White paper: COVID-19 Update – Hospital Medicine
Submitted by D. Ruby Sahoo, DO, MBA, and Suj Sundararaj, MD, MBA

Purpose
The purpose of this document is to assist you with COVID-19 awareness and preparedness as you lead your patients and community through this public health emergency. The links below will provide the most updated information, including suggestions on how to put together emergent or backup coverage.

COVID-19 Cases
Over 35 states now have confirmed cases of COVID-19, and countless communities have been affected across the United States. We found this resource from Johns Hopkins that tracks cases of confirmed COVID-19 worldwide.

(Source: Johns Hopkins University – https://www.arcgis.com/apps/opsdashboard/index.html#bda7594740640297423467b4f4a99eef0)
Transmission

• Transmission is occurring person-to-person via respiratory droplets (similar to influenza).
• Droplets are not felt to travel more than 6 feet and do not linger in the air.
• Transmission may occur via mucus membrane contact with virus-containing respiratory secretions that results from coughing, sneezing and talking, either directly or by touching an infected surface and then touching the eyes, nose or mouth.
• Transmission from asymptomatic individuals has also been described. [16-20].

Prevention

• There is currently no vaccine to protect against COVID-19.
• Avoid close contact with people who are sick.
• Cover your cough with the bend of your elbow or tissue.
• Wash your hands often, ideally with soap and water for 30 seconds. Hand sanitizer may be adequate as a second choice.

Risk Factors for Severe Illness

Per CDC, the following are underlying medical conditions that may increase the risk of serious COVID-19 for individuals of any age:

• Blood disorders
• Chronic kidney disease
• Chronic liver disease
• Immunosuppression
• Current or recent pregnancy in the last 2 weeks
• Endocrine disorders (e.g., diabetes mellitus)
• Metabolic disorders (such as inherited metabolic disorders and mitochondrial disorders)
• Heart disease (such as congenital heart disease, congestive heart failure and coronary artery disease)
• Lung disease including asthma or chronic obstructive pulmonary disease (chronic bronchitis emphysema) or other chronic conditions associated with impaired lung function or that require home oxygen
• Neurological and neurologic and neurodevelopment conditions (including disorders of brain, spinal cord, peripheral nerve, and muscle such as cerebral palsy, epilepsy (seizure disorders), stroke, intellectual disability, moderate to severe developmental delay, muscular dystrophy, or spinal cord injury)


Signs and Symptoms

• Incubation period is 2 – 14 days (Median 5 – 6 days)
• Fever (77 – 98%)
• Cough (46 – 82%)
• Fatigue (38.1%)
• Dyspnea (33%)
• Myalgias (11%)
• Other:
  o Sore throat
  o Headache
  o Hemoptysis
  o GI symptoms prior to fever: Nausea, Diarrhea


**Lab and Radiographic Findings**

On admission:

• Lymphopenia (63%)
• Elevated alanine aminotransferase and aspartate aminotransferase levels (37%) [2,4]
• Thrombocytopenia (36%) [6]
• Leukopenia (9-25%)
• Leukocytosis (24–30%)
• Normal serum levels of procalcitonin
• Chest X-ray (CXR)
  o Can be normal in the early stages of the disease
  o Most commonly reveals ground glass or patchy infiltrates
• Chest CT
  o Bilateral involvement in most patients.
  o Multiple areas of consolidation and ground glass opacities are typical findings reported to date. [2–4, 16–24]
  o 56% of patients who presented within 2 days of symptom onset had a normal CT on admission. [20]

<table>
<thead>
<tr>
<th>Total Abnormal CXRs</th>
<th>59.1%</th>
<th>Total Abnormal Chest CTs</th>
<th>86.2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground-glass opacity</td>
<td>20.1%</td>
<td>Ground-glass opacity</td>
<td>56.4%</td>
</tr>
<tr>
<td>Local patchy shadowing</td>
<td>28.1%</td>
<td>Local patchy shadowing</td>
<td>41.9%</td>
</tr>
<tr>
<td>Bilateral patchy shadowing</td>
<td>36.5%</td>
<td>Bilateral patchy shadowing</td>
<td>51.8%</td>
</tr>
<tr>
<td>Interstitial abnormalities</td>
<td>4.4%</td>
<td>Interstitial abnormalities</td>
<td>14.7%</td>
</tr>
<tr>
<td>No abnormality</td>
<td>41.9%</td>
<td>No abnormality</td>
<td>13.8%</td>
</tr>
</tbody>
</table>
Special Considerations

- Patients who develop severe respiratory illness may have a decline in respiratory status at day 6-10.
- Closer monitoring may be required in this subset of patients during this timeframe.

