Master Question List for COVID-19 (caused by SARS-CoV-2)
Weekly Report
25 March 2020

For comments or questions related to the contents of this document, please contact the DHS S&T Hazard Awareness & Characterization Technology Center at HACTechnologyCenter@hq.dhs.gov.
FOREWORD

The Department of Homeland Security (DHS) is paying close attention to the evolving Coronavirus Infectious Disease (COVID-19) situation in order to protect our nation. DHS is working very closely with the Centers for Disease Control and Prevention (CDC), other federal agencies, and public health officials to implement public health control measures related to travelers and materials crossing our borders from the affected regions.

Based on the response to a similar product generated in 2014 in response to the Ebolavirus outbreak in West Africa, the DHS Science and Technology Directorate (DHS S&T) developed the following “master question list” that quickly summarizes what is known, what additional information is needed, and who may be working to address such fundamental questions as, “What is the infectious dose?” and “How long does the virus persist in the environment?” The Master Question List (MQL) is intended to quickly present the current state of available information to government decision makers in the operational response to COVID-19 and allow structured and scientifically guided discussions across the federal government without burdening them with the need to review scientific reports, and to prevent duplication of efforts by highlighting and coordinating research.

The information contained in the following table has been assembled and evaluated by experts from publicly available sources to include reports and articles found in scientific and technical journals, selected sources on the internet, and various media reports. It is intended to serve as a “quick reference” tool and should not be regarded as a comprehensive source of information, nor as necessarily representing the official policies, either expressed or implied, of the DHS or the U.S. Government. DHS does not endorse any products or commercial services mentioned in this document. All sources of the information provided are cited so that individual users of this document may independently evaluate the source of that information and its suitability for any particular use. This document is a “living document” that will be updated as needed when new information becomes available.
### SARS-CoV-2 (COVID-19)

**What do we know?**

**SARS-CoV-2** is closely related to other coronaviruses circulating in bats in Southeast Asia. Previous coronaviruses have passed through an intermediate mammal host before infecting humans; the identity of the SARS-CoV-2 intermediate host is unknown.

Early genomic analysis indicates similarity to SARS, with a suggested bat origin. Analysis of SARS-CoV-2 genomes suggests that a non-bat intermediate species is responsible for the beginning of the outbreak. The identity of the intermediate host remains unknown.

Positive samples from the South China Seafood Market strongly suggests a wildlife source, though it is possible that the virus was circulating in humans before the disease was associated with the seafood market.

SARS-CoV-2 uses the same receptor for cell entry as the SARS coronavirus that circulated in 2002/2003.

- Experiments suggest that SARS-CoV-2 Spike (S) receptor-binding domain binds the human cell receptor (ACE2) stronger than SARS, potentially explaining its high transmissibility; the same work suggests that differences between SARS-CoV-2 and SARS-CoV Spike proteins may limit the therapeutic ability of SARS antibody treatments.
- Modeling between SARS-CoV-2 Spike and ACE2 proteins suggests that SARS-CoV-2 can bind and infect human, bat, civet, monkey and swine cells.
- There is currently no evidence that SARS-CoV-2 infects domestic animals or livestock.

### Infectious Dose – How much agent will make a healthy individual ill?

**SARS-CoV-2** is passed easily between humans, likely through close contact with relatively large droplets and possibly through smaller aerosolized particles.

- Pandemic COVID-19 has caused 6,88,523 infections and 31,192 deaths in at least 173 countries and territories (as of 3/25/2020).
- There are 66,132 SARS-CoV-2 cases across 50 US states, with 947 deaths. (as of 3/25/2020)
- High-quality estimates of human transmissibility ($R_0$) range from 2.2 to 3.1.
- SARS-CoV-2 is believed to spread through close contact and droplet transmission, with fomite transmission and close-contact aerosol transmission also plausible.
- SARS-CoV-2 replicates in the upper respiratory tract (e.g., throat), and infectious virus is detectable in throat and lung tissue for at least 8 days.
- SARS-CoV-2 is present in infected patient saliva, lower respiratory sputum, and feces.
- Aerosolized virus has been detected in COVID-19 patient rooms, with particle sizes within the human respirable range (0.25 – 2.5 μm).

