# COVID-19 Key metrics based on the latest available science – as of 19 June 2020

## Projections using RTSL calculator (19 June 2020)

These projections come from our calculator, which provides a quick rough estimate of total COVID-19 cases in a population based on the number of COVID-19-related deaths. Since case counts are highly related to the amount of testing completed, deaths (which tend to be more easily detected) can be used to estimate the total number of cases. Assumptions include:

- The number of COVID-19-related deaths is easier to ascertain than the number of cases.
- The number of true COVID-19 infections includes asymptomatic cases, presymptomatic cases, symptomatic cases, deaths and recovered patients.
- The Infection Fatality Rate or Ratio (IFR) is the number of deaths over the total number of infections, and is influenced by many factors including age distribution of a population and case management.
- There is a lag of approximately 2 weeks (or 14 days) on average between illness onset and deaths.
- Cases in the past 14 days will have a similar case fatality rate as those prior to 14 days ago.

The calculator provides a rough estimate and does not consider all of the important factors that affect cases and deaths. It will be inaccurate if deaths are highly clustered in a population (heterogenous), so that the number of deaths would not necessarily imply a certain amount of cases in the population.

## Global

### Inputs

| | Inputs | |
|---|---|---|
| Total number of COVID-19 deaths | 453,882 | |
| Total cumulative cases | 8,457,305 | |
| Total cumulative cases as of 14 days ago | 6,605,194 | |
| Total population | 7,800,000,000 | |
| Proportion of population over 65 | 9% | World bank data |
| Presumed Infection Fatality Rate | 0.50% | optional override |
| | | resource on IFR |

### Outputs (calculations)

| | Outputs |
|---|---|
| Presumed Infection Fatality Rate | 0.50% |
| Current attack rate | 0.1% |
| Total deaths among existing infections | 453,882 |
| Deaths yet to occur among current cases | 127,270 |
| Estimated total deaths in all identified cases | 581,152 |
| Current death rate | 0.0% |
| Observed CFR | 5.4% |

| | Lower estimate | Mid-point estimate | Higher estimate |
|---|---|---|---|
| Estimated total cases | 97,639,704 | 117,167,644 | 146,459,555 |
| Estimated true attack rate | 1.3% | 1.5% | 1.9% |
| Estimated cases missing | 89,182,399 | 108,710,339 | 138,002,250 |
| Estimated percentage of true cases detected | 8.7% | 7.2% | 5.8% |

## Africa

### Inputs

| | Inputs | |
|---|---|---|
| Total number of COVID-19 deaths | 7,426 | |
| Total cumulative cases | 277,116 | |
| Total cumulative cases as of 14 days ago | 177,143 | |
| Total population | 1,216,000,000 | |
| Proportion of population over 65 | 4% | World bank data |
| Presumed Infection Fatality Rate | 0.28% | optional override |
| | | resource on IFR |

### Outputs (calculations)

| | Outputs |
|---|---|
| Presumed Infection Fatality Rate | 0.28% |
| Current attack rate | 0.0% |
| Total deaths among existing infections | 7,426 |
| Deaths yet to occur among current cases | 4,191 |
| Estimated total deaths in all identified cases | 11,617 |
| Current death rate | 0.0% |
| Observed CFR | 2.7% |

| | Lower estimate | Mid-point estimate | Higher estimate |
|---|---|---|---|
| Estimated total cases | 3,507,537 | 4,209,044 | 5,261,305 |
| Estimated true attack rate | 0.3% | 0.3% | 0.4% |
| Estimated cases missing | 3,230,421 | 3,931,928 | 4,984,189 |
| Estimated percentage of true cases detected | 7.9% | 6.6% | 5.3% |

## US

### Inputs

| | Inputs | |
|---|---|---|
| Total number of COVID-19 deaths | 118,434 | |
| Total cumulative cases | 2,191,052 | |
| Total cumulative cases as of 14 days ago | 1,872,660 | |
| Total population | 327,000,000 | |
| Proportion of population over 65 | 16% | World bank data |
| Presumed Infection Fatality Rate | 0.80% | optional override |
| | | resource on IFR |

