SARS-CoV-2 (COVID-19)	**Infectious dose – how much agent will make a normal individual ill?**	**Transmissibility – How does it spread from one host to another? How easily is it spread?**	**Host range – how many species does it infect? Can it transfer from species to species?**	**Incubation period – how long after infection do symptoms appear? Are people infectious during this time?**
What do we know?	• The human infectious dose for novel Wuhan coronavirus (SARS-CoV-2), which causes coronavirus disease 19 (COVID-19) is currently unknown via all exposure routes. Severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) coronaviruses (CoV) are used as surrogates. • The infectious dose for SARS in mice is estimated to be between 67-540 PFU (average 240 PFU, intranasal route).[50-51] • Genetically modified mice exposed intranasally to doses of MERS virus between 100 and 500,000 PFU show signs of infection. Infection with higher doses result in severe syndromes.[5, 41, 73, 129] • Initial experiments suggest that SARS-CoV-2 can infect genetically modified mice containing the human ACE2 cell entry receptor. Infection via the intranasal route (dose: 10^5 $TCID_{50}$) causes light infection, however no virus was isolated from infected animals, and PCR primers used in the study do not align well with SARS-CoV-2, casting doubt on this study.[11]	• The WHO has declared SARS-CoV-2 a Public Health Emergency of International Concern[116] with 95,124 cases and 3,254 deaths[68] in 75 countries (as of 3/4/2020).[22, 96, 114] • High-quality estimates of human transmissibility (R_0) range from 2.2 to 3.1[80, 86, 91, 120, 128] • Large outbreaks are occurring in Japan, Italy, Iran, South Korea, Germany France, and Spain.[110] • There are 153 SARS-CoV-2 cases across 15 US states, with 11 deaths. (as of 3/4/2020).[68] • Sustained transmission may have been occurring in the US (Seattle) for up to 5 or 6 weeks.[14] • SARS-CoV-2 transmission has occurred in hospitals inside[108] and outside of China,[58] including the US.[17] • Pre-symptomatic[130] or asymptomatic[10] patients in China can transmit SARS-CoV-2; the degree of asymptomatic transmission is still unknown. • SARS-CoV-2 is believed to spread through close contact and droplet transmission.[30] • Viable SARS-CoV-2 has been isolated from human feces; fecal-oral transmission is possible.[81, 124, 127] • Transmission via fomites has not been confirmed for SARS-CoV-2, but occurred in prior SARS[40, 121] and MERS[70] outbreaks • SARS-CoV-2 is consistently present in infected patient saliva[104] • Infants have been diagnosed with COVID-19, but no evidence exists for vertical transmission via intrauterine infection or through breastmilk.[38, 109] • China reports no evidence of super-spreading events (SSEs) within hospital patients or staff.[101]	• Early genomic analysis indicates similarity to SARS,[132] with a suggested bat origin.[5,42, 132] • Analysis of SARS-CoV-2 genomes suggests that a non-bat intermediate species is responsible for the beginning of the outbreak.[92] Although the identity of the intermediate species remains unconfirmed, pangolins may be a natural host of related viruses possibly including SARS-CoV-2.[76-77] • Positive samples from the South China Seafood Market strongly suggests a wildlife source,[32] though it is possible that the virus was circulating in humans before the disease was associated with the seafood market.[15, 43, 122, 126] • Experiments suggest that SARS-CoV-2 Spike (S) receptor-binding domain binds the human cell receptor (ACE2) stronger than SARS,[119] 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.[119] • 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.[107]	• A study of 1,099 COVID-19 patients found a median incubation period of 3 days, with a range from 0 to 24 days.[57] • Earlier estimates of the incubation period from confirmed cases were higher; 5.8 days with a range from 1.3 to 11.3 days,[9] and 5.2 days with an upper bound of 9.2-18 days.[75] • CDC estimates that the incubation period is between 2 and 14 days [27, 31] • Asymptomatic infection has been documented, where individuals do not present with clinical symptoms but are found positive via diagnostic assay.[10, 34, 57, 101, 130] • Individuals can be infectious while asymptomatic,[30, 93, 101, 130] and asymptomatic individuals have about the same amount of virus in their nose and throat as symptomatic individuals.[133] • Infectious period is unknown, but possibly up to 10-14 days [4, 96] • On average, there are 7.5 days between symptom onset in successive cases of a single transmission chain (i.e., the serial interval).[75] • The average time for individuals to first seek medical care decreased from 5.8 days after symptom onset to 4.6 days before and after January 1st, 2020, respectively, indicating an increase in seeking care behavior.[75] • China recommends 14 quarantine for *recovered* patients due to positive genetic tests days after leaving the hospital, raising the possibility of continued transmission after symptoms subside.[64]

SARS-CoV-2 (COVID-19)	Infectious dose – how much agent will make a normal individual ill?	Transmissibility – How does it spread from one host to another? How easily is it spread?	Host range – how many species does it infect? Can it transfer from species to species?	Incubation period – how long after infection do symptoms appear? Are people infectious during this time?