**Individuals can transmit SARS-CoV-2 to others before they have symptoms.**

- Pre-symptomatic or asymptomatic patients can transmit SARS-CoV-2; between 12% and 23% of infections may be caused by asymptomatic or pre-symptomatic transmission.

**Undetected cases play a major role in transmission.**

- Models suggest up to 86% of early COVID-19 cases in China were undetected, and these infections were the source for 79% of reported cases.

**Behavior changes may limit spread.**

- Social distancing and other policies are estimated to have reduced COVID-19 spread by 44% in Hong Kong.
- Non-pharmaceutical interventions (e.g., school closures, isolation) are likely required to limit transmission.

### Transmissibility – How does it spread from one host to another? How easily is it spread?

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### Host Range – How many species does it infect? Can it transfer from species to species?

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### What do we need to know?

**SARS-CoV-2 (COVID-19)**

<table>
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<th>Infectious Dose – How much agent will make a healthy individual ill?</th>
<th>Transmissibility – How does it spread from one host to another? How easily is it spread?</th>
<th>Host Range – How many species does it infect? Can it transfer from species to species?</th>
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</thead>
</table>
| Identifying the infectious dose for humans by any exposure route will facilitate model development; animal studies are a plausible surrogate.  
- Human infectious dose by aerosol route  
- Human infectious dose by surface contact (fomite)  
- Human infectious dose by fecal-oral route | Identifying the contribution of asymptomatic or pre-symptomatic transmission is important for implementing control measures. Additionally, the relative contribution of different infection sources – fomites, droplets, aerosols, and potentially feces – are unknown.  
- Capability of SARS-CoV-2 to be transmitted by contact with fomites (phones, doorknobs, surfaces, clothing, etc.) – see also Experimental Stability  
- Superspreading capacity needs to be refined  
- Updated person to person transmission rates (e.g., $R_0$) as control measures take effect  
- What is the underreporting rate?  
- Can individuals become re-infected with SARS-CoV-2?  
- What is the difference in transmissibility among countries?  
- Is the $R_0$ estimate higher in healthcare or long-term care facilities?  
- How effective are social distancing measures?  
- When will infections peak in various cities and countries? | Little is known about SARS-CoV-2 in non-human hosts.  
- What is the intermediate host(s)?  
- What are the mutations in SARS-CoV-2 that allowed human infection and transmission?  
- What animals can SARS-CoV-2 infect (e.g., pet dogs, potential wildlife reservoirs)? |
<table>
<thead>
<tr>
<th>SARS-CoV-2 (COVID-19)</th>
<th>Incubation Period – How long after infection do symptoms appear? Are people infectious during this time?</th>
<th>Clinical Presentation – What are the signs and symptoms of an infected person?</th>
<th>Clinical Diagnosis – Are there tools to diagnose infected individuals? When during infection are they effective?</th>
</tr>
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</table>
| **What do we know?**   | The majority of individuals develop symptoms within 14 days of exposure. For most people, it takes at least 2 days to develop symptoms, and on average symptoms develop 5 days after exposure. Some individuals never develop symptoms, but can still transmit disease.  
- The best current estimate of the COVID-19 incubation period is 5.1 days, with 99% of individuals exhibiting symptoms within 14 days of exposure. Fewer than 2.5% of infected individuals show symptoms sooner than 2 days after exposure.  
- The reported range of incubation periods is wide, with high-end estimates of 24, 11.3, and 18 days.  
- Individuals can test positive for COVID-19 despite lacking clinical symptoms.  
- Individuals can be infectious while asymptomatic, and asymptomatic individuals can have similar amounts of virus in their nose and throat as symptomatic individuals.  
- Infectious period is unknown, but possibly up to 10-14 days.  
- On average, there are approximately 4 to 7.5 days between symptom onset in successive cases of a single transmission chain.  
- Most individuals are admitted to the hospital within 8-14 days of symptom onset.  
- Currently, there is no evidence that recovered patients can be reinfected with SARS-CoV-2.  