### Outputs (calculations)

| | Outputs |
|---|---|
| Presumed Infection Fatality Rate | 0.80% |
| Current attack rate | 0.7% |
| Total deaths among existing infections | 118,434 |
| Deaths yet to occur among current cases | 20,136 |
| Estimated total deaths in all identified cases | 138,570 |
| Current death rate | 0.0% |
| Observed CFR | 5.4% |

| | Lower estimate | Mid-point estimate | Higher estimate |
|---|---|---|---|
| Estimated total cases | 14,362,593 | 17,235,112 | 21,543,889 |
| Estimated true attack rate | 4.4% | 5.3% | 6.6% |
| Estimated cases missing | 12,171,541 | 15,044,060 | 19,352,837 |
| Estimated percentage of true cases detected | 15.3% | 12.7% | 10.2% |

Figure: **Global COVID-19 PSAF – All ages** – 19 June 2020 | Figure: **Global COVID-19 PSAF – Age-specific** 19 June 2020
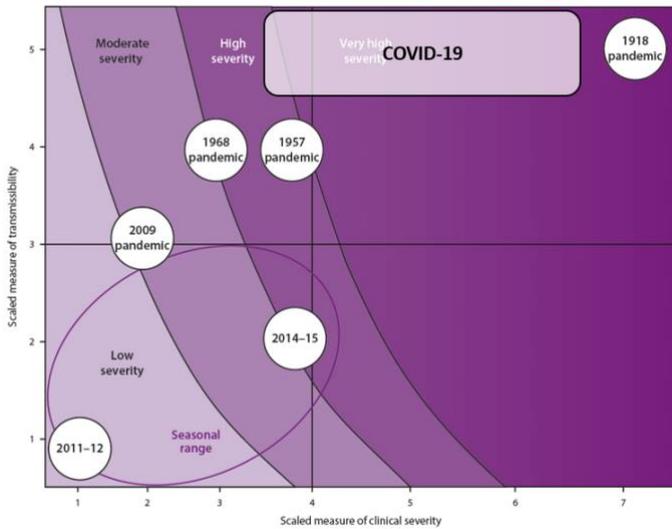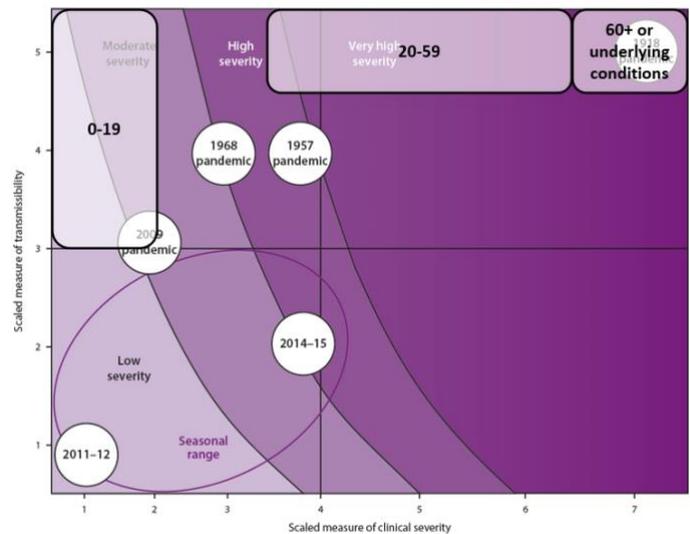


Changes this week: Adjusted age-specific box for 0-19 year-olds, broadening transmissibility to 3-5 range based on new evidence of lower susceptibility and more asymptomatic infections in this age group. Increased severity from 1 to 2 based on new information from the United States showing 3% hospitalization rate and 0.1% case fatality rate (CFR) in this age group.

