.(1,4) The majority of cases around China have a travel history to Wuhan, with some intrafamilial transmission and transmission to health workers. The majority of the cases are in China, mainly in Wuhan. Until January 20th, over 90% of cases in China were localised to Wuhan. Since then, there has been a surge in cases in the rest of China. To date most cases are still within China, although international cases are increasing, including cruise ship outbreaks. There have been 297 cases reported in Beijing and 269 in Shanghai as of February 7th. **Figure 1: Cumulative cases of 2019nCoV, with distribution of cases in Hubei, China and globally, Dec 31 2019 – Feb 8th 2020**. *Data sourced from media reports and WHO situation reports (available since Jan 21 2020). Deaths shown in yellow, cases outside of China in blue. 

Did lockdown work?	Figure 2 shows the epidemic curve (new cases) in Hubei and the rest of China. The lockdown would presumably have reduced the incidence of new cases outside of Hubei in the rest of China, and globally. It may, however, had the opposite effect or no effect in Hubei, due to the high epidemic intensity within the region and apparent sustained transmission unrelated to travel within the region. WHO situation reports provide epidemic curves of cases outside of China only, and show a peak around January 25th, which is consistent with an effect of the travel bans, as many people would have travelled for new year prior to the lockdown on January 23rd. Figure 2 below also shows a flattening of the curve for the rest of China during the 2 week incubation period after January 23rd. This is the period in which new cases may have occurred outside Hubei in people who were incubating infection and left prior to January 23rd. However, the extended New Year holiday will end on February 9th, and another surge in cases may occur around China between February 9-22nd as people who may be incubating infection travel back to their homes after the holidays. **Figure 2: New cases of 2019nCoV by location – Hubei versus the rest of China, Dec 31 2019 - February 6 2020** Data sourced from media reports, ProMED-Mail and WHO situation reports (available since Jan 21 2020). Data sources are not consistent, and there is uncertainty around the data. 
Case fatality rate (CFR)	The overall CFR ranges from 2-3% depending on changes in daily case and death counts, which are still changing rapidly. Of hospitalised cases, the CFR is reported to be 15% from an early case series.(1) For ICU cases, the CFR is 38%.(1). CFR in a larger case series was 11% of hospitalised cases.(5) One health worker fatality (a doctor) has been reported in Hubei as of January 27th.
Complications	Severe pneumonia, respiratory failure, lymphopenia, thrombocytopenia, cardiac injury, secondary infection and death.(1, 3)

Available prevention	A vaccine is being developed by the National Institutes for Health in the USA, University of Queensland, CEPI and by other groups. A MERS CoV vaccine has been developed(6) and is a high priority for the WHO and Coalition for Epidemic Preparedness Initiatives. Whether the MERS vaccine has cross protection against 2019nCoV is unknown. For the general public, WHO recommends handwashing, cough etiquette and avoiding contact with animals or animal products. Health workers are at high risk for nosocomial infection. WHO is recommending a surgical mask for health workers unless doing aerosol-generating procedures, in which case they recommend a respirator. The CDC recommends more stringent measures – a surgical masks as source control for suspected patients and airborne precautions (respirator) for health workers. The precautionary principle should be used for serious emerging infections. Research shows that even for an infection assumed to be spread by droplets, a respirator (but not a mask) has efficacy in preventing infection.(7)
Available treatment	Supportive treatment only. Intensive care, oxygen, ventilation and ECMO may be used for severe pneumonia and respiratory failure. Broad spectrum antivirals may have effectiveness against coronaviruses but are untested against 2019nCoV.(8) It is reported that HIV anti-retroviral agents Lopinavir and Ritonavir, used during the SARS epidemic, are being used to treat cases of 2019nCoV in China. A systematic review of SARS therapeutic options showed no proven effectiveness of these drugs against SARS.(9)
Comparison with past outbreaks	This is a new infection, so it can only be compared with SARS and MERS CoV. It initially appeared less infectious than SARS, which had a R0 of about 2 but more infectious than MERS CoV, which has a R0 close to 1. Data from the first 41 cases showed low transmission. Most cases did not transmit to close contacts. Some experts are estimating R0 to be 3 or higher, based on the surge in cases in late January. However, such estimates do not factor in increased awareness, testing and reporting as a factor in the surge in reported cases. We also cannot rule out a large point-source outbreak with some person-to person transmission. The epidemiologic picture of a localised epicentre (more cases in Hubei than other parts of China, and the vast majority of cases in China) does not support a R0 of >3. In many reported cases, the disease seems to have a long, mild prodromal phase before people become severely ill and present to hospital, so we need better estimates of R0 based on actual onset date of symptoms (rather than date of case report). In terms of case fatality rate (CFR), the CFR with SARS was 12%, MERS CoV 26-30% and 2019nCoV appears to be about 2-3% based on informal reports of cases and deaths. The transmission appears mixed (like MERS CoV), with the initial picture mostly a point-source outbreak and some propagated transmission from person to person in families and in a health care setting.(3) With SARS, travel-related cases in other countries frequently caused satellite epidemics with clear person to person transmission in Hong Kong, Vietnam, Singapore and Canada. This has not been seen so far with the new coronavirus, although 62 cases have been reported in 15 other countries. With MERS, the only outbreak outside of the Kingdom of Saudi Arabia was in South Korea, and over 60% of cases are sporadic.(10)

