The COVID-19 Resource Document Maintained by Mike MacKinnon  
Updated 3/22/20

### The Basic Info
- **Incubation time**: 4-10 days
- **Exposure time**: before symptoms is an average of 5.1 days (CDC)
- **Main symptoms**: Fever - 44-98% Cough (usually dry) - 46-82% SOB - 3-31%. Body aches - 11-52% NOT usually runny nose. (CDC)
- **Symptoms to Recovery/Death**:  
  - mild cases is 14 days and for severe is 3-5 weeks  
  - from symptoms to onset of death is 2-8 weeks
- **Highest Risk People**: > 60, Heart Ds, DM, Lung Ds, Immunocompromised (CDC)
- **C19 virus shedding**: happens 24-48 hours before symptoms and at that time is assumed to be infectious
- **Virus transmission**: has been identified as water droplet and likely from hands to face or within 6 feet of someone displaying symptoms. Virus identified in stool but no current evidence of Fecal-oral transmission but this DID happen with SARS
- **Length Virus Lives**: C19 hangs in the air when aerosolized for up to 3 hours, lasts on plastic and steel for up to 3 days. It is still unclear if it can be transmitted these ways.
- **This isn’t like the flu**: Flu kills about 500K a year world wide and 30-50K a year in the USA with a 0.1% mortality rate. C19 has an estimated 0.8-1% mortality rate overall and higher for those "at risk" as it stands today

### Treatment Concerns
- **Clinical Management Overview**: [HERE](#)
- **CYTOKINE STORM**: Cause of death or contribution to death is cytokine storm. A cytokine storm is an overproduction of immune cells and their activating compounds (cytokines), which, in a flu infection, is often associated with a surge of activated immune cells into the lungs. For more information on this and treatment: [HERE](#) & [HERE](#)  
  - TX: Steroids
- **NSAIDS**: WHO does not recommend against Ibuprofen in C19: [HERE](#)  
  - There is literature from case control studies in several countries that prolonged illness or the complications of respiratory infections may be more common when NSAIDs are used – both respiratory or septic complications and cardiovascular complications.  
  - Observational evidence is always difficult to interpret due to so called protopathic bias/confounding by indication but where this has been controlled for the associations still persists.  
  - The finding in two randomized trials that advice to use ibuprofen results in more severe illness or complications helps confirm that the association seen in the observational studies is indeed likely to be causal. Advice to use paracetamol is also less likely to result in

### Diagnostics
- **C19 Testing**: can have false positive and negatives. Pts can test positive after resolution of symptoms.  
  - C19 Testing: [HERE](#)
- **CXR/CT Findings**: have bilateral areas of "ground-glass opacities with Paving mostly at bases Examples [HERE](#) and attached at bottom. [CXR Example 2 CT Example2](#)  
  - Not common:  
    - Pleural effusion (seen in only ~5%).  
    - masses, cavitation, lymphadenopathy  
- **CT Guide**: [HERE](#)
- **Lung Ultrasound**: Pulmonary ground-glass or ground-glass/consolidation lesions that are peripherally-located, bilateral, and favor the lower lungs. Video and Images [HERE](#) and [HERE](#) These patients demonstrated:  
  - Focal B-lines and fused B-lines  
  - Discontinuous, rough appearance to the pleural line, with subpleural consolidation  
  - Foci of disease located predominantly in the posterior lung fields, particularly in the lower lung fields  
- **Laboratory Testing Rec**: [HERE](#)
- **Lab Findings**:  
  - WBC normal, with low Lymphocytes  
  - Mild Thrombocytopenia (> 100K)  
  - Moderate hypoxemia  
  - ABG: Mild acidosis with normal lactate and severe base deficit  
  - Elevated LDH, Very high CRP = mortality, Elevated CK
based on estimates. (this is fluid and could change up or down).

- **Older Americans**: There are 70 million americans in the US over the age of 60 alone. Even if only 1% of them died that could be close to 700K deaths in the US alone in an 18 month period. Again, prelim estimates and could change up or down.

- **Symptoms mild-severe**: The CDC states that 80% of people who get C19 will "mild/mod" and recover. They estimate that the 15% will be severe and 5% critical.
  - Mild/mod = anything up to an including a severe pneumonia which does not require O2 or an inpatient hospital stay.
  - Mod = hospitalized on O2, potentially intubated and ventilated and critical all the way up to ECMO low likelihood of survival. Case fatality rate if hospitalized is 15%

- **Super Spreaders**: someone who infects 10 or more people. Etiology unknown.