## SURVEILLANCE CASE DEFINITIONS

| Source/last updated | Criteria | Probable case | Confirmed Case |
|---|---|---|---|
| **WHO** **Updated March 20** | Suspected Case<br>A patient with acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath), AND a history of travel to or residence in a location reporting community transmission of COVID-19 disease during the 14 days prior to symptom onset;<br>OR a patient with any acute respiratory illness AND having been in contact with a confirmed or probable COVID-19 case (see definition of contact) in the last 14 days prior to symptom onset;<br>OR a patient with severe acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath; AND requiring hospitalization) AND in the absence of an alternative diagnosis that fully explains the clinical presentation. | A suspect case for whom testing for the COVID-19 virus is inconclusive OR A suspect case for whom testing could not be performed for any reason. | A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms. |
| **U.S. CDC** **Updated April 5** | Clinical Criteria<br>At least two of the following symptoms: fever (measured or subjective), chills, rigors, myalgia, headache, sore throat, new olfactory and taste disorder(s) OR at least one of the following symptoms: cough, shortness of breath, or difficulty breathing OR severe respiratory illness with at least one of the following: clinical or radiographic evidence of pneumonia, OR acute respiratory distress syndrome (ARDS) AND no alternative more likely diagnosis.<br>Laboratory Criteria<br>Laboratory evidence using a method approved or authorized by the U.S. FDA or designated authority:<br>*Confirmatory laboratory evidence:*<br>Detection of severe acute respiratory syndrome coronavirus 2 ribonucleic acid (SARS-CoV-2 RNA) in a clinical specimen using a molecular amplification detection test<br>*Presumptive laboratory evidence:*<br>Detection of specific antigen in a clinical specimen or detection of specific antibody in serum, plasma, or whole blood indicative of a new or recent infection*<br>*Serologic methods for diagnosis are currently being defined<br>Epidemiologic Linkage<br>One or more of the following exposures in the 14 days before onset of symptoms: | Meets clinical criteria AND epidemiologic evidence with no confirmatory laboratory testing performed for COVID-19.<br><br>Meets presumptive laboratory evidence AND either clinical criteria OR epidemiologic evidence.<br><br>Meets vital records criteria with no confirmatory laboratory testing | Meets confirmatory laboratory evidence. |

| | | | |
|---|---|---|---|
| | 1) Close contact** with a confirmed or probable case of COVID-19 disease; OR 2) Close contact** with a person with: clinically compatible illness AND linkage to a confirmed case of COVID-19 disease. 3) Travel to or residence in an area with sustained, ongoing community transmission of SARS-CoV-2. 4) Member of a risk cohort as defined by public health authorities during an outbreak. **Close contact is defined as being within 6 feet for at least a period of 10 minutes to 30 minutes or more depending upon the exposure. In healthcare settings, this may be defined as exposures of greater than a few minutes or more. Data are insufficient to precisely define the duration of exposure that constitutes prolonged exposure and thus a close contact. | performed for COVID-19. | |

## EPIDEMIOLOGY (BEST ESTIMATES BASED ON MULTIPLE SOURCES, AVAILABLE UPON REQUEST IF NOT LISTED)

Glossary of epidemiologic terms (IDM)

**Transmission**
- Basic Reproduction Number: $R_0$ estimate: 2-3 (1.4-5.7) (multiple), 2.5 (CDC best estimate)
  - Effective Reproduction Number: $R_t$ estimates: LSHTM, Rtlive (US-focused), Hong Kong, Covid-19 projections
- Doubling time without intervention: 6-9 days (IDM)
- Secondary attack rate (household/close contact): 3-38% (multiple)
- Risk of transmission is potentially greatest two days before symptom onset (He et al.) and high early in development of symptoms and declines over the course of several days to weeks (US CDC)
- Odds of transmitting disease in a closed environment was 19 times higher than in an open-air environment (Preprint)
- Viral loads from 14 patients peaked between days 0-3 after symptom onset (Zou et al.)
- Viral clearance in asymptomatic is faster than symptomatic (Chau et al.)
- Median duration of viral shedding (the number of days from symptoms onset till the successive negative detection of SARS-CoV-2 RNA) was 17 days (12-21 IQR) (Qi et al.)
- Proportion of SARS-CoV-2 transmission due to asymptomatic or pre-symptomatic infection compared to symptomatic infection is unclear (US CDC)
- Percentage of transmission occurring prior to symptom onset: 40% (CDC best estimate)
- Infectiousness of asymptomatic individuals relative to symptomatic individuals: 100% (CDC best estimate)
- Precautions: WHO continues to recommend droplet and contact precautions for those people caring for COVID-19 patients. WHO continues to recommend airborne precautions for circumstances and settings in which aerosol generating procedures and support treatment are performed (WHO)
- Time between symptom onset in an individual and symptom onset of a second person infected by that individual: 6 days (CDC best estimate)

