

Outbreak Report

Last updated February 11, 2020.

What's New

Editor's Note: WHO has renamed the disease "coronavirus disease 2019" (abbreviated COVID-19). The virus causing the disease has been named "severe acute respiratory syndrome coronavirus 2" (abbreviated SARS-CoV-2) by the responsible international taxonomy committee. Travax usage now reflects this nomenclature.

According to Chinese health authorities, more than 2,400 additional, confirmed cases (including 108 deaths) of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) have been reported since February 10, 2020, throughout the country, mainly in the provinces of Hubei (> 2,000), Hunan (33), Jiangxi (33), Henan (32), Anhui (30), Heilongjiang (29), and Zhejiang (25) and in the cities of Chongqing (16), Beijing (5), and Shanghai (4). Most recent deaths have occurred in Hubei Province, with 5 deaths in Anhui, Beijing, Henan, Heilongjiang, and Tianjin; 750 more patients have recovered and been discharged. More than 42,600 confirmed cases (including > 1,000 deaths)—reported through February 11 at 3:00 p.m. EST—have been officially reported since December 8, 2019. The percentage of cases reported in provinces outside of Hubei compared to cases reported in Hubei in the last week has decreased to 20% (versus 33% for the previous 2 weeks) indicating a possible lack of amplification of cases outside Hubei.

A total of 3 additional, imported confirmed cases from China have been reported since February 10 (through February 11 at 2:00 p.m. EST). Cases reported since February 10 arrived in Singapore, Thailand, and the U.S. (an evacuee under quarantine). Approximately 200 cases imported from China have been reported at international ports of entry since January 6 (through February 11 at 2:00 p.m. EST) in 26 countries. Of these cases, approximately 45 have been reported in the last 7 days possibly reflecting movement and travel controls implemented since January 23. Only 1 additional country has reported imported cases from China since February 2.

Twelve additional cases with transmission occurring outside of China have been reported since February 10 in Hong Kong, Singapore, and the U.K. More than 125 cases with transmission occurring outside of China have occurred since January 14 in 17 countries: Canada, France, Germany, Hong Kong, Japan, Macau, Malaysia, Singapore, Spain (Canary Islands and Mallorca Island), South Korea, Taiwan, Thailand, United Arab Emirates, U.K., U.S., and Vietnam. More than 10 cases of severe disease and 2 deaths have been reported in exported or secondary cases. In addition to these cases, 135 cases were acquired by passengers and crew members onboard the Diamond Princess cruise ship either at sea or while docked in Japan.

The Philippines has now banned entry of foreign nationals who have visited China, Hong Kong, Macau, or Taiwan within the previous 14 days.

A nonpeer-reviewed, ahead-of-print article from China describing a cohort of approximately 1,000 patients is notable for the finding that only 43% of patients ill enough for hospitalization had fever on admission; 88% of patients had fever during their hospital stay. The proportion of afebrile patients in the setting of a radiologic abnormality on admission is unclear. A lymphocyte count of less than $1.5 \times 10^9/L$ was present in 82% of hospitalized patients in one cohort in China.

A media report indicates at least 500 cases of COVID-19 in health care workers in Wuhan.

Overall Risk Assessment

The epidemic of coronavirus disease 2019 (COVID-19) in China is still estimated to have not peaked, especially in Hubei Province. The reliability of case-number and fatality reporting by Chinese authorities is increasingly uncertain. The above numbers reflect a narrow case definition used in China, whereby pneumonia and viral replication are required to be counted as a case; asymptomatic persons who test positive are not counted as cases. Case definitions used by U.S. CDC and others require only fever, respiratory symptoms, and viral replication. Many models indicate several hundred thousand infections may exist in China, and testing has yet to catch up to demand. Just prior to the cordoning off of Wuhan on January 23, over 5 million residents (many potentially infectious) left Wuhan, although most remained in Hubei Province and neighboring provinces. Those areas remain under quarantine. A considerable number traveled to other parts of China, and many thousands left for Hong Kong (approximately 170,000), Japan, Singapore, and Thailand. Such a mass migration causes difficulty in understanding the proportion of cases presenting in other parts of China that are imported from Hubei province versus cases that are locally acquired. The percentage of cases reported in provinces outside of Hubei compared to cases reported in Hubei in the last week

has decreased to 20% (versus 33% for the previous 2 weeks) indicating a possible lack of amplification of cases outside Hubei. Exported cases have so far been mostly to countries likely to be capable of controlling (but not preventing) ongoing transmission, which has already occurred in several countries.

With more than 400 cases (ascertained using a broader case definition) now imported into other countries or acquired in other countries with testing available for all symptomatic individuals, more information on the typical clinical course should be available within the next 2 weeks. Indications so far are of milder disease in those cases. Carefully monitored cohort studies and contact tracing in Singapore, Hong Kong, and Thailand are most likely to yield information. Despite excellent public health infrastructure, both Singapore and Hong Kong have at least 8 cases each of COVID-19, with no known link to known transmission chains, which is worrisome for sustained transmission in those areas. Overall, justification is present for the most cautious approach of having arrivals from China stay at home or in a hotel for 14 days after their last possible exposure in China (already national policy in many countries). The effect of residual immunity from SARS-CoV outbreaks in Hong Kong and Singapore in 2003 is uncertain. Hidden cases may be present in Cambodia, Indonesia, Africa, or South America, which are only now receiving diagnostics.