Unusual features	The source of infection remains unknown, although it arose in the city of Wuhan, Hubei, China. Investigations to determine the source are presumably underway in Wuhan. Reports on January 27th indicate virus has been isolated from samples in the Wuhan seafood market, but no details are available. Transmission appeared to be mainly point-source in the city of Wuhan, particularly linked to a seafood market which also sells other live animals.(1) The market was closed on January 1st but cases surged on January 18th and again on January 24th (see figure 2). There has been confirmed person-to-person spread, but like MERS CoV, most travel related cases imported to other countries have not caused epidemics. However, as the outbreak progressed, fewer cases had direct exposure to the market. The epidemic curve (see figure 2) suggests a surge in transmission after January 20th. This coincides with an increase in travel for Chinese Lunar New Year (Spring festival) celebrations. Most cases in the rest of China have a travel history to Hubei. China took the extraordinary measure of locking down Wuhan and other cities on January 23rd 2020, thereby reducing travel out of the disease epicentre. Given the timing of this epidemic around the Chinese New Year, when travel is at a peak, this would reduce the risk of travel-related importations of cases to other parts of China and the world. On January 27th it was announced that the holiday period was extended for a further three days. The phylogenetic analysis suggests low diversity (ie that the virus is not mutating rapidly, as some media suggests) and a relatively recent origin of the virus from a mammalian source in November or December 2019. However, the initial picture was a point source outbreak followed by a propagated outbreak after January 20th. It is important to compare the phylogenetics of early and more recent cases. Of 500 environmental samples, 35 were positive in the seafood section of the Huanan market. No samples in the wild animal section were positive and no animals have been found to be positive.
Critical analysis and key questions	The key questions around this epidemic are: 1. What is the source and why were the first cases not linked to the seafood market? 2. What is the dominant mode of transmission and what other modes of transmission are possible? Most infections have a dominant mode of transmission but can be transmitted by other modes. Quantifying the different modes of transmission will inform optimal disease control strategies. 3. What proportion of spread is person to person in Hubei? Detailed contact tracing investigation data have only been available from small outbreaks in Germany and Singapore. 4. Is the transmission mode changing to increased person to person spread? We have not seen any published analysis to confirm this and phylogenetic experts say reports that the virus is mutating to become more transmissible is highly unlikely. 5. Is there increased phylogenetic diversity in more recent cases? 6. What are the risk factors for disease? A case-control analysis is required to determine sociodemographic, clinical, behavioural and other risk factors. So far only case series have been published, with no control data.

7. If R0 really is >3 as some experts are reporting, then why did the epidemic not take off in early January in a travel hub city of 11 million people when case ascertainment and awareness were low, and why is it largely localised to China?
8. Is there under-ascertainment of deaths? Some media reports mention people dying of pneumonia and being cremated without any testing being done.
9. It is key to watch whether the epidemic becomes uncontrolled in the rest of China after the holidays end.
10. Could asymptomatic children and young people be the source of sustained transmission?
11. What international strategies should be used to manage cruise ships with outbreaks? Some have been refused entry at the closest ports. The largest outbreak outside China is on a cruise ship in Japan. The process for dumping of sewage from ships into the ocean should be reviewed. Like SARS, given coronavirus is also present in the faeces, this should be managed carefully. Being an enveloped virus, standard disinfectants should inactivate the virus, and chemical treatment and disinfection procedures should be reviewed for sewage.