Screening Tool

If suspicion of COVID-19

PLACE A MASK ON THE PATIENT

PLACE A MASK ON SELF / PROVIDER

- Place in isolation (airborne, contact, standard precautions with eye protection).
- Move to negative pressure room if possible.
- Notify Infection Prevention/Infection Control.
- Ensure local or state health department has been notified.*
- Consider Infectious Disease Consult.
- Communicate need for isolation to family members and visitors of patient.

Contact your local or state health department:

- https://www.naccho.org/membership/lhd-directory
- https://www.cste.org/page/EpiOnCall
Guidance for Management of Critically Ill Patients for the Hospitalist

Caring for critically ill patients with COVID-19 is based on the usual management of viral pneumonia with respiratory failure with additional precautions to reduce risk of transmission.

### Usual critical care

Many patients with severe COVID-19 develop acute respiratory distress syndrome (ARDS). Evidence-based guidelines for ARDS in the context of COVID-19 include treatments such as:

- Conservative intravenous fluid strategies
- Empirical early antibiotics for possible bacterial pneumonia
- Consideration for early invasive ventilation
- Lung-protective ventilation strategies
- Periodic prone positioning during mechanical ventilation
- Consideration of extracorporeal membrane oxygenation

### Modifications to usual critical care

- Admission of patients with suspected disease to private rooms when possible
- Use of medical face masks for symptomatic patients during assessment and transfer
- Maintain distancing of at least 2 m between patients
- Caution when using high-flow nasal oxygen or noninvasive ventilation due to risk of dispersion of aerosolized virus in the health care environment with poorly fitting masks
- Clinicians involved with aerosol-generating procedures should use additional airborne precautions including N95 respirators and eye protection

### Facility planning

- Ensure staff have updated training in infection prevention and control including personal protective equipment
- Planning at local and regional levels for a potential surge in the need for critical care resources

### COVID-19-specific considerations

Antiviral or immunomodulatory therapies are not yet proven effective for treatment of COVID-19. Patients should be asked to participate in clinical trials of supportive or targeted therapies.

(Source: JAMA – 3-11-2020 Care for Critically Ill Patients with COVID-19  S. Murthy, MD; R. Gomersall, MBBS; R. Fowler, MD)
Respiratory Support

General schema for respiratory support in patients with COVID-19

Low flow nasal cannula
- Typically set at 1-6 liters/minute

High flow nasal cannula (with limitation in the flow rate)
- Titrate FiO2 based on patient’s saturation.
- Avoid very high flow rates (e.g. perhaps flow rates between 15-30 liters/minute could be reasonable??). This isn’t truly “high flow” – yet it allows administration of high levels of FiO2 in a comfortable fashion.
- If a commercial high-flow nasal cannula isn’t available, a standard nasal cannula can be set at higher rates if clinically tolerated (e.g. 6-15 liters/minute). This may be uncomfortable and cause nasal dryness, but it’s not dangerous. Other options include venturi masks and non-rebreather facemasks.

Invasive mechanical ventilation
- Target tidal volumes of ~6 cc/kg.
- Permissive hypercapnia may be useful to allow for lung-protective settings.
- May use conventional lung-protective ventilation strategies or APRV.

Prone positioning
- Exact indication for prone ventilation is unclear.
- Prone is a front-line therapy for refractory hypoxemia, but it’s unclear whether it is beneficial in all patients with PaO2/FiO2 ratio <150.