- Experimentally infected macaques were not capable of being reinfected after their primary infection resolved.  
- According to the WHO, there is no evidence of re-infection with SARS-CoV-2 after recovery.  
- Patients are positive for COVID-19 via PCR for 8-37 days after symptom onset.  
- Individuals may test positive via PCR for 5-13 days after symptom recovery and hospital discharge.  
- The ability of these individuals to infect others is unknown.  
- According to the WHO, there is no evidence of re-infection with SARS-CoV-2 after recovery. Most COVID-19 cases are mild, but severe disease can be found in any age group. Older individuals and those with underlying medical conditions are at higher risk of serious illness and death.  
- The majority of COVID-19 cases are mild (81%, N = 44,000 cases)  
- Initial COVID-19 symptoms include fever (87.9% overall, but only 44% - 52% present with fever initially), cough (67.7%), fatigue, shortness of breath, headache, reduction in lymphocyte count, 42, 73  
- Headache and diarrhea are uncommon, though lack of appetite may be an early symptom.  
- Complications include acute respiratory distress (ARDS observed in 17-29% of hospitalized patients, which leads to death in 4-15% of cases), pneumonia, 106 cardiac injury, secondary infection, kidney failure, arrhythmia, sepsis, and shock.  
- Approximately 15% of hospitalized patients were classified as severe, 113 and approximately 5% of patients were admitted to the ICU.  
- Most deaths are caused by respiratory failure or respiratory failure combined with myocardial (heart) damage.  
- The case fatality rate (CFR) depends on comorbidities; cardiovascular disease, hypertension, diabetes, and respiratory conditions all increase the CFR.  
- The CFR increases with age; individuals older than 60 are at higher risk of death, though generally present with milder symptoms or no symptoms at all. Severe symptoms in children, however, are possible.  
- In the US, 34% of hospitalizations have been individuals less than 44 years old.  
- Variation in the CFR among countries may be due to demographics, testing criteria, and how COVID-19 related deaths are defined.  
- Based on one patient, a productive immune response is generated and sustained for at least 7 days.  
- Diagnosis relies on identifying the genetic signature of the virus in patient nose, throat, or sputum samples. These tests are relatively accurate, but testing rates in the US are low compared to other countries. As a result, confirmed cases are underreported.  
- PCR protocols and primers have been widely shared among international researchers.  
- PCR-based diagnostic assays are unable to differentiate between active and inactive virus.  
- A combination of pharyngeal (throat) RT-PCR and chest tomography are the most effective diagnostic criteria (correctly diagnosing 91.9% of infections).  
- Single throat swabs alone detect 78.2% of true infections, while duplicate tests identify 86.2% of infections.  
- Nasal and pharyngeal swabs may be less effective as diagnostic specimens than sputum and bronchoalveolar lavage fluid.  
- RT-PCR tests are able to identify asymptomatic cases; SARS-CoV-2 infection was identified in 2/114 individuals previously cleared by clinical assessment.  
- Combination RT-PCR and serology (antibody) testing may increase the ability to diagnose patients with mild symptoms, or identify patients at higher risk of severe disease.  
- The FDA released an Emergency Use Authorization enabling laboratories to develop and use tests in-house for patient diagnosis.  
- Updated tests from the US CDC are available to states.  
- US CDC has expanded patient testing criteria to include symptomatic patients at clinician discretion.  
- Several rapid or real-time test kits have been produced by universities and industry, including the Wuhan Institute of Virology, BGI, and Cepheid.  
- The US CDC is developing serological tests to determine what proportion of the population has been exposed to SARS-CoV-2.  
- Machine learning tools are being developed to predict severe and fatal COVID-19 cases based on CT scans. |
**SARS-CoV-2 (COVID-19)**

**What do we need to know?**

- While the incubation period is well-characterized, less is known about how long individuals are infectious before, during, and after symptoms. Additionally, the possibility of reinfection warrants more research.
- What is the average infectious period during which individuals can transmit the disease?
- Are individuals infectious after hospital discharge and clinical recovery, or are positive PCR tests only detecting non-infectious virus?
- Can individuals become re-infected after recovery? If so, how long after?