- **Immunity**: Not clear there is long term or that vaccines would be efficacious. C19 is 75% similar to SARS-CoV and SARS-CoV possesses antibody-dependent enhancement characteristics similar to HIV and Dengue. Having an antibody could turn a minor infection into a life-threatening one. Source: HERE

- **TESTING**: C19 Cepheid commercial test done in 45 minutes. Designed for use on Cepheid’s GeneXpert Systems. HERE

- **ACE & ARB / DM & HTN**: Current recommendation is NOT to change treatment plan: ACC

- **Excellent resource on this** HERE

- **Summary of society Reccs**: HERE

- **People with DM and HTN appear to have higher mortality rates from C19 however no direct evidence to support this as of yet. Evidence Summary**

- **C19 binds to its target cells through angiotensin-converting enzyme 2 (ACE2), which is expressed by epithelial cells of the lung, intestine, kidney, and blood vessels.**

- **Expression of ACE2 is increased in patients with type 1 or type 2 diabetes, who are treated with ACE inhibitors and angiotensin II type-I receptor blockers (ARBs).**

- **Hypertension is also treated with ACE inhibitors and ARBs, which results in an upregulation of ACE2.**

- **ACE2 can also be increased by thiazolidinediones and ibuprofen.**

- **Data suggests that ACE2 expression is increased in diabetes and treatment with ACE inhibitors and ARBs increases ACE2 expression.**

- **In Theory** increased expression of ACE2 would facilitate infection with COVID-19. We therefore hypothesize that diabetes and hypertension treatment with ACE2-stimulating drugs increases the risk of developing severe and fatal COVID-19.

- **Re-use of N95 MASK CDC**: HERE

- **Masks tested for 30 days**: HERE

- **N95 Brownian Motion**: HERE

- **Why PM0.3 is important**: HERE

- **Info about Mask**: HERE & HERE

- **Study Surgical vs N95 Mask**: HERE & HERE

- **Study on % particles under 0.1 micron Stopped by surgical v n95 masks**: HERE

- **Fluge droplets & Virus**: HERE & HERE

- **3M Study Shows N95 filters 94% of 0.1 micron**: HERE

- **VID Surgical v N95 Mask**: HERE

- **VID How long is mask good for and can it be “cleaned”**: HERE

**KEY TAKE-AWAYS (Lab Tests):**

1. Likely the most important thing a mask does is stop you from touching your face
2. Surgical masks = N95 for influenza
3. N95 masks & Surgical Masks can block particles down to 0.007 micron
4. Virus is transmitted mostly via Fluge droplets, (droplets d/t coughing or sneezing) which measure to 0.5 microns to 10 microns.
5. Viruses die after ~4hrs on masks
Therefore pts with cardiac diseases, hypertension, or diabetes, who are treated with ACE2-increasing drugs, appear to be at higher risk for severe COVID-19 infection and should be monitored for ACE2-modulating medications, such as ACE inhibitors or ARBs. [http://tinyurl.com/u36k75n](http://tinyurl.com/u36k75n)

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<td>One Vent Multiple Patients: Here is a way to use one vent for multiple people it is here: <a href="http://tinyurl.com/sfkzqro">http://tinyurl.com/sfkzqro</a></td>
<td>Italian Ethical Recommendations</td>
<td>EMCRIT INFO: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>Vent Settings: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>CMS Definition of “ELFCTIVE” Cases</td>
<td>CDC INFO: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>Chicago Med ICU HandBook: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>Spreadsheet of published case series: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>Interactive map: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>Internet Book of CC: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>Current Clinical trials: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>SCCM Info / data: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>Converting Operating Rooms to ICU rooms: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>Update on Research Activities: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>Genomic epidemiology of novel coronavirus (hCoV-19) (shows spread of virus): <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>CC Short Reference Vids: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>LANCET Article on Clinical Course and Mortality: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>UMC 3/12/20 Grand rounds video: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>SCCM CC Info for non-CC: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>List of Publications: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>Vent Basics Videos: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>UPTODATE: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<td>Guidance can be found via the ASPF: <a href="http://tinyurl.com/sfkzqro">HERE</a> &amp; <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>UW Medicine COVID-19 Protocols: <a href="https://buff.ly/2xrFYc2">https://buff.ly/2xrFYc2</a></td>
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<tr>
<td>CDC C19 Prevention &amp; Control in Healthcare Settings: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>The take away points are:</td>
<td>Testing Criteria: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<tr>
<td>CDC What Facilities Should Know: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>o Use Plastic drape over pt face</td>
<td>RN Phone Triage: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<tr>
<td>Flattening the Curve A basic explanation: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>o Use N95 mask, Double glove, googles, gown</td>
<td>RN Phone Triage Resources: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<tr>
<td>Home Isolation Guidelines &amp; D/C: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>o PAPR devices are superior if available</td>
<td>Immunocompromised Patients - <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
</tr>
<tr>
<td>State Health Dept After Hours Contact List: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>o Avoid awake FOI</td>
<td>Pregnancy Protocol: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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<tr>
<td>Homecare guidelines for mild C19: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
<td>o Avoid Ventilating, Use RSI d/t aerosolization</td>
<td>CDC Pregnancy Considerations: <a href="http://tinyurl.com/sfkzqro">HERE</a></td>
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### Myth Busting Graphics
- Converting Operating Rooms to ICU rooms: [HERE](#)
- Reuse of N95 MASK: [HERE](#)
- The Covid19 Handbook: [HERE](#)