Detection of virus by PCR in the respiratory tract of an asymptomatic individual does not differentiate between 1) being able to infect others while asymptomatic; 2) remaining asymptomatic and never becoming capable of infecting others; and 3) becoming symptomatic and being capable of infecting others during clinical illness. Both viral detection and epidemiological evidence of transmission are required to prove cause and effect of human-to-human transmission by an asymptomatic person. Experts are increasingly convinced of the occurrence, although not the frequency, of asymptomatic human-to-human transmission. Rare outlier events often are magnified in importance if detected early in an outbreak. If a subset of super-spreading events occurs, index individuals are likely to have been highly viremic and infectious in the asymptomatic stage. Such events appear to have already occurred in Singapore at a business conference in a hotel; in Munich, Germany at a business seminar; and in Hong Kong during a communal hot pot meal. A case series from China in patients ill enough to be hospitalized early in the outbreak in Wuhan (before more rigid infection-control procedures were implemented) indicated that in-hospital infection was responsible for approximately 40% of patients. A media report indicates at least 500 cases of COVID-19 in health care workers in Wuhan.

Fortunately, sequential sequencing of viral isolates over time, to date, indicates no significant new viral mutations; mutations often increase transmission or virulence. As of January 30, WHO considers the outbreak a Public Health Emergency of International Concern and assesses the risk of this event to be very high in China, high at the regional level, and high at the global level. The originally implicated animal market, now closed indefinitely, bears little relevance to the ongoing situation; human-to-human transmission in Wuhan appears to have been ongoing since mid-December. Whether the market was the focus of a single incidence of species jump from animals (possibly pangolins) to humans (indicated by sequencing data) or merely one of multiple amplification settings for initial cases is increasingly unclear. The degree of human-to-human spread outside of Hubei province remains unclear. A reproductive number, R_0 , is estimated at 2–3 both by Chinese authorities and by multiple outside estimates. R_0 greater than 1 indicates that each case leads to more than 1 subsequent case, making control much more difficult.

The spectrum of disease manifestations has only been assessed in 4 small cohorts. A severe case rate of 20% has been consistent; older males with comorbidities have predominated, with a few cases aged ≤ 15 years. Case counts and morbidity incidence rates only consider the most severe cases; the broader definition will lead to much lower rates of severe outcomes. Only 2 exported or secondary cases outside of China (as defined by the broader case definition) have died, and more than 10 cases have developed severe disease.

Case fatality is impossible to ascertain at present, and lesser or greater clinical virulence compared to MERS-CoV or SARS-CoV remains speculative. An accurate estimate of case fatality will not be possible and will require more data, such as blood tests to see how many people have antibodies, household studies to learn how often it infects family members, and further genetic sequencing to determine whether some strains are more dangerous than others. Significant rates of infection by minimally symptomatic people of a disease with low case-fatality rates (CFRs) will cause more cases, and ultimately more deaths, than lower rates of transmission of a more virulent virus with higher CFRs that is restricted to symptomatic people. Closing borders never completely succeeds because all borders are somewhat porous. China may be focusing disproportionate resources on areas outside of Hubei to stem the onset of sustained transmission in important areas. However, closings and aggressive screenings may slow the spread, allowing time for the development of drug treatments and vaccines.

Current Disease Situation

China

More than 42,600 confirmed cases (> 6,400 severe and critical cases and > 1,000 deaths)—reported through February 11 at 3:00 p.m. EST—have occurred since December 8, 2019, in the provinces of Hubei (> 31,700; mainly in Wuhan), Guangdong (>

1,100), Zhejiang (> 1,100), Henan (> 1,100), Hunan (> 910), Anhui (860), and Jiangxi (> 800); in the cities of Chongqing (> 480), Beijing (> 340), and Shanghai (> 300); and in 22 other provinces throughout the country. An additional 21,600 suspected cases have been reported since January 22. Most cases are related to Wuhan, but multigenerational transmission is now occurring throughout the country. In the setting of a large outbreak, and with delays in testing still occurring, a high proportion of suspected cases will evolve into confirmed cases. More than 3,900 cases have been discharged. The cases range from age 9 months through 96 years, with age 48 years as the median.

The number of confirmed COVID-19 cases reported by China has increased by more than 22,100 in the past 7 days.

Imported Cases from China

Approximately 200 imported cases of COVID-19 (confirmed after arrival) from China have been reported at international ports of entry since January 6 (through February 11 at 2:00 p.m. EST) in 26 countries. Of these cases, approximately 45 have been reported in the last 7 days. Only 1 additional country has reported imported cases from China since February 2.

An analysis of 395 cases identified outside of China showed approximately 34% of cases reported exposure history in Hubei Province, 13% reported no recent travel outside their home country, 5% had unknown (so far) exposure locations in China, 5% had exposure in countries outside of China, 2% were acquired in China (outside of Hubei), and 6% are still under investigation. The remainder were acquired on cruise ships. Approximately 4% of cases were detected while asymptomatic. The earliest symptom-onset date was December 31, 2019; none of the early cases had visited the implicated market.

The number of reported cases from Indonesia (0) and Cambodia (1) is notable because all models of air travel indicate that substantial numbers of cases should be present. Diagnostic capabilities in those countries are limited.

Thailand (23 cases): Cases have been reported since January 22 (through February 11).

Japan (22 cases): Cases have been reported since January 6 (through February 9).

Singapore (22 cases): Cases have been reported since January 24 (through February 10).

Australia (15 cases): Cases have been reported since January 27 (through February 6) in the states of New South Wales (Sydney; 4 cases), Victoria (Melbourne; 4 cases), South Australia (2 cases), and Queensland (5 cases).

Malaysia (15 cases): Cases have been reported since January 27 (through February 10).

South Korea (13 cases): Cases have been reported since January 24 (through February 9).

Hong Kong (13 cases; 1 death): Cases have been reported since January 19 (through February 7).

Taiwan (12 cases): Cases have been reported since January 24 (through February 4).

