Clinical Management of Critically Ill Adults with COVID-19

Clinician Outreach and Communication Activity (COCA) Webinar

Thursday, April 2, 2020
Continuing Education

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- Using the Webinar System
  - Click the Q&A button.
  - Type your question in the Q&A box.
  - Submit your question.

- If we are unable to get to your question during the call, you may also email your question to coca@cdc.gov.

- For media questions, please contact CDC Media Relations at 404-639-3286, or send an email to media@cdc.gov.
For More **Clinical Care** Information on COVID-19

- **Call** COVID-19 Clinical Call Center at 770-488-7100 (24 hours/day).
- **Refer** patients to state and local health departments for COVID-19 testing and test results.
  – Clinicians should NOT refer patients to CDC to find out where or how to get tested for COVID-19, OR to get COVID-19 test results.
- **Visit** CDC’s Coronavirus (COVID-19) website: [https://www.cdc.gov/coronavirus](https://www.cdc.gov/coronavirus)
- **Visit** [emergency.cdc.gov/coca](https://emergency.cdc.gov/coca) over the next several days to learn about future COCA Calls.
Today’s Presenters

- **CAPT Tim Uyeki, MD**
  Clinical Team Lead
  COVID-19 Response
  Centers for Disease Control and Prevention

- **Michael Bundesmann, MD, FCCP**
  Medical Director of Respiratory Therapy
  Pulmonary and Critical Care Medicine
  EvergreenHealth
  Kirkland, WA

- **Waleed Alhazzani, MD, MSc, FRCPC**
  Associate Professor Department of Medicine,
  McMaster University
  Hamilton, Ontario, Canada
COVID-19 Overview for Clinicians

Tim Uyeki MD, MPH
Clinical Team
CDC COVID-19 Response
April 2, 2020

For more information: www.cdc.gov/COVID19
Median incubation period is 4-5 days (range: 2-14 days)

# COVID-19: Wide spectrum of disease

<table>
<thead>
<tr>
<th>Mild Illness</th>
<th>Uncomplicated upper respiratory tract viral infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate Pneumonia</td>
<td>Pneumonia without the need for supplemental oxygen</td>
</tr>
<tr>
<td>Severe Pneumonia</td>
<td>Pneumonia with dyspnea, respiratory distress, SpO2≤93% on RA, P/F ratio &lt;300</td>
</tr>
<tr>
<td>Critical Illness</td>
<td>Respiratory failure, septic shock, multiple organ dysfunction/failure</td>
</tr>
</tbody>
</table>

Link: [WHO Guidelines 2020](https://www.who.int)
Most patients had mild to moderate disease, but nearly 20% had severe or critical illness.

COVID-19 - China through 11-Feb-2020 (N=44,415)

- Mild/Mod: 81%
- Severe: 14%
- Critical: 5%

Of 1,099 hospitalized COVID-19 patients (through 29-Jan-2020), 5% were admitted to the ICU (Guan et al. NEJM 2020)

Links: Wu JAMA 2020
Potential for patients to have acute deterioration in the second week of illness

COVID-19 - China through 2-Jan-2020 (N = 41)

Figure 2: Timeline of 2019-nCoV cases after onset of illness

Link: Huang Lancet 2020
Case-fatality is disproportionately higher among older adults

COVID-19 - United States, February 12–March 16, 2020 (N = 4,226)

Links: MMWR 2020
Older adults: More likely to require ICU care and die, but hospitalizations and ICU admissions also occur among non-elderly adults

COVID-19 United States, February 12–March 16, 2020 (N = 4,226)
### Chronic Conditions are Higher in Hospitalized than Non-Hospitalized Patients