VV-ECMO
- Indications remain unclear.
- Early discussion with ECMO center or team may be advisable.

The optimal strategy for respiratory support in COVID-19 remains unknown. The above strategy seems reasonable, adapted largely from experience with other types of viral pneumonia. Patients with more complex respiratory disease (e.g. COPD plus COVID-19) might benefit from BiPAP.

High-Flow Nasal Cannula (HFNC) or Non-Invasive Ventilation (NIV)
- Should only be used in selected patients with hypoxemic respiratory failure.
- Risk of treatment failure is high in patients treated with HFNC or NIV and should be closely monitored for clinical deterioration
- WHO guidelines on COVID-19 state that “Recent publications suggest that new HFNC and NIV systems with good interface fitting do not create widespread dispersion of exhaled air and therefore should be associated with low risk of airborne transmission”
- Be aware of potential to exhaust the hospital’s oxygen supply

Non-invasive Ventilation (BiPAP)
- Role of BiPAP is unclear
- Multiple studies have demonstrated that either patients had BiPAP failure and required intubation or worse outcomes compared to patients randomized to HFNC

Intubation Procedure
- REPRESENTS HIGH RISK OF TRANSMISSION TO HEALTHCARE WORKERS
• Airborne precautions, with full face shields, and full contact precautions must be adhered to
• Use of video laryngoscopy may avoid placing the operator’s face close to the patient
• Limit the number of people in the room to the minimum necessary only

Invasive Mechanical Ventilation

Ventilator Settings
• Use lower Tidal Volumes (4-8 ml/kg predicted body weight, PW) and lower inspiratory pressures (plateau pressure <30 cmH2O)
• Reports from Italy suggest-
  o Driving pressures required aren’t very high
  o Patients require high PEEP and also respond well to prone ventilation
• Primary problem may be with small airway closure and atelectasis (rather than reduced lung compliance).
  o If conventional ventilation is used, high PEEP settings should be utilized
  o Early APRV should be considered
• Permissive Hypercapnia will likely be extremely important when ventilating these patients in a safe fashion.

Proning
• Prior to consideration of proning, optimization on the ventilator for 12-24 hours is generally preferable.
• If failure to respond to initial ventilator optimization, prone ventilation may be considered.

Prognosis
• It is unclear as to what percentage of patients are hospitalized
  o Most mild cases don’t present for medical attention
  o Vast majority of infected patients (e.g. >80%) don’t get significantly ill and don’t require hospitalization
• Among hospitalized patients
  o Approx. 10-20% are admitted to the ICU
  o Approx. 3-10% require intubation
  o Approx. 2-5% die
Personal Protective Equipment


(Source: CDC - https://www.cdc.gov/niosh/npptl/pdfs/PPE-Sequence-508.pdf)
Treatment

- We are not covering triage level info (when to send home, when to admit)
- No specific treatment for COVID-19 is currently available.
- Antiviral treatments (remdesivir, lopinavir/ritonavir) have not been approved for use in COVID-19 but are being used at some facilities with promising results.
- Clinical management should include infection prevention and control measures and supportive management of complications.
- Antibacterials are not effective against COVID-19 and are not recommended unless a complicating bacterial infection is also present.
- Corticosteroids should be avoided because of the potential for prolonging viral replication as observed in MERS-CoV patients, unless indicated for other reasons. [31, 40–42] For example, for a chronic obstructive pulmonary disease exacerbation or for septic shock per Surviving Sepsis guidelines for adults (Reference A) and children. (Reference B)
- Use conservative fluid management strategy for ARDS patients without tissue hypoperfusion.

Quarantine

Provider quarantine varies widely based on local health department and individual site decisions. As the pandemic progresses, we are seeing more return to work decisions for providers who have a medium risk exposure (ie. unmasked patient, masked provider without goggles). These providers are being advised to self-monitor by checking temperature and symptoms twice daily and staying home if febrile or respiratory symptoms develop. In some cases, our providers are required to wear a mask in order to return to work.