U.S. (11 cases): Cases have been reported since January 24 (through February 11) in 6 states: California (5 counties; 6 cases), Illinois (Chicago; 1 case), Arizona (Maricopa County; 1 case), Massachusetts (Boston; 1 case), Washington (Seattle; 1 case) and Wisconsin (1 case).

Macau (9 cases): Cases have been reported since January 19 (through February 5).

Vietnam (8 cases): Cases have been reported since January 23 (through February 8) in Ho Chi Minh City and in Khanh Hoa, Thanh Hoa, and Vinh Phuc provinces.

Canada (6 cases): Cases have been reported since January 25 (through February 7) in the provinces of Ontario (Toronto; 3 cases) and British Columbia (Vancouver; 3 cases).

United Arab Emirates (6 cases): Cases have been reported since January 29 (through February 10); 4 of the cases were a familial cluster.

France (5 cases): Cases were reported on January 24 in the cities of Paris and Bordeaux and in Île-de-France Region.

India (3 cases): Cases have been reported since January 30 (through February 3) in Kerala State.

Italy (3 cases): Cases have been reported since January 31 (through February 7).

Philippines (3 cases; 1 death): Cases have been reported since January 30 (through February 5) in the city of Manila and in Bohol Province. One case (coinfecting with *Streptococcus pneumoniae* and influenza B) died on February 2.

Germany (2 cases): Cases were reported on February 2.

Russia (2 cases): Cases were reported on January 31 in Western Siberia.

Belgium (1 case): The case was reported on February 4.

Cambodia (1 case): The case was reported on January 23 in the city of Sihanoukville.

Finland (1 case): The case was reported on January 29 in Lapland Region.

Nepal (1 case): The case was reported on January 24 in Kathmandu.

Sri Lanka (1 case): The case was reported on January 27.

Sweden (1 case): The case was reported on January 31 in Jonkoping County.

U.K. (1 case): The case was reported on January 31.

The following countries have additional cases where transmission is under investigation: Philippines (1), South Korea (3), Thailand (4), United Arab Emirates (1), and Vietnam (1).

Cases with Transmission Outside of China

More than 125 confirmed cases of COVID-19 with transmission occurring outside of China have been reported since January 14 (through February 11 at 2:00 p.m. EST) in 17 countries. Incubation periods in these cases may have been as short as 3 days.

Hong Kong (36 cases; 1 death): Cases have been reported since February 1 (through February 11). Investigation continues for 11 of these cases without a known epidemiological link (including travel to China, contact with a person from China, or contact with a confirmed case). Multigenerational transmission appears to have occurred for some of the locally acquired cases.

Singapore (25 cases): Cases have been reported since February 4 (through February 11). Twenty-five locally acquired cases have been reported and epidemiological investigations have identified 3 currently known clusters: The Life Church and Missions Singapore (5 cases), Yong Thai Hang (Chinese health products store; 9 cases), and a business meeting held January 20-22 at the Grand Hyatt Singapore (3 local cases). Additional cases related to this business meeting with 109 attendees, which may represent a super-spreading event, have been reported in France, Malaysia, South Korea, Spain (Mallorca Island), and the U.K. Investigation continues for 8 of the cases reported in Singapore without a known epidemiological link (including travel to China, contact with a person from China, or contact with a confirmed case). Multigenerational transmission appears to have occurred for some of the locally acquired cases.

South Korea (13 cases): Cases have been reported since January 30 (through February 11). Exposure for 3 cases occurred outside of South Korea (2 cases were reported in South Korean nationals who attended the same conference in Singapore January 20-22).

Germany (12 cases): Cases have been reported since January 27 (through February 10). All cases are epidemiologically linked to a workplace-related exposure in Munich, Bavaria State (multigenerational transmission related to a single, imported case); 8 cases are workplace contacts (but only 2 were known to be close, direct contacts of the imported case), and 3 cases are household contacts.

U.K. (7 cases): Cases have been reported since February 6 (through February 11). One case occurred in a British national who attended a business meeting at the Grand Hyatt Singapore who went on to infect 5 other British nationals staying in the same chalet at the ski resort of Les Contamines-Montjoie near Mont Blanc.

Thailand (6 cases): Cases have been reported since January 31 (through February 10); 3 cases appear to be locally acquired, and 2 cases were imported from outside of China.

Vietnam (6 cases): Cases have been reported since January 28 (through February 9) in Ho Chi Minh City and Vinh Phuc Province.

France (6 cases): Cases have been reported since January 30 (through February 9). The first case (a doctor who had treated 2 imported cases) was reported in Île-de-France Region. Five additional cases were reported at the ski resort of Les Contamines-Montjoie near Mont Blanc in British nationals sharing a chalet; the index case for this cluster was a British national who attended a business meeting at the Grand Hyatt Singapore, the source of several other case clusters (Malaysia, Singapore, South Korea, and the U.K.).

Japan (4 cases): Cases have been reported since January 16 (through February 2); also see cases under International Conveyance (Cruise Ships), below.

Taiwan (4 cases): Cases have been reported since January 28 (through February 6); 2 of these cases reported travel history through Hong Kong, and 1 case reported travel history through Macau. One case appears to have been locally acquired.

Malaysia (3 cases): Cases have been reported since February 5 (through February 10), including in a Malaysian national who attended a conference in Singapore January 20-22 and in a close contact.

U.S. (2 cases): Cases were reported on January 30 and February 3 in Chicago, Illinois and San Benito County, California, respectively. Currently, 68 persons are under investigation in 37 states (as of February 10).

Canada (1 case): The case was reported on February 7 in Vancouver, British Columbia; the case had close contact with visitors from Hubei Province.

Macau (1 case): The case was reported on February 5.

Spain, Canary Islands (1 case): The case was reported on January 31 on La Gomera Island; the case is part of a cluster of locally acquired cases in Germany.