<table>
<thead>
<tr>
<th>Underlying health condition/Risk factor for severe outcomes from respiratory infection (no., % with condition)</th>
<th>Not hospitalized</th>
<th>Hospitalized, non-ICU</th>
<th>ICU admission</th>
<th>Hospitalization status unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total with case report form (N = 74,439)</td>
<td>12,217</td>
<td>5,285</td>
<td>1,069</td>
<td>55,868</td>
</tr>
<tr>
<td>Missing or unknown status for all conditions (67,277)</td>
<td>7,074</td>
<td>4,248</td>
<td>612</td>
<td>55,343</td>
</tr>
<tr>
<td>Total with completed information (7,162)</td>
<td>5,143</td>
<td>1,037</td>
<td>457</td>
<td>525</td>
</tr>
<tr>
<td>One or more conditions (2,692, 37.6%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus (784, 10.9%)</td>
<td>1,388 (27)</td>
<td>732 (71)</td>
<td>358 (78)</td>
<td>214 (41)</td>
</tr>
<tr>
<td>Chronic lung disease* (656, 9.2%)</td>
<td>331 (6)</td>
<td>251 (24)</td>
<td>148 (32)</td>
<td>54 (10)</td>
</tr>
<tr>
<td>Cardiovascular disease (647, 9.0%)</td>
<td>363 (7)</td>
<td>152 (15)</td>
<td>94 (21)</td>
<td>47 (9)</td>
</tr>
<tr>
<td>Immunocompromised condition (264, 3.7%)</td>
<td>239 (5)</td>
<td>242 (23)</td>
<td>132 (29)</td>
<td>34 (6)</td>
</tr>
<tr>
<td>Chronic renal disease (213, 3.0%)</td>
<td>141 (3)</td>
<td>63 (6)</td>
<td>41 (9)</td>
<td>19 (4)</td>
</tr>
<tr>
<td>Pregnancy (143, 2.0%)</td>
<td>72 (1)</td>
<td>31 (3)</td>
<td>4 (1)</td>
<td>36 (7)</td>
</tr>
<tr>
<td>Neurologic disorder, neurodevelopmental, intellectual disability (52, 0.7%)†</td>
<td>17 (0.3)</td>
<td>25 (2)</td>
<td>7 (2)</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Chronic liver disease (41, 0.6%)</td>
<td>24 (1)</td>
<td>9 (1)</td>
<td>7 (2)</td>
<td>10 (2)</td>
</tr>
<tr>
<td>Other chronic disease (1,182, 16.5%)§</td>
<td>583 (11)</td>
<td>359 (35)</td>
<td>170 (37)</td>
<td>70 (13)</td>
</tr>
<tr>
<td>Former smoker (165, 2.3%)</td>
<td>80 (2)</td>
<td>45 (4)</td>
<td>33 (7)</td>
<td>7 (1)</td>
</tr>
<tr>
<td>Current smoker (96, 1.3%)</td>
<td>61 (1)</td>
<td>22 (2)</td>
<td>5 (1)</td>
<td>8 (2)</td>
</tr>
<tr>
<td>None of the above conditions¶ (4,470, 62.4%)</td>
<td>3,755 (73)</td>
<td>305 (29)</td>
<td>99 (22)</td>
<td>311 (59)</td>
</tr>
</tbody>
</table>

**Abbreviation:** ICU = intensive care unit.

* Includes any of the following: asthma, chronic obstructive pulmonary disease, and emphysema.

† For neurologic disorder, neurodevelopmental, and intellectual disability, the following information was specified: dementia, memory loss, or Alzheimer’s disease (17); seizure disorder (5); Parkinson’s disease (4); migraine/headache (4); stroke (3); autism (2); aneurysm (2); multiple sclerosis (2); neuropathy (2); hereditary spastic paraplegia (1); myasthenia gravis (1); intracranial hemorrhage (1); and altered mental status (1).

§ For other chronic disease, the following information was specified: hypertension (113); thyroid disease (37); gastrointestinal disorder (32); hyperlipidemia (29); cancer (or history of cancer (29); rheumatologic disorder (19); hematologic disorder (17); obesity (17); arthritis, nonrheumatoid, including not otherwise specified (16); musculoskeletal disorder other than arthritis (10); mental health condition (9); urologic disorder (7); cerebrovascular disease (7); obstructive sleep apnea (7); fibromyalgia (7); gynecologic disorder (6); embolism, pulmonary or venous (5); ophthalmic disorder (2); hypertiglyceridemia (1); endocrine (1); substance abuse disorder (1); dermatologic disorder (1); genetic disorder (1).

¶ All listed chronic conditions, including other chronic disease, were marked as not present.
COVID-19 Case Fatality is highest among persons with underlying medical conditions

COVID-19 - China through 11-Feb-2020

- Cardiovascular Disease: 10.5%
- Diabetes: 7.3%
- Chronic Respiratory Disease: 6.0%
- Cancer: 5.6%

Link: China COVID-19 Epi Team 2020
Most, but not all patients have fever, cough, or shortness of breath on hospital admission (China, Singapore, U.S.)