**Incubation Period – How long after infection do symptoms appear? Are people infectious during this time?**

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<tr>
<td><strong>The true case fatality rate is unknown, as the exact number of cases is uncertain. Testing priorities and case definitions vary by location.</strong></td>
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<td>- How long does it take for infected individuals to recover outside of a healthcare setting?</td>
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<td>- Are reductions in CFR through time (e.g., China) an indication of better treatment, less overcrowding, or both?</td>
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<td>- Are pregnant women at greater risk of complications during labor?</td>
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<td><strong>In general, PCR tests appear to be sensitive and specific, though robust estimates of false positive/negative rates are still lacking.</strong></td>
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<tr>
<td>- False positive/negative rates for tests</td>
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<td>- Eclipse phase of infection (time between infection and detectable disease) in an individual</td>
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<td>- With limited testing in many locations, how accurate are clinical diagnoses compared to genetic tests?</td>
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</table>
### What do we know?

**Treatment for COVID-19** is primarily supportive care including ventilation if necessary. A number of therapeutic trials are ongoing, but results are preliminary.

- Preliminary reports from several clinical trials in China suggest that favipiravir improves lung function and reduces recovery time in COVID-19 patients.
- Early results suggest that tocilizumab may be effective at treating severe COVID-19 cases.
- Some evidence suggests that chloroquine is effective at reducing symptom duration. Hydroxychloroquine in combination with azithromycin may reduce viral load in patients compared to controls.
- Combination lopinavir and ritonavir with standard care was no more effective than standard care alone.
- JHU is pursuing an Investigational New Drug (IND) approval to provide passive antibody therapy (convalescent serum) to patients, and Takeda Pharma (Japan) is working to create treatments and Gilead Sciences are ongoing, but results are unknown.

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**Therapeutics**

- Corticosteroids are commonly given to COVID-19 patients at risk of ARDS, but their use is not recommended by the US CDC.
- Regeneron Pharmaceuticals has developed potential SARS-CoV-2 antibody therapies.
- The development of a coronavirus fusion inhibitor in the lab suggests efficacy across multiple human coronaviruses.

**Work is ongoing to develop a SARS-CoV-2 vaccine in human and animal trials.** No preliminary results are available.

- Multiple entities are working to produce a SARS-CoV-2 vaccine, including NIH/NIAID, Moderna Therapeutics and Gilead Sciences, Moderna with HHS, and Sanofi with HHS. Moderna has begun phase 1 clinical vaccine trials in humans in WA state.
- CEPI has partnered with multiple entities to develop vaccines including University of Oxford, Novavax Hong Kong University, and the Institut Pasteur.

**SARS-CoV-2 can persist on surfaces for at least 3 days depending on conditions. If aerosolized, SARS-CoV-2 is stable for at least several hours.** The seasonality of COVID-19 transmission is unknown.

**SARS-CoV-2 Data**

- SARS-CoV-2 can persist on plastic and stainless steel surfaces for up to 3 days (at 21-23°C, 40% RH), with a half-life of 13-16 hours.
- SARS-CoV-2 has an aerosol half-life of 2.7 hours (particles <5 μm, tested at 21-23°C and 65% RH).
- SARS-CoV-2 genetic material (RNA) was detected in asymptomatic and symptomatic cruise ship passengers up to 17 days after cabins were vacated; the infectiousness of this material is not known.