What do we need to know?	• Human infectious dose by aerosol route • Human infectious dose by surface contact (fomite) • Human infectious dose by fecal-oral route • Where does SARS-CoV-2 replicate in the respiratory tract?	• Capability of SARS-CoV-2 to be transmitted by contact with fomites (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 • Tendency for ill individuals to seek medical care due to symptoms • What is the underreporting rate?[67] • Can individuals become re-infected with SARS-CoV-2? • What is the difference in transmissibility among countries? • Is the R0 estimate higher in healthcare or long-term care facilities? • How effective are social distancing measures at reducing spread?	• 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)?	• How early does asymptomatic transmission begin? • What is the average infectious period during which individuals can transmit the disease? • How long do patients continue to shed infectious virus after physical recovery? • Can individuals become re-infected after recovery? If so, how long after?
Who is doing experiments/has capabilities in this area?	*Capable of performing work* - DHS National Biodefense Analysis and Countermeasures Center (NBACC)	*Performing work:* - Christian Althaus (Bern) - Neil Ferguson (MRC) - Gabriel Leung, Joseph Wu (University of Hong Kong) - Sara Del Valle (Los Alamos) - Maimuna Majumder (Boston Children's Hospital) - Trevor Bedford (Fred Hutchinson Cancer Center) - Sang Woo Park (Princeton)	*Capable of performing work:* - Vincent Munster (Rocky Mountain National Laboratory) - Matthew Frieman (University of Maryland Baltimore) - Ralph Baric (University of North Carolina) - Stanley Perlman (University of Iowa) - Susan Baker (Loyola University Chicago) - Mark Denison (Vanderbilt University) - Vineet Menachery (University of Texas Medical Branch) - Jason McLellan, Daniel Wrapp, Nianshuang Wang (University of Texas) - David O'Conner (U. Wisconsin, Madison)	*Performing work:* - Chaolin Huang (Jin Yin-tan Hospital, Wuhan, China) - The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team

SARS-CoV-2 (COVID-19)	Clinical presentation – what are the signs and symptoms of an infected person?	Clinical diagnosis – are there tools to diagnose infected individuals? When during infection are they effective?	Medical treatment – are there effective treatments? Vaccines?	Environmental stability – how long does the agent live in the environment?