### MEDICATION/Treatment Options

- **Lopinavir / ritonavir (KALETRA):** 200/50 mg2cp BID Found to have NO BENEFIT; RCT [HERE](#)
- Chloroquine 500 mg BID or hydroxychloroquine 200 mg BID
  - Hydroxychloroquine: [French Study](#) Non-randomized, open label study evaluating the use of chloroquine (200 mg TID) with or without azithromycin (500 mg once, followed by 250 mg daily for four days).
  - Yao et al study: [HERE](#)
  - MOA: Interference with ACE2
  - Impairment of acidification of endosomes, which interferes with virus trafficking within cells
  - Immunosuppressive properties. Activity against many pro-inflammatory cytokines (e.g IL-1 and IL-6)

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### Decon & Protection of Anes Machine

- **What is the best strategy for protecting the anesthesia machine from contamination by a potentially infected patient?**
  - Place a “high quality*” HMEF (heat and moisture exchange filter) between the breathing circuit and the patient’s airway and a viral filter between the expiratory limb and the machine.

- **What type of breathing circuit filter is likely to prevent passage of the SARS COV-2 virus from the patient to the anesthesia machine?**
  - A pleated (mechanical) high efficiency HMEF that is highly effective for particle sizes as low as 0.1 microns.

- **Do I have to worry about transmitting the SARS COV-2 Virus from the Anesthesia Machine to a patient?**
  - As long as the machine is protected during every case with high quality filters as described in the previous FAQs there is no risk to subsequent patients.

### TRIAGE PROTOCOLS

- CDC Checklist for transport patients: [HERE](#)
- Triage in Emergency Dept
  - UCSF flowchart [HERE](#)
  - ACEP National Strategic Plan PDF with helpful links: [HERE](#)
  - Infographic on COVID-19 Intubation: [HERE](#)
- Triage in Primary Care
  - BMJ (3/13/20): Great Infographic for GPs: [HERE](#)
  - NHS PHE UK: Interim guidance for primary care: [HERE](#)
  - UCSF: [HERE](#)
- Triage remotely
  - Telemedicine EPIC note: [HERE](#)
  - UCSF: [HERE](#)
- Drive-thru or Tent ideas
  - UW Drive-through clinic protocol: [HERE](#) (scroll down to PDF)
  - Stanford Drive-Through testing detailed protocols from 2009: [HERE](#)
might be helpful in prevention or treatment of cytokine storm

- **Antibiotic prophylaxis** (variable depending on the center): pip / tazo, ceftriaxone, bactrim, antifungals azithromycin
- **Acetylcysteine** 300 mg TID (not abundant secretions but, where present, very dense)
- **Steroids?** Only in case of signs of fibrosis (not early).
- **Tocilizumab?** IL-6 receptor inhibitor. Rationale given by the strong inflammatory picture MA utility to be evaluated in the light of a picture of lymphopenia. At the moment, NO routine indication and NO early use. **HERE**
- **Remdesivir** which is a nucleoside analog inhibitor of RNA polymerase Protocols ongoing. Evidence: **Sheahan 2020 Holshue 2020** Clinical Trial **HERE**
- **Fluid Resus:** **AVOID**
- **Treatment Options NEJM 3/18:** **HERE**
- **Official Chinese COVID treatment guidelines, translated:** **HERE**
- **The Covid19 Handbook:** **HERE**
- **UW ID TX Guidelines:** **HERE**

**Should the sampled gas be returned to the breathing circuit or scavenger?**
- Gas sampled from the machine side of an HMEF is not contaminated and can be returned to the breathing circuit or the scavenging system.

**Do I need to replace the water trap for sampled gas after each patient?**
- No, if the sampled gas passed through a high quality HMEF before entering the water trap.

**What is the proper method of cleaning the anesthesia machine between patients, including patients potentially infected with SARS COV-2?**
- Cleaning procedures are the same for all patients if a high quality HMEF is placed between the circuit and the airway. Discard disposable items – breathing circuit, reservoir bag, gas sampling tubing, mask and wipe all exposed surfaces. Manufacturers’ cleaning recommendations are useful for individual devices.
# Update on Newly Discovered Coronavirus