Spain, Mallorca Island (1 case): The case was reported on February 9 on Mallorca Island; recent travel to a French ski resort (likely the same implicated in a cluster outbreak) was reported.

United Arab Emirates(1 case): The case was reported February 8.

The following countries have additional cases where transmission is under investigation: Philippines (1), South Korea (3), Thailand (4), United Arab Emirates (1), and Vietnam (1).

Cases on an International Conveyance (Cruise Ships)

Approximately 135 cases (now hospitalized in Japan) were acquired by passengers and crew members onboard the Diamond Princess cruise ship, either at sea or while docked in Japan. 3,700 passengers are now quarantined until February 19.

Approximately 8 cases (Chinese nationals) were confirmed among passengers aboard the World Dream cruise ship January 19-24; contact tracing is underway among the 4,000 passengers who disembarked in southern China and Hong Kong. No cases were detected among the passengers and crew members (approximately 3,600) on the subsequent sailing in Hong Kong.

Entry/Exit Procedures

Screening

In a reversal of long-standing policy, WHO now recommends that all countries implement temperature screening at points of entry for passengers arriving from COVID-19-affected countries. Screening should be accompanied by dissemination of risk-communication messages at points of entry to later capture asymptomatic persons who are in the incubation phase.

Despite exit screening beginning in early January at 3 major rail stations in Wuhan and at Wuhan International Airport (until cessation of international flights on January 23) and at all international airports in China for several weeks.

Entry screening using questionnaires, fever screening, thermal scanning, or visual inspection at international ports of entry in almost all countries is now in place as stated above. In most cases, anyone with fever and respiratory symptoms who has been to China in the previous 14 days will be detained and isolated or placed in self-isolation. Anyone without symptoms but with travel to China in the previous 14 days may be placed in quarantine or self-quarantine depending on where in China exposures may have taken place. Additional information is provided for the following countries:

Australia: All passengers who are Australian citizens, permanent residents, or immediate family of citizens who have been in China in the past 14 days, arriving at all points of entry, will undergo additional screening.

Canada: All international passengers who have been in Hubei Province, arriving at Toronto Pearson International Airport, Montreal-Pierre Elliott Trudeau International Airport, and Vancouver International Airport, will undergo additional screening, such as temperature checks and questionnaires; travelers not showing signs or symptoms of illness will receive a handout advising them to follow up with their health care provider.

U.K.: All passengers on direct flights from China arriving at Heathrow International Airport are subject to monitoring.

U.S.: All passengers who are U.S. citizens, permanent residents, or immediate family of citizens who have been in China in the previous 14 days, arriving at 11 points of entry (including Hartsfield-Jackson Atlanta International Airport, John F. Kennedy International Airport, Los Angeles International Airport, O'Hare International Airport, and San Francisco International Airport), will undergo additional screening.

Asymptomatic Arrivals

Additionally, many countries have begun instituting management procedures for asymptomatic arrivals (possibly exposed in the previous 14 days) from Hubei Province and elsewhere in China, ranging from self-monitoring to mandatory quarantine. Information is provided for the following countries:

Australia: Arrivals from anywhere in China should self-quarantine and self-monitor for 14 days.

France: Arrivals from Hubei Province will be subject to mandatory quarantine in a government-designated location for 14 days; those from elsewhere in China should self-monitor.

Hong Kong: Arrivals from anywhere in China will be subject to mandatory quarantine in a government-designated location for 14 days; those exempt include select government officials, flight and cruise-ship crew members, and cross-boundary drivers.

Japan: Arrivals from Hubei Province should self-quarantine and self-monitor for 14 days; nothing is in place for those from elsewhere in China.

Singapore: Arrivals from Hubei Province will be subject to mandatory quarantine in a government-designated location for 14 days; those from elsewhere in China should self-quarantine and self-monitor for 14 days.

Taiwan: Arrivals from anywhere in China, Hong Kong, and Macau should self-quarantine for 14 days.

U.K.: Arrivals from Hubei Province should self-quarantine for 14 days. Arrivals from elsewhere in China as well as from Thailand, Japan, South Korea, Hong Kong, Taiwan, Singapore, Malaysia, or Macau who develop symptoms of cough or fever or shortness of breath within 14 days should self-isolate at that time and contact public health authorities.

U.S.: Arrivals from Hubei Province will be subject to mandatory quarantine or self-quarantine and active monitoring for 14 days; those from elsewhere in China should self-quarantine and self-monitor with public health supervision.

Travel Advisories

The following countries and/or organizations, among others, have published travel recommendations:

Avoid All Travel to Hubei Province: Belgium, Canada, China (see below), Finland, France, Germany, Israel, Japan, Mexico, Singapore, U.K.

Avoid Nonessential Travel to Hubei Province: Ukraine

Avoid All Travel to China: Australia, India, New Zealand, U.S. State Department

Avoid Nonessential Travel to China: Belgium, Canada, Finland, France, Germany, Japan, Singapore, Spain, U.S. CDC, U.K.

Avoid Nonessential Travel to China, Hong Kong, Japan, Macao, Singapore, South Korea, Taiwan, and Thailand: Israel

Avoid Nonessential Travel to Singapore: Qatar

No Advisory: WHO

Travel Restrictions

According to WHO, more than 70 countries have now implemented some form of travel restriction. Different types of travel restrictions are in effect:

Major International Airlines Still Serving China (mostly reduced frequency): Aeroflot, AirAsia, Air China, All Nippon Airways, Asiana Airlines, Cathay Pacific, China Eastern Airlines, China Southern Airlines, Emirates, Etihad Airways, Ethiopian Airlines, EVA Air, Hainan Airlines, Japan Airways, Jeju Air, Korean Air, Malaysia Airlines, Pakistan International Airlines, SilkAir, Singapore Airlines, SriLankan Airlines, Thai Airways, Thai Lion Air

No Flights from Wuhan: Wuhan Airport is closed to all scheduled international and domestic flights.