<table>
<thead>
<tr>
<th>Epidemiologic risk factors</th>
<th>Exposure category</th>
<th>Recommended Monitoring for COVID-19 (until 14 days after last potential exposure)</th>
<th>Work Restrictions for Asymptomatic HCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged close contact with a COVID-19 patient who was wearing a facemask (i.e., source control)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCP PPE: None</td>
<td>Medium</td>
<td>Active</td>
<td>Exclude from work for 14 days after last exposure</td>
</tr>
<tr>
<td>HCP PPE: Not wearing a facemask or respirator</td>
<td>Medium</td>
<td>Active</td>
<td>Exclude from work for 14 days after last exposure</td>
</tr>
<tr>
<td>HCP PPE: Not wearing eye protection</td>
<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
<tr>
<td>HCP PPE: Not wearing gown or gloves*</td>
<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
<tr>
<td>HCP PPE: Wearing all recommended PPE (except wearing a facemask instead of a respirator)</td>
<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
</tbody>
</table>
### Prolonged close contact with a COVID-19 patient who was not wearing a facemask (i.e., no source control)

<table>
<thead>
<tr>
<th>HCP PPE: None</th>
<th>High</th>
<th>Active</th>
<th>Exclude from work for 14 days after last exposure</th>
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<tbody>
<tr>
<td>HCP PPE: Not wearing a facemask or respirator</td>
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</tr>
<tr>
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<td>Low</td>
<td>Self with delegated supervision</td>
<td>None</td>
</tr>
</tbody>
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**Keeping your family safe**: Mitigation strategies for individuals and families at home

<table>
<thead>
<tr>
<th>Factor</th>
<th>Minimal to moderate</th>
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</thead>
<tbody>
<tr>
<td>Individuals and Families at Home</td>
<td>▪ Know where to find local information on COVID-19 and local trends of COVID-19 cases.</td>
</tr>
<tr>
<td></td>
<td>▪ Know the signs and symptoms of COVID-19 and what to do if symptomatic:</td>
</tr>
<tr>
<td></td>
<td>◦ Stay home when you are sick</td>
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<tr>
<td></td>
<td>◦ Call your health care provider's office in advance of a visit</td>
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<td></td>
<td>◦ Limit movement in the community</td>
</tr>
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<td></td>
<td>◦ Limit visitors</td>
</tr>
<tr>
<td></td>
<td>▪ Know what additional measures those at high-risk and who are vulnerable should take.</td>
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<tr>
<td></td>
<td>▪ Implement personal protective measures (e.g., stay home when sick, handwashing,</td>
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<td></td>
<td>respiratory etiquette, clean frequently touched surfaces daily).</td>
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<tr>
<td></td>
<td>▪ Create a household plan of action in case of illness in the household or disruption</td>
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<td></td>
<td>of daily activities due to COVID-19 in the community.</td>
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<td></td>
<td>◦ Consider 2-week supply of prescription and over the counter medications, food</td>
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<tr>
<td></td>
<td>and other essentials. Know how to get food delivered if possible.</td>
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<td></td>
<td>◦ Establish ways to communicate with others (e.g., family, friends, co-workers).</td>
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<td></td>
<td>◦ Establish plans to telework, what to do about childcare needs, how to adapt to</td>
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<td></td>
<td>cancellation of events.</td>
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<tr>
<td></td>
<td>▪ Know about emergency operations plans for schools/workplaces of household members.</td>
</tr>
<tr>
<td></td>
<td>▪ Continue to monitor local information about COVID-19 in your community.</td>
</tr>
<tr>
<td></td>
<td>▪ Continue to practice personal protective measures.</td>
</tr>
<tr>
<td></td>
<td>▪ Continue to put household plan into action.</td>
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<tr>
<td></td>
<td>▪ Individuals at increased risk of severe illness should consider staying at home</td>
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<td></td>
<td>and avoiding gatherings or other situations of potential exposures, including</td>
</tr>
<tr>
<td></td>
<td>travel.</td>
</tr>
<tr>
<td></td>
<td>▪ Continue to monitor local information.</td>
</tr>
<tr>
<td></td>
<td>▪ Continue to practice personal protective measures.</td>
</tr>
<tr>
<td></td>
<td>▪ Continue to put household plan into place.</td>
</tr>
<tr>
<td></td>
<td>▪ All individuals should limit community movement and adapt to disruptions in routine</td>
</tr>
<tr>
<td></td>
<td>activities (e.g., school and/or work closures) according to guidance from local</td>
</tr>
<tr>
<td></td>
<td>officials.</td>
</tr>
</tbody>
</table>