<table>
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<tr>
<th></th>
<th>SARS CoV</th>
<th>MERS CoV</th>
<th>2019 nCo-V (COVID-19)</th>
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<tbody>
<tr>
<td>Virion Structure</td>
<td>Enveloped RNA virus</td>
<td>Enveloped RNA virus</td>
<td>Enveloped RNA virus</td>
</tr>
<tr>
<td>Outbreak period</td>
<td>2003-2004</td>
<td>2012-present</td>
<td>2019-present</td>
</tr>
<tr>
<td>Initial site of isolation</td>
<td>Guangdong province, China</td>
<td>Saudi Arabia</td>
<td>Wuhan, China</td>
</tr>
<tr>
<td>No. of countries with cases</td>
<td>29</td>
<td>27</td>
<td>&gt;100 countries</td>
</tr>
<tr>
<td>No. of cases (mortality)</td>
<td>8,096 (9.6%)</td>
<td>2,494 (~34%)</td>
<td>&gt;114,000 (&gt;4,000)</td>
</tr>
<tr>
<td>No. of cases U.S. (deaths)</td>
<td>8</td>
<td>2 (2014)</td>
<td>&gt;500 (~25)</td>
</tr>
<tr>
<td>Reservoir (intermediate host)</td>
<td>Bats (palm civet)</td>
<td>Bats (dromedary camels)</td>
<td>Unknown (likely a zoonosis)</td>
</tr>
<tr>
<td>Incubation period</td>
<td>2-7 days (range, 2-21)</td>
<td>2-7 (range, 2-14 days)</td>
<td>2-7 days (range, 2-14 days)</td>
</tr>
<tr>
<td>Infectivity, rho; attack rate</td>
<td>2.2-3.7 (range, 0.3-4.1); 10-60%</td>
<td>0.3-1.3; 4-20%</td>
<td>Average, 3.28; median, 2.79</td>
</tr>
<tr>
<td>Super spreaders</td>
<td>Yes</td>
<td>Yes (uncommon)</td>
<td>Yes (? frequency)</td>
</tr>
<tr>
<td>Asymptomatic/Pre-sx</td>
<td>No</td>
<td>Rare</td>
<td>Perhaps yes</td>
</tr>
<tr>
<td>Transmission (including to HCP)</td>
<td>Droplet/Direct, Airborne/Indirect?</td>
<td>Droplet/Direct, Airborne/Indirect?</td>
<td>Droplet/Direct; Airborne/Indirect?</td>
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<tr>
<td>Treatment (PEP)</td>
<td>Supportive (none)</td>
<td>Supportive (none)</td>
<td>Supportive (none)</td>
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<tr>
<td>Infection Prevention*</td>
<td>Airborne, contact, face shield</td>
<td>Airborne, contact, face shield</td>
<td>Airborne, contact, face shield</td>
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</tbody>
</table>

*PAPR or N95 respirator for cough-inducing procedures; Weber DJ, et al. Am J Infect Control 2016;44:e91-100
How does COVID-19 compare to influenza?

Seasonal Flu
Case fatality rates for the influenza season 2018-19 in the USA.
Symptomatic cases are calculated based on models which aim to account for underreporting. Figures based on medical visits are therefore also shown in square brackets, which may be a closer comparison to COVID-19 case fatality rates.

COVID-19
Case fatality rates for the COVID-19 outbreak in China, for the period up to February 11, 2020.

Who is at risk of dying from COVID-19?

Mortality by age, Wuhan, China through 11 Feb 2020
(among 44,672 confirmed cases)

Older populations are most at risk. 14.8% of people aged 80 or older who were diagnosed died.
What’s happening now?

Social distancing flattens the curve

[Diagram showing the impact of social distancing on the spread of cases]

During Airway Manipulation

Apply:
- Disposable mask, goggles, footwear, gown and gloves. Consider adopting the **double glove** technique.
- Standard ASA monitoring should be applied before induction of anesthesia.
- N95 mask at a minimum should be utilized. PAPR devices may offer superior protection when manipulating an airway of an infected patient.

Assign:
- Designate the most experienced anesthesia professionals available to perform intubation, if possible. Avoid trainee intubation for sick patients.

Avoid:
- Awake fiberoptic intubation, unless specifically indicated. Atomized local anesthetic can aerosolize the virus.

Prepare to:
- Preoxygenate for 5 minutes with 100% FiO2
- Perform a rapid sequence induction (RSI) to avoid manual ventilation of patient’s lungs and potential aerosolization of virus from airways.
- Consider using a video-laryngoscope.

RSI:
- Depending on the clinical condition, the RSI may need to be modified. If manual ventilation is required, apply small tidal volumes.

Use:
- Ensure there is a high quality HMEF (Heat and Moisture Exchanging Filter) rated to remove at least 99.97% of airborne particles 0.3 microns or greater placed in between the facemask and breathing circuit or between facemask and reservoir bag.

Dispose:
- Re-sheath the laryngoscope immediately post intubation (**double glove technique**)
- Seal all used airway equipment in a double zip-locked plastic bag. It must then be removed for decontamination and disinfection.

Remember:
- After removing protective equipment, avoid touching your hair or face before washing hands.
75yo Italian man with confirmed COVID-19

“There are bilateral large areas of ground-glass opacities with crazy paving →
and, more evident at both bases, areas of consolidation.”

https://radiopaedia.org/cases/covid-19-pneumonia-12?lang=ru

75yo Italian man with confirmed COVID-19

“AP chest radiograph for CVC position shows the presence of extensive bilateral ground-glass opacities as demonstrated on the recent CT. Also right IJV catheter and ETT noted.”

https://radiopaedia.org/cases/covid-19-pneumonia-12?lang=ru
How coronavirus / Covid-19 spread to the UK

20-23 Jan
Steve Walsh contracts virus in Singapore

24 Jan Flies to France

11 people infected in ski resort

Feb Flies from France to UK

One returns to Majorca

Feb Flies return to UK including two GPs

6 Feb Quarantined

12 patients seen by GPs are being tested
and many others traced and tested

*Two Chinese nationals who tested positive in York are not connected to this case
Source: PA, BBC research