No Flights from China: Indonesia, Israel, Italy, Kazakhstan, Northern Mariana Islands, Palau (no flights from China, Hong Kong, or Macau), Russia (except for Aeroflot flights), Vietnam

Land Borders with China Closed: Burma (Myanmar), Kyrgyzstan, Mongolia, North Korea, Russia (entire land border with China, except for the portion between Altai Republic and Nei Mongol Autonomous Region [Mongolia]); high speed rails, bus services, and ferry services are suspended, and all but 2 border crossings are closed in Hong Kong.

No Travelers from Hubei Province: Brunei (excluding its residents), Hong Kong, Japan (including visitors in the past 14 days), Macau, Malaysia (also applies to travelers who have been to Zhejiang and Jiangsu provinces), Philippines, South Korea (including visitors in the past 14 days)

No Travelers from China: Foreign nationals who have visited China within the previous 14 days are banned from entry into Antigua and Barbuda, Australia, Fiji, Gabon, Grenada, India, Israel, Maldives, Mauritius, New Zealand, Saint Lucia, Singapore, U.S., and Vietnam. Exceptions may include immediate family of citizens and permanent residents who, along with citizens, may be subject to a 14-day mandatory quarantine (if coming from Hubei Province) or enhanced screening and self-quarantine (if coming from elsewhere in China). Foreign nationals who have visited China, Hong Kong, or Macau within the previous 14 days are banned from entry into Taiwan. Foreign nationals who have visited China, Hong Kong, Macau, or Taiwan within the previous 14 days are banned from entry into the Philippines. Additionally, Belize, Cook Islands, El Salvador, Guatemala, Jamaica, Indonesia, Iraq (passengers arriving at Basra International Airport), Micronesia, Saudi Arabia, and Trinidad and Tobago have banned all travelers coming from China in the previous 14 days. Marshall Islands and Samoa have banned travelers coming from COVID-19-affected countries in the past 14 days. Travelers going to French Polynesia, Tonga, and Vanuatu must present a medical certificate declaring that they are free of infection.

Internal Travel Restrictions in China: Restrictions on movement exist throughout the country, especially in Chongqing, Zhejiang, Anhui, and Heilongjiang provinces. Most public transportation has been suspended, and many intercity roads are closed. An estimated 54 million persons are quarantined inside this "cordon sanitaire." Interprovince shuttle buses in major areas have stopped. Much of the country has also closed bars, restaurants, shops, businesses, schools, and museums, as well as many major tourist attractions. China has stopped all inbound and outbound tour groups but not individual travel. Following the extended Lunar New Year holiday, workers in China (excluding Hubei Province) are now returning to workplaces in major cities; many workplaces remain closed, and others are allowing employees to work from home. Visitors from Hubei Province will be actively monitored for 14 days in Haikou, Hainan Province.

Repatriation Flights

These persons will be closely monitored for 14 days after arrival at the quarantine location and present little threat of onward transmission. Almost all countries are testing respiratory specimens from repatriated persons for SARS-CoV-2, and asymptomatic carriers are being detected. Natural history and transmissibility studies in these persons may answer several pending questions.

Australia: On February 8, an Australian government-chartered plane evacuated more than 200 persons to Manigurr-Ma Village in Howard Springs (Northern Territory). On February 5, a flight evacuated 50 persons to Christmas Island on a New Zealand government-chartered flight. On February 3, the first flight evacuated 241 persons to Christmas Island. To date, no cases among the evacuated persons have been reported.

Canada: On February 10, a Canadian government-chartered plane evacuated 185 persons to Canadian Forces Base Trenton in Ontario. On February 7, a Canadian government-chartered plane evacuated 176 persons, and a U.S. government-chartered plane evacuated 39 persons to Canadian Forces Base Trenton. To date, no cases among the evacuated persons have been reported.

U.K.: On February 9, a U.K. government-chartered plane evacuated approximately 200 persons to Kents Hill Park in Milton Keynes. Twenty-five persons were evacuated February 2-4 on planes chartered by other countries. On January 31, the first flight evacuated 83 persons to Arrowe Park Hospital in Wirral. To date, no cases among the evacuated persons have been reported.

U.S.: Five government-chartered evacuation flights have occurred. On February 7, two flights evacuated approximately 300 persons to Marine Corps Air Station Miramar in San Diego, California and Camp Ashland near Omaha, Nebraska, respectively. On February 5, two flights evacuated 178 persons to Travis Air Force Base in Fairfield, California and 172 persons to Marine Corps Air Station Miramar in San Diego, California. On January 29, the first flight evacuated 195 persons to March Air Reserve Base in Riverside County, California. To date, only 1 case among the evacuated persons was reported on February 11 at Marine Corps Air Station Miramar in San Diego, California.

Transmission

The detailed epidemiology of possible causative animal exposures and zoonotic transmission at the outset of the outbreak remains unclear. Many (67%) of the cases in December 2019 and approximately 50% of cases in January 2020 were directly linked to South China Seafood City market in Jiangnan District, which sold seafood and other wildlife (including birds). Thirty-three environmental samples from the market tested positive for SARS-CoV-2, indicating that the market was an—or the—origin or amplification point of the large-scale outbreak. No samples taken directly from live animals have been reported as positive. The symptom-onset date of the first case identified in the outbreak was December 1, 2019; the case reported no exposure to the market; no epidemiological link has been detected between this case and later cases. An initial single jump of SARS-CoV-2 directly from bat to human, or from an intermediate animal host to a human, with subsequent initial human-to-human propagation within the seafood market, is increasingly likely.