- Fever
  - 2 US ICU cohorts: 50-52% had fever at admission
- Cough
- Dyspnea

Complications

• Pneumonia (91%)
• Critically ill
  • ARDS: (61%)
  • Shock or septic shock: (31-67%)
  • Acute kidney injury/renal failure: (8-29%/5-19%)
  • Acute hepatic injury: (14%)
• Cardiac abnormalities
  • Acute cardiac injury: (12-23%)
  • Cardiomyopathy: (33%)
  • Arrhythmia (44%)
  ➢ Hospital-acquired infection/VAP
Lower respiratory specimens may have higher virus yield than upper respiratory specimens, China (N = 205) Jan 1-Feb 17 2020

Table. Detection Results of Clinical Specimens by Real-Time Reverse Transcriptase–Polymerase Chain Reaction

<table>
<thead>
<tr>
<th>Specimens and values</th>
<th>Bronchoalveolar lavage fluid (n = 15)</th>
<th>Fibrobronchoscope brush biopsy (n = 13)</th>
<th>Sputum (n = 104)</th>
<th>Nasal swabs (n = 8)</th>
<th>Pharyngeal swabs (n = 398)</th>
<th>Feces (n = 153)</th>
<th>Blood (n = 307)</th>
<th>Urine (n = 72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive test result, No. (%)</td>
<td>14 (93)</td>
<td>6 (46)</td>
<td>75 (72)</td>
<td>5 (63)</td>
<td>126 (32)</td>
<td>44 (29)</td>
<td>3 (1)</td>
<td>0</td>
</tr>
<tr>
<td>Cycle threshold, mean (SD)</td>
<td>31.1 (3.0)</td>
<td>33.8 (3.9)</td>
<td>31.1 (5.2)</td>
<td>24.3 (8.6)</td>
<td>32.1 (4.2)</td>
<td>31.4 (5.1)</td>
<td>34.6 (0.7)</td>
<td>ND</td>
</tr>
<tr>
<td>Range</td>
<td>26.4-36.2</td>
<td>26.9-36.8</td>
<td>18.4-38.8</td>
<td>16.9-38.4</td>
<td>20.8-38.6</td>
<td>22.3-38.4</td>
<td>34.1-35.4</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>28.9-33.2</td>
<td>29.8-37.9</td>
<td>29.3-33.0</td>
<td>13.7-35.0</td>
<td>31.2-33.1</td>
<td>29.4-33.5</td>
<td>0.0-36.4</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: ND, no data.

Link: *Wang JAMA 2020*
Laboratory findings at hospital admission

- **Lymphopenia** (83%)
  - Thrombocytopenia (36%)
  - Leukopenia (34%)
  - C-reactive protein ≥10 mg/L: (61%)
  - Elevated AST, ALT: (20-39%) - higher with severe disease
  - Procalcitonin - typically normal on admission

- Co-infections:
  - Sporadic viral co-infections reported (e.g., influenza, parainfluenza)
  - Community-acquired secondary bacterial infection not reported in published case series (blood cultures: negative)

Laboratory abnormalities in severe disease

- Associated with severe or critical illness:
  - ↓lymphocytes, ↑neutrophils
  - ↑alanine aminotransferase and ↑aspartate aminotransferase levels
  - ↑lactate dehydrogenase, ↑PCT, ↑CRP, ↑ferritin levels
  - ↑serum levels of pro-inflammatory cytokines and chemokines
  - Evidence of immune dysregulation: Higher plasma levels of pro-inflammatory cytokines (TNFα, IL-1, IL-6) and chemokines (IL-8) in severe/critically ill patients vs less severely ill patients

- Associated with mortality: ↑D-dimers and lymphopenia

Leukocytosis, specifically neutrophilia, during hospitalization is associated with death (N = 138, China, Jan 1-28, 2020)

Link: Wang JAMA 2020
Lymphopenia is common in all patients, but may be lower in non-survivors than survivors (N = 138, China, Jan 1-28, 2020)

Link: Wang JAMA 2020
D-dimer is a strong predictor of death when compared with other markers of COVID-19 severity (N = 191), China, Dec 28, 2019 - Jan 28, 2020