COVID-19 SUPERSPREADER

IMPACT OF A SINGLE SUPERSPREADER

A single infected physician who traveled to Hong Kong
led to worldwide transmission of SARS

A single traveler to Republic of Korea led to an outbreak in that
country
COVID-19 Adult Clinical Evaluation Guide

**Clinical Signs/Symptoms**
- Fever seen in >75% of hospitalized cases at some point but almost 50% are febrile on admission
- Cough 45-80% (dry or productive)
- SOB 20-50%
- Myalgias 10-50%
- URI symptoms (HA, sore throat, rhinorrhea) in <15%
- GI symptoms: N/V in <10%, diarrhea in <25%

**Labs**
- CBC with diff, BMP, LFTs, procalcitonin
- Clues to COVID-19: leukopenia, lymphopenia

**Microbiology**
- Test for other viruses
- Consider blood cultures, sputum culture
- Clues to COVID-19: absence of other pathogens, but note that coinfections can occur

**Imaging**
- CXR in all patients
- Consider chest CT if there is diagnostic uncertainty
- Clues to COVID-19: bilateral, GGO, peripheral distribution

**Laboratory and Biomarkers**
- Median WBC 4.7, with leukopenia in 17-45% (leukocytosis in 25%)
- Lymphopenia in 33-85%
- Median platelets normal, slight decrease in <35%
- AST/ALT increase in 4-35%
- CRP increased in 61-86%, LDH increased in 27-75%
- PCT 0.5 in 5-10%, higher in severe or ICU

**Microbiology**
- Coinfection rate with viruses or bacteria is unknown
- The presence of another virus (e.g., influenza) makes COVID-19 less likely but does not rule it out
- Bacterial coinfection might increase with severity of illness of bacterial infection in severely ill patient does not exclude COVID-19

**Imaging**
- CXR abnormal in 50%, 77% (severe), chest CT abnormal in 86% (95% if severe)
- Unilateral findings on CXR (CT) in 14-25% (especially if mild or early in disease)
- Most common findings: GGO and patchy consolidations (>50%), peripheral distribution (>50%)
- Nodules, LAN, cystic changes, effusion in <10%
One Seoul test center consists of four trailer-like offices with white canopies in front. Put car in park, turn A/C to recirculation. Doctors in full protective suits and goggles take the driver's temperature with an infrared ear thermometer and hand out a questionnaire to fill out. If you're running a fever and, in the doctor's opinion, may be at risk based on where you've been or whom you've contacted, you're eligible for a test. Samples are collected from your nose and throat — only the driver is tested — passengers are not. Results are texted the next day. The test is free.
The symptoms of coronavirus disease [COVID-19]

The most common signs and symptoms of 59,924 laboratory confirmed cases of COVID-19 reported from China in the period up to February 22, 2020.

Fever: 67.9%
Dry cough: 67.7%
Fatigue: 38.1%
Sputum production: 32.4%
Shortness of breath: 18.6%
Muscle pain or joint pain: 14.8%
Sore throat: 13.9%
Headache: 13.6%
Chills: 11.4%
Nausea or vomiting: 5%
Nasal congestion: 4.8%
Diarrhoea: 2.7%

Many of the most common symptoms are shared with those of the flu or cold. So it is also good to know which common symptoms of the flu or the common cold are not symptoms of COVID-19.

COVID-19 infection seems to rarely cause a runny nose.

Data source: World Health Organization (2020). Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Symptoms in fewer than 1% are not shown. OurWorldInData.org - Research and data to make progress against the world’s largest problems. Licensed under CC-BY by the authors.
Chest CT


- Ground-glass opacities (GGO) (86.1%)
- Mixed GGO and consolidation (64.4%)
- Vascular enlargement in the lesion (71.3%).
- Peripheral distribution (87.1%)
- Bilateral involvement (82.2%)
- Lower lung predominant (54.5%)
- Multifocal (54.5%)

In patients at high risk for COVID19 infection, chest CT evidence of viral pneumonia may *precede* positive RT-PCR test results. https://buff.ly/2U1jlmG
## CMS DEFINITION OF “ELECTIVE” CASES

<table>
<thead>
<tr>
<th>Tiers</th>
<th>Action</th>
<th>Definition</th>
<th>Locations</th>
<th>Examples</th>
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</thead>
<tbody>
<tr>
<td>Tier 1a</td>
<td>Postpone surgery/procedure</td>
<td>Low acuity surgery/healthy patient - outpatient surgery - Not life threatening illness</td>
<td>HOPD* ASC** Hospital with low/no COVID-19 census</td>
<td>- Carpal tunnel release - EGD - Colonoscopy - Cataract</td>
</tr>
<tr>
<td>Tier 1b</td>
<td>Postpone surgery/procedure</td>
<td>Low acuity surgery/unhealthy patient</td>
<td>HOPD ASC Hospital with low/no COVID-19 census</td>
<td>- Endoscopies</td>
</tr>
<tr>
<td>Tier 2b</td>
<td>Postpone surgery/procedure if possible</td>
<td>Intermediate acuity surgery/unhealthy patient</td>
<td>HOPD ASC Hospital with low/no COVID-19 census</td>
<td></td>
</tr>
<tr>
<td>Tier 3a</td>
<td>Do not postpone</td>
<td>High acuity surgery/healthy patient</td>
<td>Hospital</td>
<td>- Most cancers - Neurosurgery - Highly symptomatic patients</td>
</tr>
<tr>
<td>Tier 3b</td>
<td>Do not postpone</td>
<td>High acuity surgery/unhealthy patient</td>
<td>Hospital</td>
<td>- Transplants - Trauma - Cardiac w/ symptoms - Limb threatening vascular surgery</td>
</tr>
</tbody>
</table>

