COVID-19 Key COVID-19 metrics based on the latest available science – as of 29 May 2020

SURVEILLANCE CASE DEFINITIONS (WHO UPDATED 20 MARCH)

Suspect case

- 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;
- 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;
- 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.

Probable case

- 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.

Confirmed case

- A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms

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
- Effective Reproduction number: varies greatly by country and time (LSHTM estimates)
- 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)
- Viral loads from 14 patients peaked between days 0-3 after symptom onset (Zou et al.)
- The 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)
- The 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 6 days with a range from 0-14 days (CDC best estimate)
- 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%) Myalgias (11–35%)
- 81% of cases are mild or moderate (including outpatient pneumonia), 14% severe, and 4% 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)

- o 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%
- Percent of infections that are asymptomatic 35% (CDC best estimate)
- 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.)
- US (CDC best estimate)

	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 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)

Figure. Estimated Variation Over Time in Diagnostic Tests for Detection of SARS-CoV-2 Infection Relative to Symptom Onset
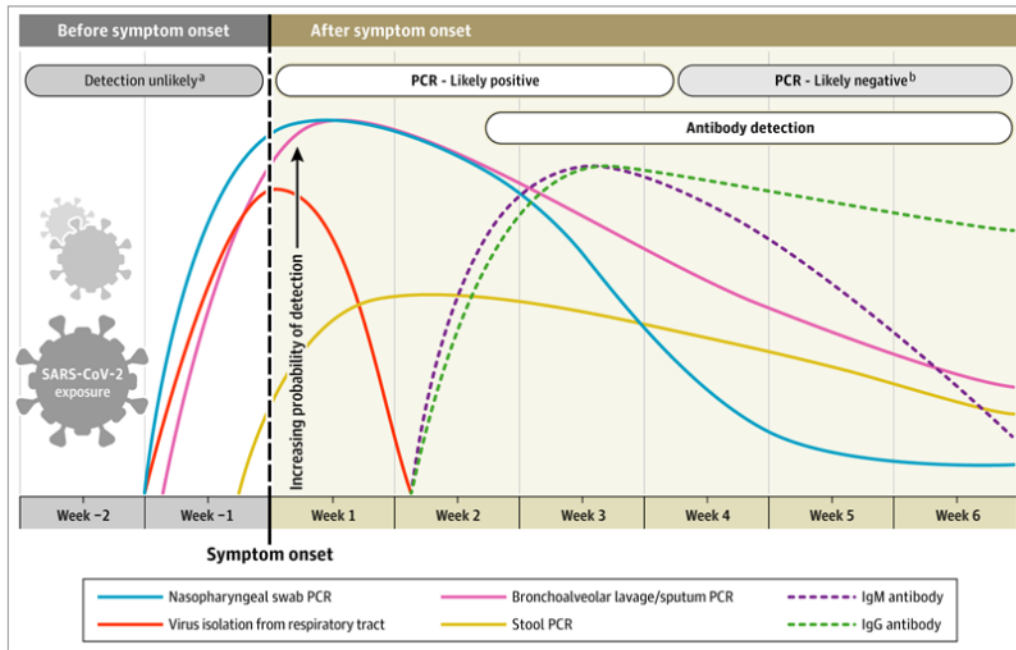
Estimated time intervals and rates of viral detection are based on data from several published reports. Because of variability in values among studies, estimated time intervals should be considered approximations and the probability of detection of SARS-CoV-2 infection is presented qualitatively. SARS-CoV-2 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 6.9% as of 15 May 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 (link)
- Estimate true infection fatality rate (IFR) (accounts for undetected cases): 0.1-1.3% (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%)
    - US symptomatic CFR 0.4% (CDC)

TREATMENT

Limited evidence of effective COVID-19 therapies
- Give supplemental oxygen therapy immediately to patients with 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 1 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, controlled trials (WHO)
- No specific treatment for COVID-19 is currently FDA approved. No FDA-approved drugs have demonstrated safety and efficacy in randomized controlled trials for patients with COVID-19 (US CDC)
- Preliminary evidence suggests remdesivir is effective at reducing the duration of COVID-19 illness, more data is needed to confirm this result (NEJM)
- NIH COVID-19 treatment guidelines
- WHO Clinical Management of COVID-19 (see care pathway below)