**Table 3: Risk factors associated with in-hospital death**

<table>
<thead>
<tr>
<th>Demographics and clinical characteristics</th>
<th>Univariable OR (95% CI)</th>
<th>p value</th>
<th>Multivariable OR (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years*</td>
<td>1.14 (1.09-1.18)</td>
<td>&lt;0.0001</td>
<td>1.10 (1.03-1.17)</td>
<td>0.0043</td>
</tr>
<tr>
<td>SOFA score</td>
<td>6.14 (3.48-10.85)</td>
<td>&lt;0.0001</td>
<td>5.65 (2.61-12.23)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>D-dimer, μg/mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤0.5</td>
<td>1 (ref)</td>
<td></td>
<td>1 (ref)</td>
<td></td>
</tr>
<tr>
<td>&gt; 0.5</td>
<td>1.96 (0.52-7.43)</td>
<td>0.32</td>
<td>2.14 (0.21-21.39)</td>
<td>0.52</td>
</tr>
<tr>
<td>&gt; 1</td>
<td>20.04 (6.52-61.56)</td>
<td>&lt;0.0001</td>
<td>18.42 (2.64-128.55)</td>
<td>0.0033</td>
</tr>
</tbody>
</table>

*Link: Zhou Lancet 2020*
Adult ICU Case Series, U.S.
(N = 21) Feb 20-March 5, 2020; (N=24) Feb 24-March 9, 2020

- Common co-morbidities
  - Heart failure (0-43%)
  - COPD (4-33%)
  - Diabetes (33-58%)
  - Kidney disease (21-48%)
  - Obstructive sleep apnea (21-29%)

- Onset to ICU admission: @4.5-7 days

- Mean age: 70 years (43-92); 63 years (23-97)

- Complications
  - Respiratory failure requiring mechanical ventilation: (71-75%)
  - Shock requiring vasopressors: (67-71%)
  - Acute kidney failure: (0-19%)
  - Cardiomyopathy: (0-33%)
  - Bacterial co-infection (1/21; 0/20)

- Mortality: (50-52%)

Arentz JAMA 2020; Bhatraju NEJM 2020
COVID-19: Inpatient clinical management

➢ No proven FDA-approved treatment for COVID-19
  • Several drugs under investigation:
    • Remdesivir
    • Hydroxychloroquine or chloroquine
    • Lopinavir/ritonavir
    • IL-6 blockers

➢ Corticosteroids should be avoided unless indicated for other reasons
  • Potential for prolonging viral replication

➢ Clinical management is supportive care of complications

Link: CDC Clinical Guidance 2020
Resources for Inpatient COVID-19 Management

Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19)

Waleed Alhazzani1,2, Morten Hylander Møller3,4, Yaseen M. Arabi5, Mark Loeb1,2, Michelle Ng Gong6, Eddy Fan7, Simon Ozczkowski1,2, Mitchell M. Levy8,9, Lennie Derde10,11, Amy Dzierska11, Bin Du12, Michael Aboudi4, Hannah Wunsch14,15, Maurizio Cecconi14,17, Youssof Koh18, Daniel S. Chertow19, Kathryn Martin20, Faye Alshanski21, Emilie Belley-Cote1,22, Massimiliano Greco14,17, Matthew Laundy23, Jill S. Morgan24, Jozef Kepecsigoth19, Allison McGeer25, Leonard Merl3, Manoj J. Mammen26, Paul E. Alexander27, Amy Arrington28, John Centofanti29, Giuseppe Citerio30,31, Bander Baw1,32, Ziad A. Memish33, Naomi Hammond34,35, Frederick G. Hayden19, Laura Evans37, Andrew Rhodes38

<table>
<thead>
<tr>
<th>Level</th>
<th>Recommendation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Must do or must avoid</td>
<td>✓</td>
</tr>
<tr>
<td>Best Practice</td>
<td>Must do or must avoid</td>
<td>!</td>
</tr>
<tr>
<td>Weak</td>
<td>Consider doing or consider avoiding</td>
<td>⚪️</td>
</tr>
</tbody>
</table>

Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected
Interim guidance
13 March 2020

This is the second edition (version 1.2) of this document, which was originally adapted from Clinical management of severe acute respiratory infection when MERS-CoV infection is suspected (WHO, 2019).