**Incubation period**
- Estimates of median incubation period are 4-5 days with a range from 0-14 days (CDC)
- 97.5% of persons with COVID-19 who develop symptoms will do so within 11.5 days of SARS-CoV-2 infection (Lauer et al.)

**Clinical presentation**
- Signs and symptoms of COVID-19 present at illness onset vary, but over the course of the disease, most persons with COVID-19 will experience the following (US CDC):
  - Fever (83–99%); Cough (59–82%); Fatigue (44–70%); Anorexia (40–84%); Shortness of breath (31–40%); Sputum production (28–33%); and Myalgia (11–35%).
- 81% of cases are mild or moderate (including outpatient pneumonia); 14% are severe and 5% are critical (China CDC Weekly)
- Proportion of asymptomatic infection (5-80%) (CEBM – combined estimate from 21 reports)
  - Percent of infections that are asymptomatic 35% (CDC best estimate)
  - Varies by setting:
    - Diamond Princess (18%)
    - Vo, Italy (50-75%)
    - Japanese nationals evacuated from Wuhan (31%)
    - Residents of a Long-Term Care Nursing Facility King County, Washington (57% includes pre-symptomatic, total 13% asymptomatic throughout);
    - Children in China (28%, 10/36 children)
    - Cruise Ship to Argentina (81%)
    - Pregnant women presenting for childbirth in Connecticut (73%)
- Case hospitalization ratio 3.4% (CDC best estimate)

- o   0-49 1.7%  |  50-64 4.5%  |  65+ 7.4%
- Health Alert Network on Multisystem Inflammatory Syndrome in Children (MIS-C) with COVID-19 (CDC)

**Clinical course**
- Among patients who developed severe disease (US CDC):
  - o   the median time to dyspnea ranged from 5 to 8 days,
  - o   the median time to acute respiratory distress syndrome (ARDS) ranged from 8 to 12 days, and
  - o   the median time to ICU admission ranged from 10 to 12 days.
- 17.8 days (95% CI 16.9-19.2) mean duration from onset of symptoms to death (Verity et al.)
- 24.7 day (95% CI 22.9-28.1) mean duration from symptoms to hospital discharge (Verity et al.)
- Median duration from ICU admission to death was seven days for non-survivors (Yang et al.)
- U.S. (CDC best estimate) for additional indicators by age

|  | 0-49 | 50-64 | >65 |
|---|---|---|---|
| **Mean number of days from symptom onset to hospitalization (standard deviation)** | 6.9 (5) | 7.2 (5.3) | 6.2 (5.7) |
| **Mean number of days of hospitalization among those not admitted to ICU** | 3.9 (3.7) | 4.9 (4.3) | 6.3 (5.1) |
| **Mean number of days of hospitalization among those admitted to ICU** | 9.5 (7.2) | 10.5 (7.0) | 10.0 (6.8) |
| **Percent admitted to ICU among those hospitalized** | 21.9% | 29.2% | 26.8% |
| **Percent on mechanical ventilation among those in ICU** | 72.1% | 77.6% | 75.5% |
| **Mean number of days of mechanical ventilation** |  | 5.5 (5.3) |  |
| **Mean number of days from symptom onset to death** | 14.9 (7.7) | 15.3 (8.1) | 12.9 (7.6) |
| **Mean number of days from death to reporting** | 7.1 (7.7) | 7.2 (7.7) | 6.6 (7.3) |