COVID-19 Care Pathway

Appendix 1: COVID-19 care pathway
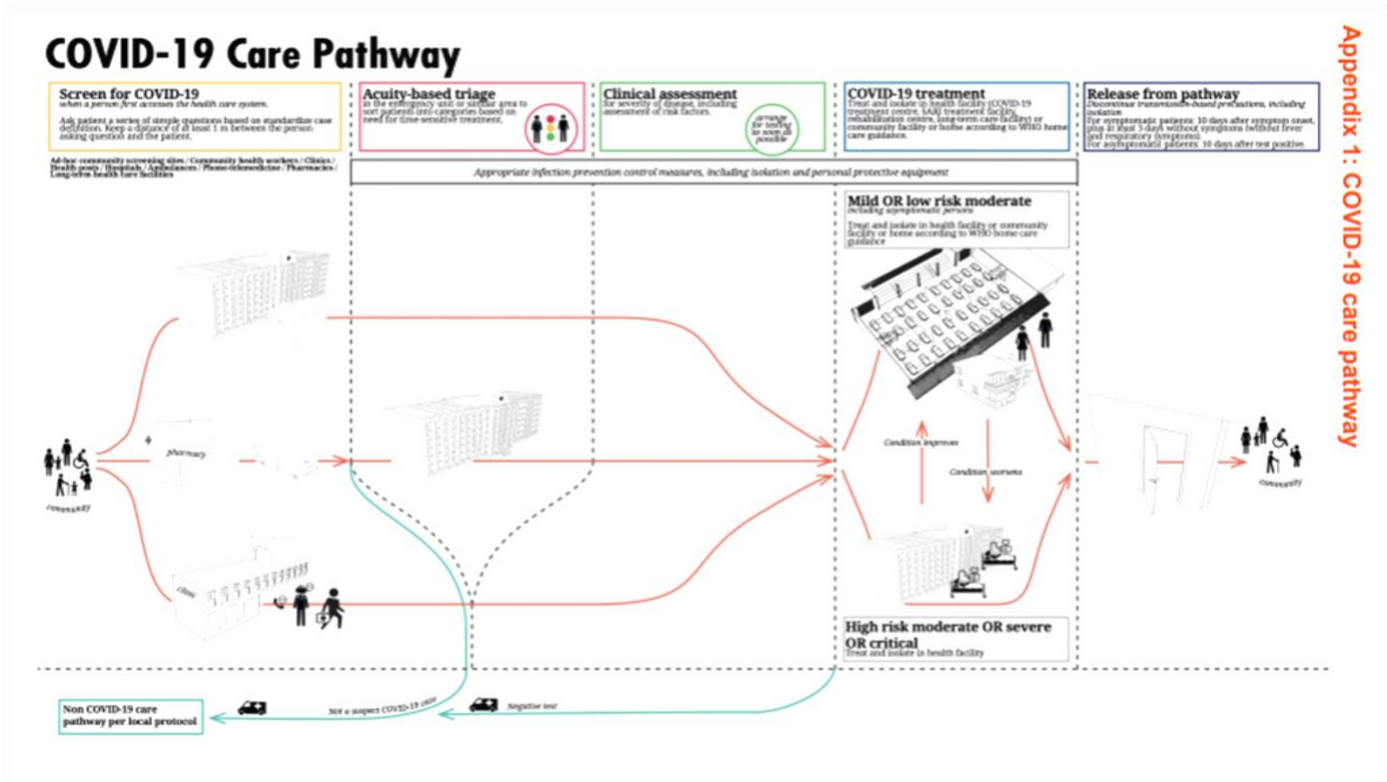
ENVIRONMENT

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: (NEJM)
    - 72 hours after application to plastic, 48 hours on stainless steel, 24 hours on cardboard and 4 hours on copper
- 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)