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What to do if you are sick with coronavirus disease 2019 (COVID-19)

If you are sick with COVID-19 or suspect you are infected with the virus that causes COVID-19, follow the steps below to help prevent the disease from spreading to people in your home and community.

Stay home except to get medical care
You should restrict activities outside your home, except for getting medical care. Do not go to work, school, or public areas. Avoid using public transportation, ride-sharing, or taxis.

Separate yourself from other people and animals in your home
People: As much as possible, you should stay in a specific room and away from other people in your home. Also, you should use a separate bathroom, if available.

Animals: Do not handle pets or other animals while sick. See COVID-19 and Animals for more information.

Call ahead before visiting your doctor
If you have a medical appointment, call the healthcare provider and tell them that you have or may have COVID-19. This will help the healthcare provider’s office take steps to keep other people from getting infected or exposed.

Wear a facemask
You should wear a facemask when you are around other people (e.g., sharing a room or vehicle) or pets and before you enter a healthcare provider’s office. If you are not able to wear a face mask (for example, because it causes trouble breathing), then people who live with you should not stay in the same room with you, or they should wear a face mask if they enter your room.

Cover your coughs and sneezes
Cover your mouth and nose with a tissue when you cough or sneeze. Throw used tissues in a lined trash can immediately wash your hands with soap and water for at least 20 seconds or clean your hands with an alcohol-based hand sanitizer that contains at least 60% alcohol covering all surfaces of your hands and rubbing them together until they feel dry. Soap and water should be used preferentially if hands are visibly dirty.

Avoid sharing personal household items
You should not share dishes, drinking glasses, cups, eating utensils, towels, or bedding with other people or pets in your home. After using these items, they should be washed thoroughly with soap and water.

Clean your hands often
Wash your hands often with soap and water for at least 20 seconds. If soap and water are not available, clean your hands with an alcohol-based hand sanitizer that contains at least 60% alcohol, covering all surfaces of your hands and rubbing them together until they feel dry. Soap and water should be used preferentially if hands are visibly dirty. Avoid touching your eyes, nose, and mouth with unwashed hands.

Clean all “high-touch” surfaces every day
High touch surfaces include counters, tabletops, doorknobs, bathroom fixtures, toilets, phones, keyboards, tablets, and bedside tables. Also, clean any surfaces that may have blood, stool, or bodily fluids on them. Use a household cleaning spray or wipe, according to the label instructions. Labels contain instructions for safe and effective use of the cleaning product and the precautions you should take when applying the product, such as wearing gloves and making sure you have good ventilation during use of the product.

Monitor your symptoms
Seek prompt medical attention if your illness is worsening (e.g., difficulty breathing). Before seeking care, call your healthcare provider and tell them that you have, or are being evaluated for, COVID-19. Put on a facemask before you enter the facility. These steps will help the healthcare provider’s office to keep other people in the office or waiting room from getting infected or exposed.

Ask your healthcare provider to call the local or state health department. Persons who are placed under active monitoring or facilitated self-monitoring should follow instructions provided by their local health department or occupational health professionals, as appropriate. When working with your local health department, check their available hours.

If you have a medical emergency and need to call 911, notify the dispatch personnel that you have, or are being evaluated for COVID-19. If possible, put on a facemask before emergency medical services arrive.

Discontinuing home isolation
Patients with confirmed COVID-19 should remain under home isolation precautions until the risk of secondary transmission to others is thought to be low. The decision to discontinue home isolation precautions should be made on a case-by-case basis, in consultation with healthcare providers and state and local health departments.