What do we know?	• The majority of COVID-19 cases are mild (81%, N = 44,000 cases)[101] • Initial COVID-19 symptoms include fever (87.9% overall, but only 43.8% present with fever initially[57]), cough (67.7%[57]), fatigue, shortness of breath, headache, reduction in lymphocyte count.[31, 37, 63] Headache[36] and diarrhea are uncommon[63, 74] • Complications include acute respiratory distress (ARDS) observed in 17-29% of hospitalized patients,[39, 62] which leads to death in 4-15% of cases.[39, 63, 108] • Other complications include pneumonia (characteristic ground glass opacities[84]), acute cardiac injury, secondary infection, kidney failure, arrhythmia, and shock.[57,63,108] • Approximately 15% of hospitalized patients were classified as severe,[57, 101] and severe cases were older and more likely to have underlying disorders[57, 108]; approximately 5% of patients were admitted to the ICU.[57, 101] • Between 23-32% of cases that include pneumonia required intensive respiratory support.[63, 108] • Overactive immune cells may contribute to symptom severity.[123] • Approximately 1% of hospitalizations occur in children < 19 years old.[57, 101] • The case fatality rate (CFR) depends on patient comorbidities; no comorbidities = 0.9%, cardiovascular disease = 10.5%, diabetes = 7.3%, chronic respiratory disease = 6.3%, hypertension = 6.0%, cancer = 5.6%.[101] • The CFR is age-dependent; ≥80 years old = 14.8%, 70-79 = 8.0%, 60-69 = 3.6%, 50-59 = 1.3%, 40-49 = 0.4%, 10-39 = 0.2%, 0-9 = 0%.[101] • 63.8% of confirmed fatalities have been male.[101]	• Updated tests from the US CDC are available to states.[21, 30] • The FDA released an Emergency Use Authorization describing an accelerated policy enabling laboratories to develop and use tests in-house for patient diagnosis.[56] • The US has relaxed criteria for testing patients, no longer requires travel history or close contact with known case.[13] • US CDC has expanded patient testing criteria to include symptomatic patients at Clinician discretion.[13] CDC recommends that testing decisions should be based on local transmission, travel history, patient clinical course, close contact with infected patients, and occupational risk (e.g., Health Care Workers).[24] • SARS-CoV-2 is consistently present in infected patient saliva, suggesting that saliva may be an effective diagnostic specimen.[104] • Several RT-PCR assays have been developed to detect SARS-CoV-2 in humans.[1, 46, 113, 115] • PCR protocols and primers have been widely shared among international researchers.[21, 47, 75, 99, 111, 115] • Several rapid or real-time test kits have been produced by universities and industry, including the Wuhan Institute of Virology,[49] BGI,[16] and Cepheid.[106] • RT-PCR tests are able to identify asymptomatic cases; SARS-CoV-2 infection was identified in 2/114 individuals previously cleared by clinical assessment.[61]	• Treatment for COVID-19 is primarily supportive care including oxygen and mechanical ventilation,[29] though China has released a treatment plan[8]; over 80 clinical trials are set to run on various treatments in China.[82] • Efficacy antivirals (lopinavir, ritonavir, ribavirin, oseltamivir) is unknown[8]; however several therapeutics [Remdesivir[98] and chloroquine] inhibit SARS-CoV-2 infection in human cells *in vitro*[38] and are undergoing clinical trials in China[49] and the US.[2-3, 83] • Multiple entities are working to produce a SARS-CoV-2 vaccine, including NIH/NIAID,[59, 72] Moderna Therapeutics and Gilead Sciences,[2-3, 83] and Sanofi with HHS.[18] • The hospitalized case-fatality rate in China has decreased from 14.4% to 0.8% as of between December, 2019 and February, 2020,[101] suggesting improved treatment or increased capacity • Approximately 38% of COVID-19 patients in China received oxygen therapy, 6.1% received mechanical ventilation, 57.5% received IV antibiotics, and 35.8% received the antiviral oseltamivir.[57] • A clinical report (one patient) suggested that corticosteroids should be considered for severe patients to prevent ARDS.[123] However, US CDC recommends avoiding steroid use due to an increase in viral replication in MERS patients.[25] • Similarity in the spike proteins of SARS-CoV-2 and SARS-CoV might offer target for therapeutics,[44, 52, 71, 119, 132] as vaccines derived from spike proteins are effective at inhibiting MERS symptoms in mice.[41]	• No information yet exists regarding the environmental stability of SARS-CoV-2; SARS and MERS coronaviruses are used as surrogates instead. • Studies suggest that coronavirus can survive on non-porous surfaces up to 9-10 days (MHV, SARS-CoV)[20, 35], and porous surfaces for up to 3-5 days (SARS-CoV)[54] in air conditioned environments (20-25°C, 40-50% RH) • Coronavirus survival tends to be higher at lower temperatures and lower relative humidity (RH),[20, 35, 89, 105] though infectious virus can persist on surfaces for several days in typical office or hospital conditions[105] • SARS can persist with trace infectivity for up to 28 days at refrigerated temperatures (4°C) on surfaces.[20] • Beta-coronaviruses (e.g., SARS-CoV) may be more stable than alpha-coronaviruses (HCoV-229E).[89] • No strong evidence for reduction in transmission with seasonal increase in temperature and humidity.[79] • Survival of SARS-CoV-2 specifically is unknown, and surrogate coronavirus data need to be used at this time. • One hour after aerosolization approximately 63% of airborne MERS virus remained viable in a simulated office environment (25°C, 75% RH)[87] • 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.[66] Both higher and lower RH reduced HCoV-229E survival; lower temperatures improved survival.[66]

SARS-CoV-2 (COVID-19)	Clinical presentation – what are the signs and symptoms of an infected person?	Clinical diagnosis – are there tools to diagnose infected individuals? When during infection are they effective?	Medical treatment – are there effective treatments? Vaccines?	Environmental stability – how long does the agent live in the environment?