*Hospital Outpatient Department  
**Ambulatory Surgery Center  
Created by: Sameer Siddiqui MD (used with permission)  
Version 3.15.20
INITIAL EXPERIENCE WITH COVID-19 IN ITALY

COVID-19 is like a tsunami: you can’t understand if you are not in.
Continuously increasing demand, as beds available are saturated. Intensive care teams are re-defining whole hospital operation with negative pressure. Patients without the need of ICU, requiring just O2 or NIV, need for increased COVID dedicated intensive care areas to admit ICU patients, involving sub-intensive care unit, day surgery wards, recovery rooms (severely reduced conventional surgical activity, just emergencies).

KEEP PACE WITH SARS-CoV-2
You need to be prepared (before patients flow): Know hospital/logistics in advance area where to admit patients (but be ready to find alternative solutions day by day as situation evolves). Selective triage for COVID pts.
Know: clean areas in advance, clean & dirty areas.
Take care of your human resources: be able to figure out your PPE need & practice donning and doffing procedures. Keep providers & areas safe: protect personnel in areas that are going to look after patients.
Be properly organized in a network. Support of surrounding hospitals may be crucial to drain huge amount of critical patients, transferring them to other ICUs, guided by main coordination center. Also non-COVID pts need to be managed and eventually diverted to other areas/hospitals.

(EARLY) DIAGNOSIS
Patients similar to one another easy to diagnose: CXR interstitial, bilateral infiltrates common (rarely asymmetrical), with gravitational distribution. ARS/blood tests: initially moderate hypoxemia, mild acidosis with normal lactate, severe base deficit, high anion gap, elevated LIP. Very high CRP. Elevated CK, negative procalcitonin.
Early diagnosis mandatory to properly manage patients & predict pre-defined pathways in area involved by outbreak. Interstitial pneumonia/respiratory failure &/or flu like syndrome. Treat as COVID positive unless proven otherwise. Using Swab to exclude more than to confirm?! Be careful, do not blindly trust negative Swab if symptoms/pneumonia with suggestive CXR. CT scan, LUS go for bronchoalveolar lavage/deep bronchial aspirate/bronchoalveolar (prefer closed suction systems).

FLUIDS
Keep negative fluid balance. With minimal volemia, requested to avoid hypoperfusion (inotropes/vasopressors generally better vs fluid replacement, if no indicators of hypovolemia).
Due to high airway pressures MV induced. Often ICU fixed/dilated heart involved, frequently with hypodynamic. Strictly control temperature; consider eventual severe glicemic/metabolic derangement (antiviral infection??), and eventual hypocalcemia (both reported).

MV & WEANING
Respiratory failure take time, usually need a phase of controlled MV with high PEEP (15-20 cmH2O) before assisted breathing. Check whole clinical conditions. Not only MV often patients are easy to ventilate, with high compliance and acceptable PIP. Be prepared to accept low PIP to avoid excessive MV pressures; be cautious with VT to avoid overdistention. Consider (early) PEEP
Early spontaneous ventilation due to the risk of derecruitment, particularly in posterior lung fields. Very long time needed to wean; due to delayed weaning, (early) think to tracheostomy: MV sedation management easier/proning still feasible.

LUNG ULTRASOUND
Coup’s of LUS pattern reported:

c. Sign of pulmonary interstitial syndrome with diffusion, multifocal involvement, both anterior & posterior lung fields. May be coalescent, with bilateral distribution. Probably PEEP responders: titrate PEEP (check if pattern disappears as increasing PEEP).

c. Normal anterior lung fields (risk of overdistention if high PEEP). Tissue like pattern in posterior lung fields, probably not recruitable with PEEP alone. May need prone positioning to be recruited.

Consider daily LUS (as feasible due to high number of patients) to guide MV settings/management (ie PEEP titration, prone positioning) & monitor evolution: loss of aeration/re-aeration, Early deduct complications in consolidation suggesting superinfection, bacteraemia due to high MV settings/recruitment maneuver (ie PII/Subcutaneous emphysema).

PRONING
To improve prone positioning effectively keep patient prone for 10 if no instability/complications; then 6-8 h as possible. Otherwise early re-proning. Consider longer PP (ie 18-22h) if severe hypoxemia persists, until stable P/F ratio. Due to lung injury, repeated PP usually required, not easy for staff due to PPE, particularly if inexperienced nurses admitted from other ICU areas, trained on the field.

