COVID-19 is a clinical syndrome caused by the novel severe acute respiratory syndrome–Coronavirus-2 (SARS-CoV-2) with >12 million reported cases worldwide and 550,000 deaths, affecting 180 countries and all 50 US states. It is spread by via droplet transmission but can be aerosolized. It binds to the ACE2 receptor, found in pneumocytes, intestinal endothelium, and cardiac myocytes. R is estimated to be 2.3. Approximately 14% of patients will be hospitalized. Mortality rate is estimated to be 1-2% in the US but increases with age (>60 increased risk) and comorbidities (COPD, sickle cell disease, cancer, CKD, diabetes, obesity, CVD). Emerging data indicate higher rates in racial minorities and those affected by economic inequality.

Disease Progression

• First: initial symptoms (fever, sore throat, headache, nonproductive cough, GI symptoms, anosmia). Average time of symptoms before time of presentation to hospital ranges from day 8-14. Most common cause of hospital presentation is respiratory distress & hypoxemia.
• Second: cytokine upregulation, which has been associated with respiratory distress and sepsis
• Third: later complications, including ARDS, acute cardiac injury, AKI, secondary infections
• Fourth: recovery for survivors with longer viral shedding in those who suffered critical illness

Mortality increases with age (especially >60yo) and comorbidities such as COPD, sickle cell disease, cancer, CKD, DM, obesity, immunosuppression. Those who live in long-term care facilities appear to be at additional risk as well. However, cases of critical illness have been seen in every decade of life.

Can we predict who will decompensate?
Those with risk factors for mortality above are at highest risk (12x increase in mortality), as well as those around day 9-10 of illness. It may correlate with severe lymphopenia, increased inflammatory markers (CRP, d-dimer, ferritin), troponin, and SOFA score – evidence still in progress. Checking inflammatory markers on admission and around day 9-10 of illness can be used to risk stratify patients.

Complications

• Sepsis (59% overall), median day 9 of illness (7-13)
• ARDS (31%), day 12 (8-15) - easy compliance, requiring high PEEP, proning helps, some simple cardiogenic pulmonary edema that improves with mechanical ventilation (see pre/post intubation x-rays above)
• Heart failure (23%)
• Septic shock (20%)
• Coagulopathy (19%)
  • Strongly associated with increased incidence of DVT and PE (NIH currently recommends only standard dose prophylactic anti-coagulation though many institutions are initiating therapeutic anti-coagulation on ICU admission; see local protocols)
• Acute cardiac injury (17%), day 15 (10-17)
  • Definition: +troponin or abnormal ECG or echo;
  • May present as unspecified arrhythmias, sudden cardiac arrest, ST elevation (widespread or localized), shock.
  • May lead to cardiomyopathy or fulminant myocarditis
• Acute Kidney Injury (15%), day 15 (13-19.5). Continuous renal replacement therapy in 5%.
• Secondary infections (15%), day 17 (13-19), including VAP
  • Time from intubation to VAP: median 8 days (2-9)
• Less common: "cytokine storm syndrome," HLH, CVA, GBS, acute encephalitis

Sources
NIH COVID-19 Treatment Guidelines