PANDEMIC SEVERITY ASSESSMENT FRAMEWORK UPDATE:
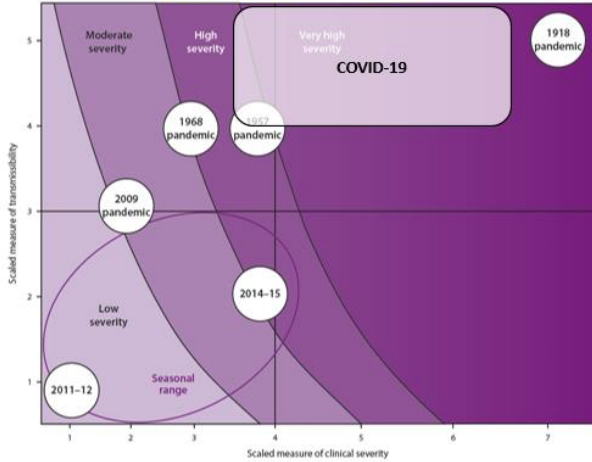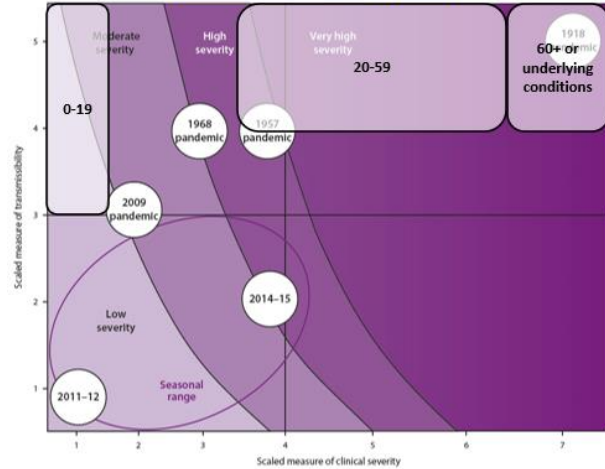
Figure: Global COVID-19 PSAF – All ages – 29 May 2020

Figure: Global COVID-19 PSAF – Age-specific 29 May 2020

Projections using RTSL calculator (29 May 2020)

Global

Inputs

	Inputs	
Total number of COVID-19 deaths	360,089	
Total cumulative cases	5,776,934	
Total cumulative cases as of 14 days ago	4,407,652	
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	360,089
Deaths yet to occur among current cases	111,865
Estimated total deaths in all identified cases	471,954
Current death rate	0.0%
Observed CFR	6.2%

	Lower estimate	Mid-point estimate	Higher estimate
Estimated total cases	79,293,400	95,152,080	118,940,100
Estimated true attack rate	1.0%	1.2%	1.5%
Estimated cases missing	73,516,466	89,375,146	113,163,166
Estimated percentage of true cases detected	7.3%	6.1%	4.9%

Africa

Inputs

	Inputs	
Total number of COVID-19 deaths	3,790	
Total cumulative cases	134,776	
Total cumulative cases as of 14 days ago	77,798	
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	3,790
Deaths yet to occur among current cases	2,776
Estimated total deaths in all identified cases	6,566
Current death rate	0.0%
Observed CFR	2.8%

	Lower estimate	Mid-point estimate	Higher estimate
Estimated total cases	1,982,408	2,378,889	2,973,612
Estimated true attack rate	0.2%	0.2%	0.2%
Estimated cases missing	1,847,632	2,244,113	2,838,836
Estimated percentage of true cases detected	6.8%	5.7%	4.5%

US

Inputs

	Inputs	
Total number of COVID-19 deaths	101,617	
Total cumulative cases	1,721,750	
Total cumulative cases as of 14 days ago	1,417,889	
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%
Attack rate	0.5%
Cases in past 14 days	303,861
Total deaths among existing infections	101,617
Deaths yet to occur among current cases	21,777
Estimated total deaths in all identified cases	123,394
Current death rate	0.0%
Observed CFR	5.9%
Adjusted CFR (current deaths/cases 14 days ago)	7.2%

	Lower estimate	Mid-point estimate	Higher estimate
Estimated total cases	12,789,599	15,347,519	19,184,399
Estimated true attack rate	3.9%	4.7%	5.9%
Estimated cases missing	11,067,849	13,625,769	17,462,649
Estimated percentage of true cases detected	13.5%	11.2%	9.0%