**Surrogate Coronavirus data:**

- Studies suggest other coronaviruses can survive on non-porous surfaces up to 9-10 days (MHV, SARS-CoV) and porous surfaces for up to 3-5 days (SARS-CoV) in air conditioned environments (20-25°C, 40-50% RH).
- Coronavirus survival tends to be higher at lower temperatures and lower relative humidity (RH).
- SARS-CoV can persist with trace infectivity for up to 28 days at refrigerated temperatures (4°C) on surfaces.
- No strong evidence exists showing reduction in transmission with seasonal increase in temperature and humidity.
- One hour after aerosolization approximately 63% of airborne MERS virus remained viable in a simulated office environment (25°C, 75% RH).
- The aerosol survival of related human coronavirus (229E) was relatively high, (half-life of ~67 hours at 20°C and 50% RH), indicating ~20% of infectious virus remained after 6 days.
- Porous hospital materials, including paper and cotton cloth, maintain infectious SARS-CoV for a shorter time than non-porous material.

**Decontamination – What are effective methods to kill the agent in the environment?**

- Soap and water, as well as common alcohol and chlorine-based cleaners, hand sanitizers, and disinfectants are effective at inactivating SARS-CoV-2 on hands and surfaces.
- SARS-CoV-2
  - Twice-daily cleaning with sodium dichloroisocyanurate decontaminated surfaces in COVID-19 patient hospital rooms.
  - Alcohol-based hand rubs are effective at inactivating SARS-CoV-2.
  - EPA has released a list of SARS-CoV-2 disinfectants, but solutions were not tested on live virus.

**Other Coronaviruses**

- Chlorine-based and ethanol-based solutions are recommended.
- Heat treatment at 56°C is sufficient to kill coronaviruses, though effectiveness depends in part on amount of protein in contaminated media.
- 70% ethanol, 50% isopropanol, sodium hypochlorite [bleach, 200 ppm], and UV radiation are effective at inactivating several coronaviruses (MHV and CCV).
- Ethanol-based biocides are effective disinfectants against coronaviruses dried on surfaces, including ethanol containing gels similar to hand sanitizer.

**Other Coronaviruses**

- Surface spray disinfectants such as Mikrobac, Dismozon, and Korsolex are effective at reducing infectivity of the closely related SARS-CoV after 30 minutes of contact.
- Coronaviruses may be resistant to thermal inactivation for up to 7 days when stabilized in stool.
- Additionally, coronaviruses are more stable in matrices such as respiratory sputum.
- Hydrogen peroxide vapor was found to be effective with repeated decontamination of N95 respirators.
### What do we need to know?

**Medical Treatment – Are there effective treatments? Vaccines?**
- In general, the efficacy of various therapeutic options for COVID-19 is unknown, though clinical trial results are beginning to be released.
  - Is GS-5734 (remdesivir) effective in vivo (already used in clinical trials under Emergency Use Authorization)?
  - Is the GLS-5000 MERS vaccine cross-reactive against SARS-CoV-2?
  - Efficacy of antibody treatments developed for SARS and MERS?
  - What is the efficacy of various MERS and SARS Phase I/II vaccines and other therapeutics?
  - Are viral replicase inhibitors such as beta-D-N4-hydroxycytidine effective against SARS-CoV-2?

**Environmental Stability – How long does the agent live in the environment?**
- Additional testing on SARS-CoV-2, not surrogate viruses, is needed to support initial estimates of stability.
  - Stability of SARS-CoV-2 in aerosol, droplets, and other matrices (mucus/sputum, feces)
  - Particle size distribution (e.g., droplet, large droplet and true aerosol distribution)
  - Duration of SARS-CoV-2 infectivity via fomites and surface (contact hazard)?
  - Stability of SARS-CoV-2 on PPE (e.g., Tyvek, nitrile, etc.)

**Decontamination – What are effective methods to kill the agent in the environment?**
- Additional decontamination studies, particularly with regard to PPE and other items in short supply, are needed.
  - What is the minimal contact time for disinfectants?
  - Does contamination with human fluids/waste alter disinfectant efficacy profiles?
  - How effective is air filtration at reducing transmission in healthcare, airplanes and public spaces?
  - Are landfills and wastewater treatment plant processes effective at inactivating SARS-CoV-2?
### What do we know?