Infected intermediate animal hosts, if they exist, may still be present, but the sale of live animals in markets in China has officially ceased. Preliminary data, not yet peer-reviewed and published, indicate pangolins may be a leading candidate. South China Seafood City market, closed indefinitely since December 31, 2019, is irrelevant at the current phase of the epidemic. Sustained multigenerational human-to-human transmission is clear in Hubei; the degree of sustained community spread in other parts of China remains variable, with little specific data available. All evidence to date suggests that the main route of transmission is via respiratory droplets or close contact with an infected person. Aerosolized transmission has been announced by some local health officials in China; however, no specific data or peer review are available yet. A reproductive number, R_0 , is estimated at 2–3 both by Chinese authorities and by multiple other international estimates. R_0 greater than 1 indicates that each case leads to more than 1 subsequent case, making control much more difficult. R_0 is not a constant number and changes with the ongoing circumstances and evolution of an outbreak. A pandemic is defined as an ongoing epidemic on 2 or more continents, and these

criteria will be met if sustained transmission occurs outside of Asia. A pandemic can be global, but with levels of severity in individuals that range from mild (with low mortality) to severe.

Several published cluster studies indicate at least asymptomatic shedding (but not necessarily transmission). After an evacuation flight, Japanese officials screened and tested every passenger; 8 tested positive, but 4 of those had no symptoms at all. German virologists were able to culture SARS-CoV-2 from nasopharyngeal swabs from several minimally symptomatic cases in the Munich secondary cluster. Sequence data from several small clusters indicate identical virus in all subjects within the cluster. The frequency of asymptomatic transmission is unclear and, so far, appears to be an outlier or rare event, especially if super-spreaders with high viral loads early in the incubation phase exist. No case of COVID-19 has been attributed to transmission on an aircraft.

More than 187,700 close contacts remain under surveillance in China (> 26,700 have been released), and contact tracing is ongoing in affected provinces and municipalities. However, not all contacts are being ascertained or monitored adequately.

The survival rate of SARS-CoV-2 on surfaces or in the environment is unknown. In general, the survivability of zoonotic coronaviruses on surfaces is significant, generally 1 to 6 days (longest on plastic) depending on ambient conditions, including temperature, humidity, and the specific infected bodily fluid contaminating the surface. The risk of spread is very low from items shipped at ambient temperatures over several days. No evidence exists of SARS-CoV-2 transmission associated with imported goods; no associated cases have been reported to date.

Disinfection processes that are effective for other zoonotic coronaviruses should be followed for now. Clean daily all "high-touch" surfaces, such as counters, tabletops, doorknobs, bathroom fixtures, toilets, phones, keyboards, tables, and bedside tables. Also, clean any surfaces that may have blood, bodily fluids, and/or secretions or excretions on them. After cleaning solid materials using a detergent, use a diluted bleach solution or a household disinfectant with a label that says "EPA-approved." To make a bleach solution, add 15 mL (1 tablespoon) of bleach to 1 L (1 quart) of water; for a larger supply, add 60 mL (2 oz) of bleach to 4 L (1 gallon) of water. For surfaces sensitive to bleach, at least 70% ethanol should be used. Alcohol-based hand disinfectants and common hospital personal disinfectants are all effective against SARS-CoV-2 but provide no ongoing protection between uses.

Clinical Manifestations

An incubation period of 2 to 7 days appears most common (5 days typical), with an upper range of 14 days. Most cases in China (using the Chinese case definition, which includes pneumonia) have reportedly exhibited symptoms of fever, respiratory compromise, and pneumonia, with focal ground glass-like infiltrates on chest x-ray or CT scan, which may progress to bilateral diffuse pneumonia. SARS-CoV and MERS-CoV induce excessive and aberrant non-effective host immune responses that are associated with severe lung pathology, leading to death. Some patients with COVID-19 have developed acute respiratory distress syndrome (ARDS), with characteristic pulmonary ground glass changes on imaging. A lymphocyte count of less than $1.5 \times 10^9/L$ was present in 82% of hospitalized patients in one cohort in China. Diarrhea may occur, but incidence has been highly variable in several cohorts. Overall, about 20% of the Chinese cases have been severe or critical, including pneumonia, respiratory failure, and, in some cases, death. The spectrum of early disease, overall disease, and case fatality in cases ascertained by non-Chinese criteria (requiring only respiratory symptoms) will become clearer once data on the evolution of the cases outside of China are available. Based on available information, only 2 exported or secondary cases outside of China, as defined by the broader case definition, have died, and more than 10 cases have developed severe disease.

A non-peer-reviewed, ahead-of-print journal article from China describing a cohort of approximately 1,000 patients is notable for the finding that only 43% of patients ill enough for hospitalization had fever upon admission; 88% of patients had fever during their hospital stay. The proportion of afebrile patients in the setting of a radiologic abnormality is unclear.

No known drug treatment, vaccine, or therapeutic monoclonal exists for COVID-19. Chloroquine, remdesivir, and lopinavir/ritonavir have an inhibitory effect on SARS-CoV-2, and a clinical trial of remdesivir has begun in China. Remdesivir is available from the U.S. CDC and has been used for 2 U.S. cases. Lopinavir/ritonavir (readily available as Kaletra in most countries) is being used empirically in China and elsewhere. Usual antiviral drugs are ineffective, including oseltamivir (Tamiflu) and acyclovir. Favipiravir, baloxavir, interferon-alpha, and ribavirin have weak activity but are being tried as part of drug combinations. Steroids should not be used. Hypoxemic respiratory failure patients failing standard oxygen therapy (10-15 LPM through a non-rebreather mask) should not routinely be treated with high-flow nasal oxygen or noninvasive ventilation. Risk of treatment failure exists; if used, patients must be closely monitored for deterioration and the need for intubation.