A modelling study suggests that, based on the number of travel-related cases, there could be 1000 to 9000 undetected cases of 2019nCoV.(11) A similar modelling estimation of a large proportion of undetected, asymptomatic or mild cases was made for MERS CoV,(12) but not supported by active screening studies or serological surveys of humans in affected areas.(13,14). Serological surveys in Wuhan and China will help determine how much mild or asymptomatic infection there may be.

Until the questions above are answered, the main disease control strategies should focus on

1. **Surveillance.** Enhanced disease surveillance to detect new cases early and isolate cases. We require a properly constructed epidemic curve based on date of onset of symptoms (rather than date of reporting of cases), with complete contact and risk factor history, in order to distinguish point-source from person to person transmission and calculate the R0. Enhanced surveillance data will also enable calculation of a median incubation period and range.
2. **Serosurveillance.** Age specific serological surveys will help quantify transmission and potential for asymptomatic spread.
3. **Case isolation and contact tracing.** Case isolation and contact tracing can reduce transmission to zero. Contact tracing should include serological testing of asymptomatic children if possible, given the evidence of infection in asymptomatic children. Contacts should be monitored for 2 weeks from the exposure date, given this is presently the upper estimate of the incubation period.
4. **Travel interventions.** Travel is the main route of global spread. Strategies include airport screening, health communication to passengers at risk, reduction or prevention of travel (such as the lock down of Wuhan which occurred on January 23rd 2020). With the rest of China now affected, any flights from China could import the virus to other countries. Many countries are banning all flights from China. Areas in

	lockdown should ensure adequate food, water, medicine and other supplies to residents. This is a concern on quarantined cruise ships, too. 5. **Universities.** In countries receiving imported, travel-related cases, universities may be at high risk of outbreaks. Universities usually have high numbers of international students. The combination of high numbers of return travellers from affected areas following Lunar New Year, crowding of large numbers of people in close proximity on campuses and residential dormitories, and the possibility of asymptomatic transmission in young people is a unique combination of risks. Strategies such as risk communication to at-risk students are important. Timing of university activities should also be considered. Two cases have been reported in university students to date, one student from Arizona State University in the US and one from the University of New South Wales, Australia. Many countries including Australia and the US have implemented travel bans for people arriving from China, which will delay potentially infected students arriving at universities. 6. **Hospitals and the health system** are vulnerable to outbreaks. Both SARS and MERS CoV caused nosocomial outbreaks. Patients with 2019nCoV will present to the health system, and if they are not suspected as cases and isolated rapidly, they may infect others. Health workers should be aware that throat swabs may be negative, and should attempt to get sputum samples from suspected cases. They should also be aware that a mild prodrome may occur for 5-12 days before the patient becomes very unwell. Triage, isolation and infection control are key, as well as personal protective equipment (PPE) for health care workers. Health workers paid a heavy price with SARS, with many preventable deaths due to delayed diagnosis or inadequate PPE. The occupational health and safety of health workers should be a high priority. 7. **Triage.** The precautionary principal of exposing as few people as possible to potential new emerging infections should be used. Where feasible, this can be achieved by limiting the number of sites where potential infected people encounter the health system. These sites should have adequate isolation rooms, PPE and infection control policies. Travellers should be informed of designated hospitals for suspected patients. Even in countries which have designated hospitals, some patients may present to primary care, which may be less prepared for infection control. Surgeries should have adequate respiratory protection for staff, including reception staff. Triage is critical, and reception staff should be advised to ask a travel history of anyone with fever and respiratory symptoms. If the patient has travelled to Wuhan or China, they should be moved to a separate room if possible, while staff contacts the public health unit or health department for further advice. In general hospitals, triage staff should ask a travel history of any patient with an unexplained fever. Isolation should be used until a diagnosis can be made.

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