The effectiveness of PPE for SARS-CoV-2 is currently unknown, and data from other related coronaviruses are used for guidance. Healthcare workers are at high risk of acquiring COVID-19, even with recommended PPE.

- Healthcare worker illnesses (over 1,000) demonstrates human-to-human transmission despite isolation, PPE, and infection control.
- Risk of transmission to healthcare workers appears high, with up to 20% of healthcare workers in Lombardy, Italy becoming infected.
- US CDC does not recommend the use of facemasks for healthy people. Facemasks should be used by people showing symptoms to reduce the risk of others getting infected. The use of facemasks is crucial for health workers and people in close contact with infected patients (at home or in a health care facility).
- “Healthcare personnel entering the room of SARS-CoV-2 patients should use standard precautions, contact precautions, airborne precautions, and use eye protection (e.g., goggles or a face shield).”
- WHO indicates healthcare workers should wear clean long-sleeve gowns as well as gloves.
- Respirators (NIOSH-certified N95, EUFPP2 or equivalent) are recommended for those dealing with possible aerosols.
- Additional protection, such as a Powered Air Purifying Respirator (PAPR) with a full hood, should be considered for high-risk procedures (i.e., intubation, ventilation).
- Particular attention should be paid to the possibility of transmission via exhaled air during supportive respiratory procedures.
- Despite extensive environmental contamination, air sampling in patient rooms did not detect SARS-CoV-2 RNA (but detected RNA in other rooms).
- The efficacy of “homemade” PPE, made with T-shirts, bandanas, similar materials, is less than standard PPE, but may be used if no other options are available.

### Forensics – Natural vs Intentional use? Tests to be used for attribution.

All current evidence supports the natural emergence of SARS-CoV-2 via a bat and possible intermediate mammal species.

- Genomic analysis places SARS-CoV-2 into the betacoronavirus clade, with close relationship to bat viruses. The SARS-CoV-2 virus is distinct from SARS and MERS viruses.
- Genomic analysis suggests that SARS-CoV-2 is a natural variant, and is therefore unlikely to be human-derived or otherwise created by “recombination” with other circulating strains of coronavirus.
- Some genomic evidence indicates a close relationship with pangolin coronaviruses; data suggests that pangolins may be a natural host for beta-coronaviruses. Additional research is needed.
- Genomic data support at least two plausible origins of SARS-CoV-2: (i) natural selection in a non-human animal host prior to zoonotic transfer, and (ii) natural selection in humans following zoonotic transfer.
- Either scenario is consistent with the observed genetic changes found in all known SARS-CoV-2 isolates.
- Additionally, “[…] SARS-CoV-2 is not derived from any previously used virus backbone,” reducing the likelihood of laboratory origin, and “[…] genomic evidence does not support the idea that SARS-CoV-2 is a laboratory construct, [though] it is currently impossible to prove or disprove the other theories of its origin.”

### Genomics – How does the disease agent compare to previous strains?

Current evidence suggests that SARS-CoV-2 accumulates mutations at a similar rate as other coronaviruses. Mutations and deletions in specific portions of the SARS-CoV-2 genome have not been linked to any changes in transmission or disease severity.

- There have been no documented cases of SARS-CoV-2 prior to December 2019.
- Preliminary genomic analyses, however, suggest that the first human cases of SARS-CoV-2 emerged between 10/19/2019 – 12/17/2019.
- The mutation rate of SARS-CoV-2 is estimated to be similar to other RNA viruses (e.g., SARS, Ebola, Zika), and is currently calculated to be 1.04x10^{-2} substitutions per site per year (N = 116 genomes).
- Preliminary phylogenetic analysis identified a very close genetic similarity between SARS-CoV-2 and a Bat coronavirus (RaTG13) isolated from Yunnan Province, China; suggesting that SARS-CoV-2 originated from bats.
- Pangolin coronaviruses are closely related to both SARS-CoV-2 and the closely related Bat coronavirus (RaTG13); phylogenetic analysis suggested that SARS-CoV-2 is of bat origin, but is closely related to pangolin coronavirus.
- The Spike protein of SARS-CoV-2, which mediates entry into host cells and is the major determinant of host range, is very similar to the Spike protein of SARS-CoV. The rest of the genome is more closely related to two separate bat and pangolin coronavirus.
- Analysis of SARS-CoV-2 sequences from Singapore has identified a large nucleotide (382 bp) deletion in ORF-8 that may result in an attenuated (less virulent) phenotype.
### SARS-CoV-2 (COVID-19)