**Diagnostic testing**
- Detection of SARS-CoV-2 viral RNA is better in nasopharynx samples compared to throat samples (US CDC)
- Lower respiratory samples may have better yield than upper respiratory samples (US CDC)
- SARS-CoV-2 RNA has also been detected in stool and blood. Detection of SARS-CoV-2 RNA in blood may be a marker of severe illness (US CDC)
- Viral RNA shedding may persist over longer periods among older persons and those who had severe illness requiring hospitalization (median range of viral shedding among hospitalized patients is 12–20 days) (US CDC)
- Viral shedding appears before symptom onset and is highest in the first week of symptom onset then declines with time (To et al., He et al., ECDC)
- Infection with both SARS-CoV-2 and with other respiratory viruses has been reported, and detection of another respiratory pathogen does not rule out COVID-19 (US CDC)

## Fig. 2: Estimating the age-specific symptomatic rate from age-specific case counts for six countries.

From: Age-dependent effects in the transmission and control of COVID-19 epidemics
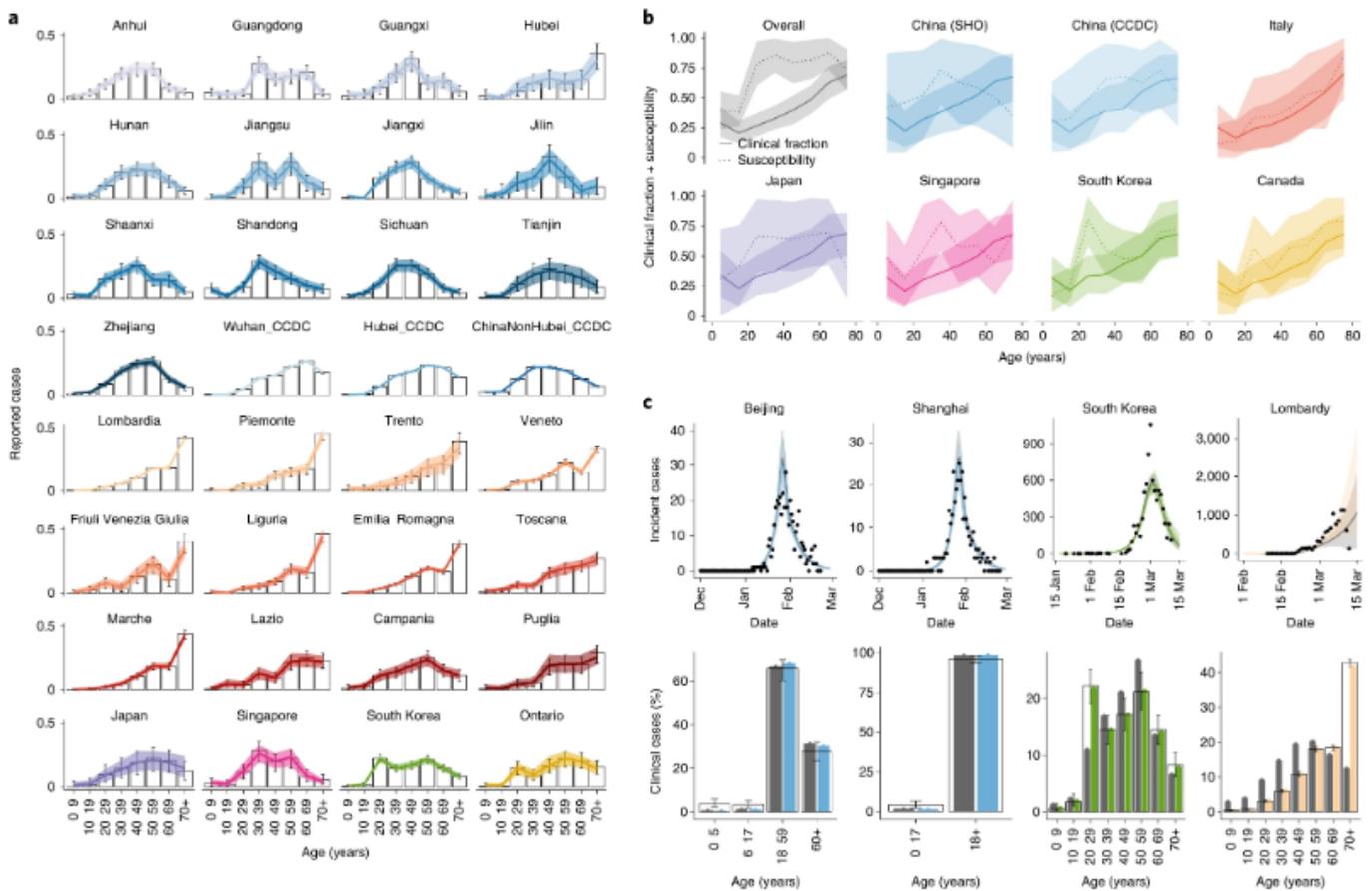