It is intended for clinicians involved in the care of adult, pregnant, and paediatric patients with or at risk for severe acute respiratory infection (SARI) when infection with the COVID-19 virus is suspected. Considerations for paediatric patients and pregnant women are highlighted throughout the text. It is not meant to replace clinical judgment or specialist consultation but rather to strengthen clinical management of these patients and to provide up-to-date guidance. Best practices for infection prevention and control (IPC), triage and optimized supportive care are included.

Link: [WHO Guidelines 2020, Surviving Sepsis Campaign 2020](#)
COVID-19 Case Examples

MICHAEL BUNDESMANN, MD, FCCP
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PULMONARY AND CRITICAL CARE MEDICINE
EVERGREEN HEALTH, KIRKLAND, WA
CDC COCA CALL, APRIL 2, 2020
Disclaimer

The views expressed in this presentation are those of the author and do not necessarily represent the opinion of the Centers for Disease Control and Prevention.
Case 1

47-year-old man with 7 days of URI, 3 days of worsening dyspnea

- HTN, obesity (BMI 36), untreated DM
- No tobacco
- Home medications included lisinopril, HCTZ, carvedilol
- At time of presentation, he was not tested for COVID-19
Hospital Course

- Intubation and institution of lung protective ventilation from day 2 through day 14
- Proned days 2-13 of hospitalization
  - Inhaled epoprostenol and NMB were not given
  - Extubated to HFNC
- Ceftriaxone and azithromycin discontinued after 7 days (no initial procalcitonin checked)
- On day 6, compassionate use Remdesivir was given for 10-day course
- On day 10, hydroxychloroquine 400 BID, then daily x 5 days
- On day 21, weaned to room air, significant neuromuscular weakness
Notable Findings

- 3/2 Respiratory pathogen panel negative
- 3/2 NP sample drawn, SARS-CoV-2 detected 3/6
- 3/2 Bronchoscopy BAL 62% Ly, 13% PMN
- Abs lymphocyte $1.0 \times 10^3$/uL
- AST/ALT < 2x ULN
- CRP 15.93 on 3/8 decreased to 1.11
- Normal NT-proBNP, TnI
- Normal echocardiogram, except for mild pulmonary HTN
Lab Trends

- CPK
- C Reactive Prot
- Lymph # Auto
- POC P/F Ratio
Hospital course

- Significant weakness and myopathy
  - No steroids or NMB were used

- Remains hospitalized more than four weeks after admission
  - Complicated below DVT, then psoas hematoma on anticoagulation

- COVID-19 testing remained positive after 3 weeks

- Repeat COVID-19 testing negative during 4th week
Case 2

73-year-old man with controlled asthma, HL, BPH. Good functional capacity and active.

- 4 days prior to admit was seen in urgent care for 7 days of cough, fever, fatigue
- 2/27 – presents to ED with SpO2 82%. Placed on HFNC, intubated within 24 hrs
- At the time of admission, RF for COVID-19 were not identified.
- COVID-19 testing was positive in 2/29
4 days prior to admission

Day of admission
Hospital Course

- Cefepime, Vancomycin
- Paralyzed, prone x 4 days
- Day 7 compassionate use remdesivir was added
- Weaned off vasopressors by day 7
- Day 11 worsening acute kidney injury
- Day 11 worsening shock and LVEF (normal troponin)
- CRRT started day 14
- Comatose on day 24, failing SBT, remains on HD. MRI brain, CT brain and LP negative
- Acutely deteriorated further, goals changed to comfort-care and patient expired
Lab Trends

**CPK**

**C Reactive Prot**

**Lymph\# Auto**

**POC P/F Ratio**
Bronchoscopy & Laboratory Results

- Day 1 Bronchoscopy with lavage - 32% Ly, 34% PMN
- Procalcitonin 0.97
- Day 9 Bronch due to suspected VAP – negative cultures. PMN 63%
Echocardiogram Results

- Day 1 – normal transthoracic echocardiogram
- Day 4 – limited TTE remains normal
- Day 9 – LVEF 30% with global dysfunction
Evergreen ICU Summary

- >45 ICU admits
- >30 Required mechanical ventilation
- 4 Transferred for ECMO (3 were ultimately cannulated)
- 7 extubations (ages 44-84)
  - Includes 44 year old transfer for ECMO and RRT
- Duration of MV in extubated patients has been 5-13 days
- 4 required renal replacement therapy
Approach to care