What do we need to know?	• How long does it take for infected individuals to recover outside of a healthcare setting? • How does the CFR vary between countries? • Is the reduction in CFR through time an indication of better treatment, less overcrowding, or both?	• False positive/negative rates for tests • Eclipse phase of infection (time between infection and detectable disease) in an individual	• Is GS-5734 (remdesivir) effective in vivo (already used in clinical trials under Emergency Use Authorization)?[97] • Is the GLS-5000 MERS vaccine[125] cross-reactive against SARS-CoV-2? • Efficacy of antibody treatments developed for SARS[48, 100] and MERS[33] • 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?[12]	• Stability of SARS-CoV-2 in aerosol, droplets, and other matrices (mucus/sputum, feces) • "Hang time' of the virus in air (Aerosol decay rate) • 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.)
Who is doing experiments/has capabilities in this area?	- Jin Yin-tan Hospital, Wuhan, China - China-Japan Friendship Hospital, Beijing, China - Peking Union Medical College, Beijing, China - Capital Medical University, Beijing, China - Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China - Huazhong University of Science and Technology, Wuhan, China - The Central Hospital of Wuhan, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China - Tsinghua University School of Medicine, Beijing, China - Zhongnan Hospital of Wuhan University, Wuhan, China - Peking University First Hospital, Beijing, China - Peking University People's Hospital, Beijing, China - Tsinghua University-Peking University Joint Center for Life Sciences, Beijing, China - The Fifth Medical Center of PLA General Hospital, Beijing, China	*Performing work:* - CDC - Wuhan Institute of Virology - Public Health Agency of Canada - Doherty Institute of Australia - Cepheid - BGI	*Performing work:* - Peter Doherty Institute for Infection and Immunity - Academy of Military Medical Sciences, Beijing, China - Tim Sheahan (University of North Carolina) *Capable of performing work:* - Ralph Baric (University of North Carolina) - Matthew Frieman (University of Maryland Baltimore) - Sanofi, with BARDA - Janssen Pharma and BARDA[60] *Funded work:* CEPI ($12 million to three groups): - Moderna and NIAID for mRNA platform vaccine - Inovio preparing DNA vaccine (for MERS) - University of Queensland, Australia NIAID/NIH: - Moderna and Kaiser Permanente for mRNA vaccine Phase I trial.[3] - University of Nebraska Medical Center Trial (multiple therapeutics including Gilead's Remdesivir).[2]	*Capable of performing work*: - Mark Sobsey (University of North Carolina) - DHS National Biodefense Analysis and Countermeasures Center (NBACC) - Defence Science and Technology Laboratory (Dstl) - Public Health Agency of Canada - CDC - EPA - NIH

SARS-CoV-2 (COVID-19)	Decontamination – what are effective methods to kill the agent in the environment?	PPE – what PPE is effective, and who should be using it?	Forensics – natural vs intentional use? Tests to be used for attribution.	Genomics – how does the disease agent compare to previous strains?