**Required Information for Effective Infectious Disease Outbreak Response**

**Updated 3/25/2020**

#### What do we need to know?

<table>
<thead>
<tr>
<th>SARS-CoV-2 (COVID-19)</th>
<th>PPE – What PPE is effective, and who should be using it?</th>
<th>Forensics – Natural vs intentional use? Tests to be used for attribution.</th>
<th>Genomics – How does the disease agent compare to previous strains?</th>
</tr>
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</table>
| Most PPE recommendations have not been made on SARS-CoV-2 data, and comparative efficacy of different PPE for different tasks (e.g., intubation) is unknown. Identification of efficacious PPE for healthcare worker is critical due to their high rates of infection. | Identifying the intermediate species between bats and humans would aid in reducing potential spillover from a natural source.  
- What tests for attribution exist for coronavirus emergence?  
- What is the identity of the intermediate species?  
- Are there closely related circulating coronaviruses in bats or other animals with the novel PRRA cleavage site found in SARS-CoV-2? | Research linking genetic changes to differences in phenotype (e.g., transmissibility, virulence, progression in patients) is needed.  
- Are there similar genomic differences in the progression of coronavirus strains from bat to intermediate species to human?  
- Are there different strains or clades of circulating virus? If so, do they differ in virulence? |
| What is the importance of aerosol transmission?  
What is the effective distance of spread via droplet or aerosol?  
How effective are barriers such as N95 respirators or surgical masks?  
What is the appropriate PPE for first responders? Airport screeners?  
What are proper procedures for reducing spread in medical facilities / transmission rate in medical settings?  
How effective are homemade masks at reducing transmission? | | |