a, Age-specific reported cases from 13 provinces of China, 12 regions of Italy, Japan, Singapore, South Korea and Ontario, Canada. Open bars are data and the colored lines are model fits with 95% HDI. b, Fitted mean (lines) and 95% HDI (shaded areas) for the age distribution in the clinical fraction (solid lines) and the age distribution of susceptibility (dashed lines) for all countries. The overall consensus fit is shown in gray. c, Fitted incidence of confirmed cases and resulting age distribution of cases using either the consensus (gray) or country-specific (color) age-specific clinical fraction from b.

From: Age-dependent effects in the transmission and control of COVID-19 epidemics, Nature Medicine, June 16, 2020

**Figure. Estimated Variation Over Time in Diagnostic Tests for Detection of SARS-CoV-2 Infection Relative to Symptom Onset**
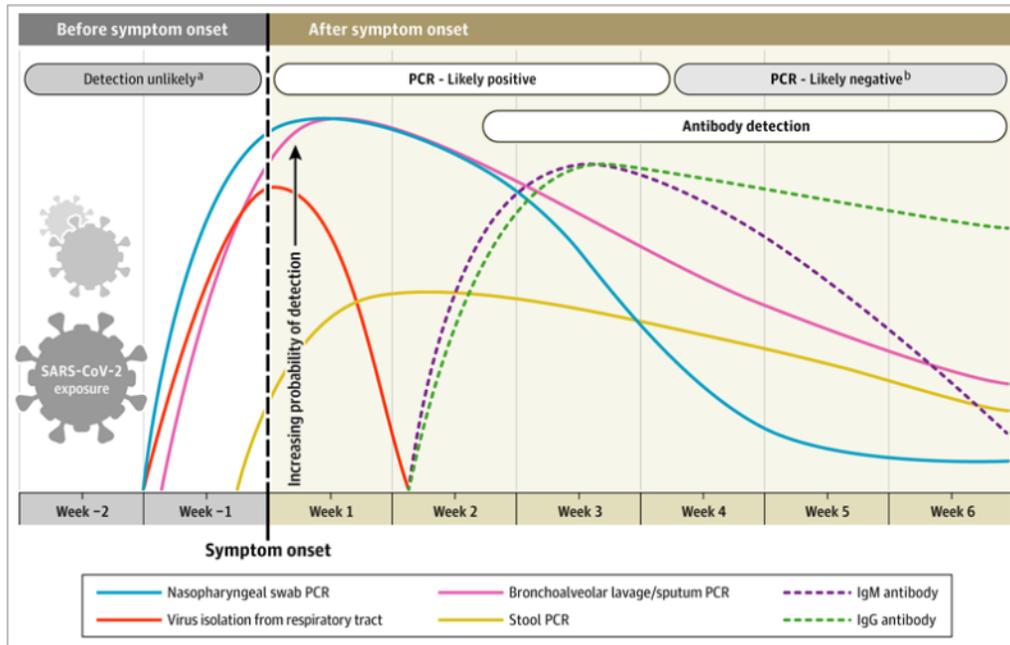


Estimated time intervals and rates of viral detection are based on data from several published reports. Because of variability in values among studies, estimated time intervals should be considered approximations and the probability of detection of SARS-CoV-2 infection is presented qualitatively. SARS-CoV-2 indicates severe acute respiratory syndrome coronavirus 2; PCR, polymerase chain reaction.