For more information: www.cdc.gov/COVID19
Emergent Coverage Planning
  • For the next 12 weeks at a minimum, plan an emergent coverage staffing plan.
  • If you have questions about compensation regarding quarantined clinicians or emergent coverage, talk to your VPO/RMD.

Jeopardy system
  • Voluntary Sign up by clinicians for on-call
  • Emergent Staffing responsibilities made clear: Admitter, Observation discharger, Rounder etc. for a set amount of hours and set compensation per hour

Flex Shifts
  • Consider flexing shifts up in hours for additional coverage (ie flex 10hr shift up to 12hr shift as needed).

Reallocate Resources where they’re needed the most:
  • Swing shifts and admitter shifts can be flexed to rounding + admissions (i.e. 1p-9p swing shift can be extended to 7a-9p for rounding on 10 patients, then admissions 1p-9p).
  • Depending on FMD schedule and availability, utilize FMD in surge capacity instead of strict 7 on / 7 off.

Designated Physicians
  • Consider limiting the number of clinicians being exposed to COVID-19 patients.

Disclaimer: These are suggestions of workflows. We advise that you discuss with the hospital administration and/or infection control before implementing these.
Additional Resources

The data surrounding this public health emergency is changing daily and sometimes hourly, so we have included some links below of websites to stay updated.

- https://www.thelancet.com/coronavirus
- https://jamanetwork.com/journals/jama/fullarticle/2762130
- https://my.visme.co/projects/4d80743j-covid19-sheet#s1
- https://criticalcarenorthampton.com/2020/03/08/covid-19-your-one-stop-resource/
- https://www.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6

COVID-19, The Internet Book of Critical Care, 3/2/2020 - J. Farkas
Appendix 1: Printable information from Critical Care Northampton

**CORONAVIRUS - #COVID19**

**ZOONOTIC, BETA, NOVEL, HUMAN CORONAVIRUS**

Can pass from animals to humans

Subtype of the virus

New as of December 2019

It is seen and can cause disease in humans, including respiratory symptoms

The virus is called SARS-CoV-2 and the illness is COVID-19

It is a mutating virus, which may complicate matters in time

**RESPIRATORY SYMPTOMS**

Cough, fever, dyspnoea and sputum production are most common

**PNEUMONIA**

Matting ground glass opacities predominantly peripheral and basal

**ARDS**

Pulmonary fissure is made → 5%

**TRANSMISSION**

Large droplet transmission ← 6 feet away from patient

Airborne transmission ← unsuitable if it can travel this way

If this route is the vector, one would need FFP3 masks & advanced PPE if carrying out aerosol generating procedures

Follow your own hospital’s guidelines for the use of PPE if dealing with patients who have COVID-19

The virus persists on ‘surfaces’ or vectors in the environment. All efforts to control the viral spread must focus on stopping the spread of the large droplets which are colonized out, settling on surfaces, being touched and then transmitted to the face.

Surfaces will need to be frequently cleaned (Ethanol or Hypochlorite), hands washed appropriately + alcohol hand gel and avoid touching your face

**TYPICAL EVOLUTION**

~6 days post exposure = dyspnoea

~8 days post exposure = admission

~10 days post exposure = ICU admission/intubation

**TREATMENT MODALITIES**

Antibiotics - not unless severe disease with potential of bacterial addition - yes in late infection

Antivirals - consider in deterioration - currently scant evidence base

Steroids - unlikely a role - but some debate - may prolong viral shedding too

HFN0, IVF, NEBS and MV - beware of aerosol generation & spread of infection

**RISK FACTORS THAT INCREASE SEVERITY**

- Elderly, male patients
- >65 years of age
- Hypertensive
- Smoker/ex-smoker
- Bacterial co-infection
- Co-morbidities

**LABS**

- WBC tends to be normal
- Lymphopenia is common in ~80%
- Mild thrombocytopenia (~100 is uncommon)
- Elevated D-dimer can occur
- Does not appear to increase procalcitonin
- Elevated procalcitonin may indicate bacterial involvement
- Elevated liver enzymes in ~30%
- PT/INR decreased in about 30%
- Lab findings tend to be generally nonspecific