ECMO ??
Patients are hypoxemic but really compliant to MV, and prone positioning responders. So, to date, most do not need rescue MI-ECMO vs hILD pneumonia (and this is good as patients admission massive...). Consider eventual need for veno-arterial support due to myocarditis/hypoxic cardiac arrest, or veno-arterial-venous ECMO if hemodynamic impairment, no responders to MV.

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ACE/ARB Society Recommendations related to ARB/ACE

Summary: CONTINUE ACE/ARB

<table>
<thead>
<tr>
<th>Society</th>
<th>Summary of recommendations</th>
<th>Last Statement Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Society of Hypertension</td>
<td>Recommend continuing ACEIs/ARBs due to lack of evidence to support differential use in COVID-19 patients. In those with severe symptoms or sepsis, antihypertensive decisions should be made on a case-by-case basis taking into account current guidelines.</td>
<td>March 12, 2020</td>
</tr>
<tr>
<td>European Society of Cardiology Council on Hypertension</td>
<td>Strongly encourage continuing ACEIs/ARBs due to lack of evidence to support discontinuing</td>
<td>March 13, 2020</td>
</tr>
<tr>
<td>Hypertension Canada</td>
<td>Recommend continuing ACEIs/ARBs due to lack of evidence that patients with hypertension or those treated with ACEIs/ARBs are at higher risk of adverse outcomes from COVID-19 infection</td>
<td>March 13, 2020</td>
</tr>
<tr>
<td>Canadian Cardiovascular Society</td>
<td>Strongly encourage continuing ACEIs/ARBs and Angiotensin Receptor Neprilysin Inhibitors due to a lack of clinical evidence to support withdrawal of these agents</td>
<td>March 15, 2020</td>
</tr>
<tr>
<td>The Renal Association, United Kingdom</td>
<td>Strongly encourage continuing ACEIs/ARBs due to unconvincing evidence that these medications increase risk</td>
<td>March 15, 2020</td>
</tr>
<tr>
<td>International Society of Hypertension</td>
<td>Strongly recommend that the routine use of ACEIs/ARBs to treat hypertension should not be influenced by concerns about COVID-19 in the absence of compelling data that ACEIs/ARBs either improve or worsen susceptibility to COVID-19 infection nor do they affect the outcomes of those infected.</td>
<td>March 16, 2020</td>
</tr>
<tr>
<td>American College of Physicians</td>
<td>Encourage continuing ACEIs/ARBs because there is no evidence linking them to COVID-19 disease severity, and discontinuation of antihypertensive therapy without medical indication could in some circumstances result in harm</td>
<td>March 16, 2020</td>
</tr>
<tr>
<td>Spanish Society of Hypertension</td>
<td>Recommend that ACEIs/ARBs should not be empirically stopped in patients who are already taking them; in seriously ill patients, changes should be made on a case-by-case basis</td>
<td>March 16, 2020</td>
</tr>
<tr>
<td>American Heart Association, Heart Failure Society of America, American College of Cardiology</td>
<td>Recommend continuing ACEIs/ARBs for all patients already prescribed them</td>
<td>March 17, 2020</td>
</tr>
<tr>
<td>European Renal Association - European Dialysis and Transplant Association</td>
<td>Recommend continuing ACEIs/ARBs in COVID-19 infection patients due to a lack of evidence to support differential use and the discontinuation of ACEIs/ARBs in COVID-19 patients</td>
<td>March 17, 2020</td>
</tr>
<tr>
<td>American Society of Pediatric Nephrology</td>
<td>Strongly recommend continuing ACEIs/ARBs until new evidence to the contrary becomes available</td>
<td>March 17, 2020</td>
</tr>
<tr>
<td>High Blood Pressure Research Council of Australia</td>
<td>Recommend continuing routine use of ACEIs/ARBs. Patients should not cease blood pressure lowering medications unless advised to do so by their physician</td>
<td>March 18, 2020</td>
</tr>
</tbody>
</table>
A Seattle Intensivist’s One-pager on COVID-19

Infection: Coronavirus Disease 2019 a.k.a. COVID-19
Virus: SARS-CoV-2, 2019 Novel Coronavirus
NOT “Wuhan Virus” NOT “China Virus”

BMI: 16.9 kg/m², 1st day of fever

Signs:
- Tachypnea
- Oxygen saturation <90%
- Temperature >37°C

Symptoms:
- 65-80% cough
- 45% febrile on presentation (85% febrile during illness)
- 20-40% dyspnea
- 15% URI symptoms
- 10% GI symptoms
- Effect of ACE/ARB is unclear; not recommended to change medications at this time.