What do we know?	• No decontamination data for SARS-CoV-2 have been identified. SARS-CoV provides a plausible surrogate, as it is a close genetic relative of SARS-CoV-2 in the beta-coronavirus clade. • Chlorine-based[113] and ethanol-based[45] solutions recommended, and the European CDC has released disinfectant guidelines for non-healthcare facilities.[55] • "The virus [SARS-CoV-2] has relatively weak viability *in vitro* and can be inactivated at 56 ° C for 30 minutes. Chlorine-containing disinfectants and 75% ethanol can effectively inactivate the virus."[131] • Heat treatment at 56°C is sufficient to kill coronaviruses,[89, 131] though effectiveness depends in part on amount of protein in contaminated media[89] • 70% ethanol, 50% isopropanol, sodium hypochlorite [bleach, 200 ppm], and UV radiation are effective at inactivating several coronaviruses (MHV and CCV)[94] • Ethanol-based biocides (including ethanol-containing gels) are effective disinfectants against coronaviruses dried on surfaces, including ethanol containing gels similar to hand sanitizer.[65, 117] • 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.[88] • Coronaviruses may be resistant to thermal inactivation for up to 7 days when stabilized in stool.[102-103] • Additionally, coronaviruses are more stable in matrixes such as respiratory sputum.[53]	• PPE effectiveness for SARS-CoV-2 is currently unknown; SARS is used as a surrogate. • US CDC does not recommend the use of face masks for healthy people. Face masks should be used by people showing symptoms to reduce the risk of others getting infected. The use of face masks is crucial for health workers and people in close contact with infected patients (at home or in a health care facility).[23] • "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)"[28] • WHO indicates healthcare workers should wear clean, non-sterile, long-sleeve gowns as well as gloves.[112] • Respirators (NIOSH-certified N95, EUFFP2 or equivalent) are recommended for those dealing with possible aerosols[113] • 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)[19] • Healthcare worker illnesses (over 1,000[101]) demonstrates human-to-human transmission despite isolation, PPE, and infection control.[95] • Porous hospital materials, including paper and cotton cloth, maintain infectious SARS-CoV for a shorter time than non-porous material.[69] • CDC recommends face masks for individuals attempting to prevent spread of SARS-CoV-2 in the home.[26]	• Genomic analysis places SARS-CoV-2 into the beta-coronavirus clade, with close relationship to bat viruses. The SARS-CoV-2 virus is distinct from SARS and MERS viruses.[52] • Genomic analysis suggest 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.[6, 132] • Some genomic evidence indicates a close relationship with pangolin coronaviruses[118]; data suggests that pangolins may be a natural host for beta-coronaviruses [76-77]. 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."[6] Either scenario is consistent 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 origination,[6] 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."[6]	• 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.[7, 15, 90] • 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 between 3.29×10^{-4} – 2.03×10^{-3} substitutions per site per year (median 1.07×10^{-3}),[7] though this estimate may change as more genomes are sequenced. • 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.[85] • 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.[76-77] • 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.[78] The rest of the genome is more closely related to two separate bat [78] and pangolin[77] coronavirus. • Protein modeling and preliminary laboratory studies suggest that SARS-CoV-2 binds to the human ACE2 receptor,[107, 119] the same cellular entry receptor used by SARS and other beta-coronaviruses.

SARS-CoV-2 (COVID-19)	**Decontamination – what are effective methods to kill the agent in the environment?**	**PPE – what PPE is effective, and who should be using it?**	**Forensics – natural vs intentional use? Tests to be used for attribution.**	**Genomics – how does the disease agent compare to previous strains?**
What do we need to know?	• What is the minimal contact time for disinfectants? • Are antiseptic wipes effective for cleaning hard, non-porous surfaces? • Does contamination with human fluids/waste alter disinfectant efficacy profiles? • How effective is air filtration at reducing transmission in healthcare, airplanes and public spaces?	• Mode of aerosol transmission? Effective distance of spread via droplet or aerosol? • Is virus detectable in aerosol samples from patient rooms? • How effective are barriers such as N95 respirators or surgical masks? • What is the appropriate PPE for first responders? • What are the proper procedures for reducing spread in medical facilities / transmission rate in medical settings?	• 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?	• 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?