**CLEARED FOR PUBLIC RELEASE**
### Table 1. Definitions of commonly-used acronyms

<table>
<thead>
<tr>
<th>Acronym/Term</th>
<th>Definition</th>
<th>Description</th>
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<tbody>
<tr>
<td>Attack rate</td>
<td>Proportion of “at-risk” individuals who develop infection</td>
<td>Defined in terms of “at-risk” population such as schools or households, defines the proportion of individuals in those populations who become infected after contact with an infectious individual</td>
</tr>
<tr>
<td>SARS-CoV-2</td>
<td>Severe acute respiratory syndrome coronavirus 2</td>
<td>Official name for the virus previously known as 2019-nCoV.</td>
</tr>
<tr>
<td>COVID-19</td>
<td>Coronavirus disease 19</td>
<td>Official name for the disease caused by the SARS-CoV-2 virus.</td>
</tr>
<tr>
<td>CFR</td>
<td>Case Fatality Rate</td>
<td>Number of deaths divided by confirmed patients</td>
</tr>
<tr>
<td>PFU</td>
<td>Plaque forming unit</td>
<td>Measurement of the number of infectious virus particles as determined by plaque forming assay. A measurement of sample infectivity.</td>
</tr>
<tr>
<td>TCID&lt;sub&gt;50&lt;/sub&gt;</td>
<td>50% Tissue Culture Infectious Dose</td>
<td>The number of infectious units which will infect 50% of tissue culture monolayers. A measurement of sample infectivity.</td>
</tr>
<tr>
<td>HCW</td>
<td>Healthcare worker</td>
<td>Doctors, nurses, technicians dealing with patients or samples</td>
</tr>
<tr>
<td>SARS</td>
<td>Severe Acute Respiratory Syndrome</td>
<td>Coronavirus with over 8,000 cases in global 2002-2003 outbreak</td>
</tr>
<tr>
<td>MERS</td>
<td>Middle-East Respiratory Syndrome</td>
<td>Coronavirus with over 2,000 cases in regional outbreak since 2012</td>
</tr>
<tr>
<td>CoV</td>
<td>Coronavirus</td>
<td>Virus typified by crown-like structures when viewed under electron microscope</td>
</tr>
<tr>
<td>R&lt;sub&gt;0&lt;/sub&gt;</td>
<td>Basic reproduction number</td>
<td>A measure of transmissibility. Specifically, the average number of new infections caused by a typical infectious individual in a wholly susceptible population.</td>
</tr>
<tr>
<td>MHV</td>
<td>Mouse hepatitis virus</td>
<td>Coronavirus surrogate</td>
</tr>
<tr>
<td><strong>CCV</strong></td>
<td>Canine coronavirus</td>
<td>Canine coronavirus</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Fomite</td>
<td>Inanimate vector of disease</td>
<td>Surfaces such as hospital beds, doorknobs, healthcare worker gowns, faucets, etc.</td>
</tr>
<tr>
<td>Droplet transmission</td>
<td>Sneezing, coughing</td>
<td>Transmission via droplets requires relatively close contact (e.g., within 6 feet)</td>
</tr>
<tr>
<td>Airborne transmission</td>
<td>Aerosolization of infectious particles</td>
<td>Aerosolized particles can spread for long distances (e.g., between hospital rooms via HVAC systems)</td>
</tr>
<tr>
<td>Transgenic</td>
<td>Genetically modified</td>
<td>In this case, animal models modified to be more susceptible to MERS and/or SARS by adding proteins or receptors necessary for infection</td>
</tr>
<tr>
<td>Intranasal</td>
<td>Agent deposited into external nares of subject</td>
<td>Simulates inhalation exposure by depositing liquid solution of pathogen/virus into the nose of a test animal, where it is then taken up by the respiratory system.</td>
</tr>
<tr>
<td>Incubation period</td>
<td>Time between infection and symptom onset</td>
<td>Time between infection and onset of symptoms typically establishes guidelines for isolating patients before transmission is possible</td>
</tr>
<tr>
<td>Infectious period</td>
<td>Length of time an individual can transmit infection to others</td>
<td>Reducing the infectious period is a key method of reducing overall transmission; hospitalization, isolation, and quarantine are all effective methods</td>
</tr>
<tr>
<td>Serial interval</td>
<td>Length of time between symptom onset of successive cases in a transmission chain</td>
<td>The serial interval can be used to estimate $R_0$, and is useful for estimating the rate of outbreak spread</td>
</tr>
<tr>
<td>Superspreading</td>
<td>One individual responsible for an abnormally large number of secondary infections</td>
<td>Superspreading can be caused by high variance in the distribution of secondary cases caused by a single individual; most individuals infect very few people, while some infect a large number, even with the same average number of secondary infections</td>
</tr>
<tr>
<td>Nosocomial</td>
<td>Healthcare- or hospital-associated infections</td>
<td>Characteristic of SARS and MERS outbreaks, lead to refinement of infection control procedures</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ACE2</td>
<td>Angiotensin-converting enzyme 2</td>
<td>Acts as a receptor for SARS-CoV, allowing entry into human cells</td>
</tr>
<tr>
<td>ARDS</td>
<td>Acute respiratory distress syndrome</td>
<td>Leakage of fluid into the lungs which inhibits respiration and leads to death</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal protective equipment</td>
<td>Gowns, masks, gloves, and any other measures used to prevent spread between individuals</td>
</tr>
<tr>
<td>PCR</td>
<td>Polymerase chain reaction</td>
<td>PCR (or real-time [RT] or quantitative [Q] PCR) is a method of increasing the amount of genetic material in a sample, which is then used for diagnostic testing to confirm the presence of SARS-CoV-2</td>
</tr>
</tbody>
</table>
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