Medication: Hydroxychloroquine 400 mg/day

Laboratory:
- CBC: Leukopenia & lymphopenia (80%)
- BMP:↑BNP/Cr
- Uric acid:
- ↑D-dimer, ↑CRP, ↑LDH
- ↑IL-6, ↑Ferritin
- ↓Procalcitonin
- CT may be high w/ superinfection (rare)

Imaging — (imaging NOT diagnostic)
- CXR: Hazy bilateral, peripherally opacities
- CT: Ground glass opacities (GGD), crazy paving, consolidation, *rarely may be unilateral*
- POCUS: Numerous B-lines, pleural line thickening, consolidations w/ air bronchograms

Isolation:
- Phone call is best: isolation (e.g. move to telemed)
- Place patient in mask; single room, limit/restrict visitors

Precautions:
- In correct sequence: STANDARD + CONTACT (double glove) + either AIRBORNE (for aerosolizing procedures: intubation, extubation, NIPPV, suctioning, etc) or DROPLET (for everything else; ideally airborne)
- N95 masks must be fit tested; wear eye protection
- PPE should be donned/doffed with trained observer
- Hand hygiene: 20+ seconds w/ soap/water or alcohol containing hand gel

Treatment
- Isolate & send PCR test early (may take days to result)
- GOC discussion / triage
- Notify DOH, CDC, etc
- Fluid sparing resuscitation
- Avoid NSAIDS; use acetaminophen/paracetamol for fever
- Empiric antibiotic
- Intubate early under controlled conditions: RSI, no bagging, VL, have suction, cannography connected to avoid circuit breaks.
- Avoid HFNC or NIPPV (aerosolizes virus) unless individualized reasons exist (e.g. COPD, DNI status, etc; consider helmet mask interface if available) if using NIPPV; avoid nebulizers
- Mechanical ventilation for ARDS
- ILV per ARDSNet protocol
- PEEP/Parilectors/Prone irrigation Prostacyclin, etc
- High PEEP ladder may be better
- ECMO in select cases (unclear who)
- Consider using PCCUS to monitor/evaluate lungs
- Investigational therapies: consider clinical trial enrollment
- Remdesivir — not approved; used investigational
- Hydroxychloroquine (HCQ) — available: limited evidence
- Chloroquine (CQ) — available: limited evidence
- Tocilizumab — available: investigational for pt in shock
- Lopinavir/Ritonavir — available: recent negative RCT
- Oseltamivir — not recommended (no evidence of efficacy)
- Corticosteroids — not recommended (* harmful)

Prognosis
- Age and comorbidities (DM, COPD, CVD) are significant predictors of poor clinical outcome; admission SOFA score also predicts mortality.
- Lab findings predict mortality (↑D-dimer, ferritin, troponin, cardiac myoglobin)
- Expect prolonged MV (median)
- Watch for complications: Secondary infection (VAP), Cardiomyopathy

Nick Mark, MD
@rickmark
Typical features according to current publications
Age Mean (SD) 55.5 (13.1), Male (68%)
Exposure to Huanan seafood market in Wuhan, China (49%)
Chronic medical underlying illness (51%)
Admission to Intensive Care Unit (23%)

<table>
<thead>
<tr>
<th>INOCULATION PERIOD and ONSET OF SYMPTOMS 3 DAYS AGO</th>
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<tbody>
<tr>
<td>REPEATED SAMPLING OF THE NASOPHARYNX AND TRACHEAL ASPIRATES (IF INTUBATED) BY iRT-PCR FOR THE COVID-19</td>
</tr>
<tr>
<td>Initial important viral shedding</td>
</tr>
<tr>
<td>Decrease of the viral shedding sometimes associated with transient respiratory deterioration</td>
</tr>
<tr>
<td>Respiratory failure, increase of the viral shedding and viremia or Decrease of the viral shedding, and superinfections</td>
</tr>
<tr>
<td>Duration of viral excretion unknown</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SETTING</td>
</tr>
<tr>
<td>OXYGEN THERAPY AND MECHANICAL VENTILATION</td>
</tr>
<tr>
<td>Fever, cough, and shortness of breath (15%), bilateral pneumonia (75%), lymphopenia (35%), thrombocytopenia (12%), prothrombin time decreased (30%), elevated liver enzyme levels (about 30%)</td>
</tr>
<tr>
<td>Deterioration of respiratory status with most often spontaneous recovery</td>
</tr>
<tr>
<td>ARDS</td>
</tr>
<tr>
<td>At shock beware of superinfections</td>
</tr>
<tr>
<td>Possible renal failure</td>
</tr>
<tr>
<td>Neurological failure unlikely</td>
</tr>
<tr>
<td>Hemostasis disorders</td>
</tr>
<tr>
<td>YES</td>
</tr>
<tr>
<td>ORGAN FAILURE</td>
</tr>
<tr>
<td>CO-INFECTION/SUPERINFECTION</td>
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<tr>
<td>ANTI-INFECTION drugs</td>
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<tr>
<td>ANTIVIRAL AGENTS</td>
</tr>
<tr>
<td>ANTI-INFECTIVE THERAPY</td>
</tr>
<tr>
<td>YES</td>
</tr>
</tbody>
</table>

FNC = flow nasal cannula; HFNC = high flow nasal cannula; HAP = healthcare-associated pneumonia; VAP = ventilator-associated pneumonia; MV = Mechanical ventilation; a The use of immunomodulation including corticosteroids is unlikely but debated