Who is doing experiments/has capabilities in this area?	*Capable of performing work*: - DHS National Biodefense Analysis and Countermeasures Center (NBACC)	*Generating recommendations:* - WHO - CDC - Pan-American Health Organization	*Performing genomic investigations:* - Kristian Andersen, Andrew Rambaut, Ian Lipkin, Edward Holmes, Robert Garry (Scripps, University of Edinburgh, Columbia University, University of Sydney, Tulane, Zalgen Labs [Germantown, MD]) *Capable of performing work:* - Pacific Northwest National Laboratory - DHS National Biodefense Analysis and Countermeasures Center (NBACC)	*Performing work:* - Trevor Bedford (Fred Hutchinson Cancer Research Center) - Ralph Baric, UNC - National Institute for Viral Disease Control and Prevention, Chinese Center for Disease Control and Prevention - Shandong First Medical University and Shandong Academy of Medical Sciences - Hubei Provincial Center for Disease Control and Prevention - Chinese Academy of Sciences - BGI PathoGenesis Pharmaceutical Technology, Shenzhen, China - People's Liberation Army General Hospital, Wuhan, China - Wenzhou Medical University, Wenzhou, China - University of Sydney, Sydney, NSW, Australia - The First Affiliated Hospital of Shandong First Medical University (Shandong Provincial Qianfoshan Hospital), Jinan, China

Table 1. Definitions of commonly-used acronyms

Acronym/Term	Definition	Description
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2	Official name for the virus previously known as 2019-nCoV.
COVID-19	Coronavirus disease 19	Official name for the disease caused by the SARS-CoV-2 virus.
CFR	Case Fatality Rate	Number of deaths divided by confirmed patients
PFU	Plaque forming unit	Measurement of the number of infectious virus particles as determined by plaque forming assay. A measurement of sample infectivity.
$TCID_{50}$	50% Tissue Culture Infectious Dose	The number of infectious units which will infect 50% of tissue culture monolayers. A measurement of sample infectivity.
HCW	Healthcare worker	Doctors, nurses, technicians dealing with patients or samples
SARS	Severe Acute Respiratory Syndrome	Coronavirus with over 8,000 cases in global 2002-2003 outbreak
MERS	Middle-East Respiratory Syndrome	Coronavirus with over 2,000 cases in regional outbreak since 2012
CoV	Coronavirus	Virus typified by crown-like structures when viewed under electron microscope
R_0	Basic reproduction number	A measure of transmissibility. Specifically, the average number of new infections caused by a typical infectious individual in a wholly susceptible population.
MHV	Mouse hepatitis virus	Coronavirus surrogate
CCV	Canine coronavirus	Canine coronavirus
Fomite	Inanimate vector of disease	Surfaces such as hospital beds, doorknobs, healthcare worker gowns, faucets, etc.

Droplet transmission	Sneezing, coughing	Transmission via droplets requires relatively close contact (e.g., within 6 feet)
Airborne transmission	Aerosolization of infectious particles	Aerosolized particles can spread for long distances (e.g., between hospital rooms via HVAC systems)
Transgenic	Genetically modified	In this case, animal models modified to be more susceptible to MERS and/or SARS by adding proteins or receptors necessary for infection
Intranasal	Agent deposited into external nares of subject	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.
Incubation period	Time between infection and symptom onset	Time between infection and onset of symptoms typically establishes guidelines for isolating patients before transmission is possible
Infectious period	Length of time an individual can transmit infection to others	Reducing the infectious period is a key method of reducing overall transmission; hospitalization, isolation, and quarantine are all effective methods
Serial interval	Length of time between symptom onset of successive cases in a transmission chain	The serial interval can be used to estimate R_0, and is useful for estimating the rate of outbreak spread
Superspreading	One individual responsible for an abnormally large number of secondary infections	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
Nosocomial	Healthcare- or hospital-associated infections	Characteristic of SARS and MERS outbreaks, lead to refinement of infection control procedures
ACE2	Angiotensin-converting enzyme 2	Acts as a receptor for SARS-CoV, allowing entry into human cells

ARDS	Acute respiratory distress syndrome	Leakage of fluid into the lungs which inhibits respiration and leads to death
PPE	Personal protective equipment	Gowns, masks, gloves, and any other measures used to prevent spread between individuals

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