Positive stool PCR for SARS-CoV-2 has been reported for the first time in an exported case and alluded to in China (data not available), but the implications are unknown. Stool-mediated transmission of SARS-CoV occurred but appeared not to be a significant driver of the 2003 outbreak.

Virology

SARS-CoV-2 was initially isolated from 1 case and entirely sequenced; this information was published internationally by Chinese scientists on January 10. Electron microscopy of 1 specimen demonstrated classic coronavirus particles. SARS-CoV-2 is the seventh member of the family of coronaviruses that infect humans. Novel coronaviruses from Wuhan, together with 2 bat-derived SARS-like strains, form a distinct clade in lineage B of the subgenus sarbecovirus. SARS-CoV-2 is a group 2b coronavirus (as are MERS-CoV and SARS-CoV), with a whole genome similarity of up to 80% to SARS-CoV but with a similarity between different gene segments ranging from 60% to 90%. SARS-CoV-2 exhibits a 96.5% similarity to the known bat coronavirus precursors in the same viral clade.

SARS-CoV-2 has been shown to use the same cell-entry receptor as SARS-CoV. Prediction of human-to-human transmissibility from sequence data is difficult because coronaviruses vary widely in their transmissibility; coronaviruses that are acquired from animals generally have some potential for human-to-human transmission. Evidence from subsequent whole genome sequences acquired over the last several weeks show little genetic variation, indicating that the virus jumped from an animal reservoir to humans within the last few months. Identical, recent mutations in epidemiologically unlinked cases support sustained human-to-human transmission.

Diagnosis

Sequence data available since early January have allowed national laboratories to rapidly develop PCR diagnostic kits, which are now available in most developed countries and most Asian countries. Very few national laboratories in the African and South American regions currently have the reagents needed to conduct tests. PCR testing is centralized at national laboratories in most countries. One hundred state and other domestic laboratories in the U.S. have received kits, and reporting by individual states will become more timely than reporting from U.S. CDC, which will no longer be the only location for testing. Some states (including Florida) will no longer be reporting cases under investigation to U.S. CDC. An FDA Emergency Use Authorization for the U.S. CDC kit was granted on February 4. An additional 100 kits will be shipped to public health agencies worldwide, including in Africa. The U.S. CDC assay protocol is publicly available and requires approximately 4 hours to get a result. Viral loads appear to be highest in lower respiratory tract specimens (obtained by tracheal aspirate or bronchoalveolar lavage), but both these specimens and upper respiratory specimens from nasopharyngeal or oropharyngeal swabs should be sent for testing. Upper respiratory specimens alone are usually adequate for the U.S. CDC PCR. Serial PCR studies have not been performed on respiratory specimens from confirmed cases to determine onset or duration of viremia/infectiousness.

HKU1, NL63, 229E, and OC43 are human coronaviruses that are detected by some routine multiplex PCR panels used in routine clinical practice. These coronaviruses are associated with minor upper respiratory infections and viral pneumonia, but unlike SARS-CoV, MERS-CoV, and SARS-CoV-2, these agents are not associated with major outbreaks or severe respiratory distress syndrome.

SARS-CoV-2–specific blood antibody detection tests that would be especially useful for population-based studies to detect asymptomatic individuals are unavailable, even in research laboratories. Point-of-care rapid tests, presently unavailable, took months to develop during the 2014 Ebola outbreak, which involved a well-characterized virus. Even refined rapid tests do not generally perform well in asymptomatic individuals with low pretest probability of infection (such as travelers); even with a specificity of 98% or more, in a low-risk population, more than 90% of positive tests will end up being false positives. Such tests work well on ill people in epidemic areas where the pretest probability is very high.

Criteria for Testing of Suspected Cases

U.S. CDC

Persons meeting the following criteria (clinical features and epidemiologic risk) for suspected cases of COVID-19 will be considered persons under investigation (PUI):

- Fever *or* symptoms of lower respiratory illness (e.g., cough, shortness of breath) *plus* close contact with an ill, laboratory-confirmed COVID-19 case within 14 days of symptom onset
- Fever *and* symptoms of lower respiratory illness (e.g., cough, shortness of breath) *plus* a history of travel from Hubei Province within 14 days of symptom onset
- Fever *and* symptoms of lower respiratory illness (e.g., cough, shortness of breath) requiring hospitalization *plus* a history of travel from mainland China within 14 days of symptom onset

HCWs entering the room with a PUI should use standard precautions, contact precautions, airborne precautions, and eye protection (e.g., goggles or a face shield).

PUIs for COVID-19 should be asked to wear a surgical mask as soon as they are identified and be evaluated in a private room with the door closed, ideally in an airborne-infection isolation room if available.

Prevention

Travel to China

Travelers going to China should avoid animals (alive or dead), animal markets, products that come from animals (such as uncooked meat) and contact with ill-appearing persons. Quality of infection control at medical facilities in Wuhan is uncertain, and those with minor medical problems should avoid busy medical settings. Infection-control supplies have been depleted in medical facilities in the smaller cities in central China; the situation is critical in many areas, and resupply is uncertain. Current influenza vaccination is recommended to decrease the risk of simple influenza being mistaken for COVID-19 upon return.