[a]Detection only occurs if patients are followed up proactively from the time of exposure.

[b]More likely to register a negative than a positive result by PCR of a nasopharyngeal swab.

*Source:* https://jamanetwork.com/journals/jama/fullarticle/2765837

## Case fatality rate (CFR) / Infection fatality rate (IFR)
- Global observed CFR of 5.6% as of 12 June 2020 (ECDC) is an overestimate due to undetected cases (mild, presymptomatic, asymptomatic)
- In China, the CFR was higher in the early stages of the outbreak (17% for cases from 1 to 10 January) and reduced to 0.7% for patients with symptom onset after 1 February (WHO)
- Estimate true infection fatality rate (IFR) (accounts for undetected cases): 0.1-1.1% (multiple, most recent Oxford)
  - Age specific IFRs (Rinaldi et al)
    - Under 60 years - 0.05% (95% CI 0-0.19%)
    - 60 and above - 4.25% (3.01-6.39%)
  - Symptomatic CFR 0.4% (0.2-1%) (CDC)

## TREATMENT

### Limited evidence of effective COVID-19 therapies
- Give supplemental oxygen therapy immediately to patients with severe acute respiratory infection (SARI) and respiratory distress, hypoxemia or shock and target > 94% (WHO)
- Give empiric antimicrobials to treat all likely pathogens causing SARI and sepsis as soon as possible, within one hour of initial patient assessment for patients with sepsis (WHO)
- Do not routinely give systemic corticosteroids for treatment of viral pneumonia outside of clinical trials (WHO)
- Use of investigational anti-COVID-19 therapeutics should be done under ethically approved randomized control trials (WHO)
- No U.S. Food and Drug Administration (FDA)-approved drugs have demonstrated safety and efficacy in randomized controlled trials when used to treat patients with COVID-19, although the FDA has granted an Emergency Use Authorization for the use of remdesivir to treat severe cases (US CDC)
- Preliminary evidence suggests remdesivir is effective at reducing the duration of COVID-19 illness, more data is needed to confirm this result (NIH)

- [Press release](#) shows dexamethasone reduced deaths by one-third in ventilated patients (rate ratio 0.65 [95% confidence interval 0.48 to 0.88]; p=0.0003) and by one-fifth in other patients receiving oxygen only (0.80 [0.67 to 0.96]; p=0.0021). There was no benefit among those patients who did not require respiratory support (1.22 [0.86 to 1.75; p=0.14). DATA PENDING
- [NIH COVID-19 treatment guidelines](#)
- [WHO Clinical Management of COVID-19 (see care pathway below)](#)
- [CDC Clinical guidance on management of patients with COVID-19](#)

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## ENVIRONMENT

**Temperature**
- Emerging non-peer reviewed evidence appears to suggest that weather conditions may influence the transmission of the novel coronavirus (SARS-CoV-2), with cold and dry conditions appearing to boost the spread. This phenomenon may manifest itself through two mechanisms: the stability of the virus and the effect of the weather on the host. The weather effect is minimal, and all estimates are subject to significant biases, reinforcing the need for robust public health measures. ([Oxford](#))
- Epidemic peak could shift to winter in temperate countries. Seasonal changes in transmission rate could shift the timing of the peak into winter months, which will have important implications for healthcare capacity planning ([Danon](#))

**Fomites**
- Survival of SARS-CoV-2 in a controlled setting:
  - 72 hours after application to plastic, 48 hours on stainless steel, 24 hours on cardboard and 4 hours on copper ([NEJM](#)).
- Study of hospital wards in Wuhan, China tested air and surface samples. Virus was widely distributed on floors, computer mice, trash cans, and sickbed handrails and was detected in air ≈4 m from patients ([EID](#))