In the Workplace

To help prevent workplace exposure to acute respiratory illnesses, including COVID-19, U.S. CDC recommends that, beginning immediately, employers actively encourage (through generous leave policies) employees with fever or symptoms of respiratory illness to remain at home, to observe hand hygiene (frequent, thorough handwashing) and social distancing (maintaining a distance of 1 m [3 ft] from ill-appearing persons) if possible, and to avoid sharing of household items. Employees who become ill at work should be immediately isolated from other employees and sent home. Employee education on the aforementioned measures should be aggressive. Worksite hygiene measures and worksite disinfection should be active and continuous. Should an outbreak of COVID-19 occur in the U.S., large-scale absenteeism is possible. Contingency planning guidance is provided by U.S. CDC at <https://www.cdc.gov/coronavirus/2019-ncov/guidance-business-response.html>.

Employees, Students, Visitors, All Others Coming from China

Arrivals who develop fever or respiratory symptoms within 14 days of travel to China should self-isolate; observe respiratory hygiene (cough and sneeze etiquette), hand hygiene, and social distancing; wear a mask; and contact public health authorities (or telephone ahead before presenting to a hospital).

The extent of transmission from asymptomatic individuals infected with SARS-CoV-2 to others is unknown, but several apparent instances have been documented. Influenza viruses can be transmitted 1 to 2 days prior to symptom onset. SARS-CoV did not transmit until 4 days after symptom onset, which led to its eradication because all contacts with fever could be promptly identified and isolated. Management strategies for asymptomatic persons are based on the person's risk level, as shown in the table below.

Table: Management of Asymptomatic Persons with Potential SARS-CoV-2 Exposure

Risk Category	Movement Restrictions and Public Activities	Monitoring	Travel
High Hubei exposure ¹	Quarantined (voluntary or under public health orders) in a location determined by public health authorities (PHA). No public activities	Daily active monitoring (communication with PHA)	Controlled (travel must be coordinated with PHA)
Medium Other China exposure ² Certain aircraft exposure ³	Remain at home or in a comparable setting, if possible. Avoid congregate settings, limit public activities, and remain out of public places where close contact may occur.	Aircraft exposure: active monitoring (communication with PHA) Travel from China outside of Hubei Province: self-monitoring (take temperature 2 times per day and remain alert for symptoms) with PHA supervision	Postpone additional long-distance travel after reaching the final destination. Persons who do travel may not be able to return if they become symptomatic during travel.
Low Certain aircraft exposure ⁴	No restrictions	Self-observation (remain alert for symptoms)	No restrictions

Risk Category	Movement Restrictions and Public Activities	Monitoring	Travel
<ol style="list-style-type: none"> 1. Travel from Hubei Province in the previous 14 days 2. Travel from mainland China outside of Hubei Province and not having a high-risk exposure 3. Seated on an aircraft within 2 m (6 ft; approximately 2 seats in each direction) of a symptomatic, laboratory-confirmed case of COVID-19; laboratory confirmation may not occur until after travel. Out of an abundance of caution, providers may presume the symptomatic case to be infected with SARS-CoV-2 and management of the exposed person implemented. 4. Seated on an aircraft not within 2 m of a symptomatic laboratory-confirmed case of COVID-19 infection and not otherwise having a medium- or high-risk exposure 			

Businesses may choose to have low-risk, asymptomatic arrivals from China self-quarantine and self-monitor by taking a temperature reading immediately prior to coming into the workplace or school for 14 days after their last exposure in China. A more stringent approach would require that an employee, student, or visitor—upon arrival to a workplace or school—be instructed to perform an additional temperature check in the presence of medical personnel to ensure compliance with local, self-monitoring requirements. In addition, at intervals during the day and prior to any gathering of ≥ 2 persons, attendees could be required to perform additional self-monitoring or witnessed monitoring. Businesses and schools in most countries are enforcing self-quarantine for 14 days after arrival from China. To date, all known cases exported to other countries had either visited Wuhan or had contact with an ill person from Wuhan while in China.

Based on advanced information and employee or visitor medical screening, additional preventive measures may be required (e.g., increased ventilation, larger meeting rooms with more personal space per participant, disinfection of work areas and lavatories, and provision of alcohol wipes). Data show that the public use of masks (including N-95 masks) by asymptomatic persons is not beneficial.

Household members of a PUI should observe hand hygiene and social distancing if possible and should avoid sharing household items. Such persons should self-monitor, and employers should consider the various options above, including exclusion from the workplace until 14 days after the last possible day of infectiousness for a PUI. Confirmed cases outside of China are still rare and are not considered in detail here.

U.S. CDC, Singapore's Ministry of Health, and Hong Kong's Centre for Health Protection essentially state that household members of asymptomatic individuals in self-quarantine after arrival from China are not considered case contacts and may continue their daily activities (e.g., work or school) while continually monitoring their health and seeking medical attention if symptoms develop. However, businesses may conservatively opt to implement restrictions on a case-by-case basis.

Caregivers of a confirmed case or a PUI should take additional precautions to include the use of disposable gloves, gowns, and masks and the proper disposal of these items.

Key Unanswered Questions

- Numerical risk for travelers going to areas with sustained transmission (i.e., destinations with cases occurring without known exposure to other cases)
- Implications of respiratory tract viral detection in asymptomatic individuals
- Onset and duration of infectivity with respect to symptoms
- Existence and frequency of super-spreading events
- Role of surfaces and inanimate objects in transmission
- Reproductive number; on average how infectious is the typical case
- Spectrum of clinical disease; proportions of asymptomatic persons, persons who are symptomatic but apparently (to others) asymptomatic, those with influenza-like illness, with focal pneumonia, with severe respiratory compromise, and fatalities
- Differences in clinical manifestation in Chinese (smoking, pollution) versus other populations
- Likelihood of mutations within the genome with serial passage through humans
- Mechanism of species jump from bats to humans and whether animals still pose a threat
- Speed of vaccine development
- Utility of very traditional Chinese methods of social distancing and quarantine in the twenty-first century

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