▪ Early intubation
▪ Early use of proning, lung protective ventilation
▪ Light sedation, early PT
▪ Avoidance of corticosteroids, unless clear indication
▪ Enrollment in clinical trial for therapeutics
▪ Fluid restrictive approach
▪ Early discontinuation of antibiotics if low procalcitonin, negative cultures
▪ Consider early consultation for ECMO in young and sickest patients
Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19)

Waleed Alhazzani MD, FRCP, MSc
Associate Professor of Medicine
McMaster University
COI Disclosures

• Chair of GUIDE Group, and
• Member of the GRADE Working Group

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**SSC COVID Guidelines Panel Members**

<table>
<thead>
<tr>
<th>Morten Hylander</th>
<th>Hannah Wunsch</th>
<th>Leonard Mermel</th>
</tr>
</thead>
<tbody>
<tr>
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</table>
Expert Identified evidence

Systematic reviews: ARDS, MERS, SARS, shock

COVID-19

Summarize the evidence

Assess quality

New evidence

Dissemination

Expedited Review & Publication

Recommendation

Panel Discussion

Evidence Profile

Certainty of Evidence

PICO question

Systematic reviews

ARDS, MERS, SARS, shock

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ARDS, MERS, SARS, shock

Expedited Review & Publication

COVID-19

Summarize the evidence

Assess quality

New evidence

Dissemination

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Recommendation

Panel Discussion

Evidence Profile

Certainty of Evidence

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Evidence Profile

Certainty of Evidence
Strong Recommendation for the Intervention

Desirable consequences

Undesirable consequences
Desirable consequences

Undesirable consequences
Weak Recommendation for the Intervention

Desirable consequences

Undesirable consequences
## Patients

<table>
<thead>
<tr>
<th>For Patients</th>
<th>Strong Recommendation</th>
<th>Weak Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most</strong> individuals in this situation would want the recommended course of action, and only a <strong>small</strong> proportion would not</td>
<td>The <strong>majority</strong> of individuals in this situation would want the suggested course of action, but <strong>many</strong> would not</td>
<td></td>
</tr>
</tbody>
</table>
Clinicians

<table>
<thead>
<tr>
<th>For Clinicians</th>
<th>Strong Recommendation</th>
<th>Weak Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Most individuals should receive</strong> the recommended course of action.</td>
<td>Different choices are likely to be appropriate for different patients</td>
</tr>
<tr>
<td></td>
<td>Formal decision aids <strong>are not likely to be needed</strong> to help individuals make decisions consistent with their values and preferences</td>
<td>Therapy should be tailored to the individual patient’s circumstances, such as patients’ or family’s values and preferences</td>
</tr>
</tbody>
</table>
## Policymakers

<table>
<thead>
<tr>
<th>For Policymakers</th>
<th>Strong Recommendation</th>
<th>Weak Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Can be adapted as policy in most situations, including for use as performance indicators</td>
<td>Policies will likely be variable</td>
</tr>
</tbody>
</table>
Infection control

• Aerosol generating procedure vs not
• Negative pressure room vs regular room
• Surgical masks vs respirator masks
### Aerosol Generating Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Studies</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intubation</td>
<td>4</td>
<td>OR 6.6 (2.3, 18.9)</td>
</tr>
<tr>
<td>Manipulation of BiPAP mask</td>
<td>1</td>
<td>OR 6.2 (2.2, 18.1)</td>
</tr>
<tr>
<td>CPR</td>
<td>1</td>
<td>OR 4.5 (1.5, 13.8)</td>
</tr>
<tr>
<td>Tracheostomy</td>
<td>1</td>
<td>OR 4.2 (1.5, 11.5)</td>
</tr>
<tr>
<td>Non-Invasive Ventilation</td>
<td>2</td>
<td>OR 3.1 (1.4, 6.8)</td>
</tr>
<tr>
<td>Manual Ventilation</td>
<td>1</td>
<td>OR 2.8 (1.3, 6.4)</td>
</tr>
</tbody>
</table>

Infection Control

• For healthcare workers performing aerosol generating procedures on patients with COVID-19 in the ICU, we recommend using fitted respirator masks (N95 respirators, FFP2, or equivalent), as compared to surgical/medical masks, in addition to other personal protective equipment.

*FFP3 respirators are more commonly used in many parts of the world.
Infection Control

1. Usual care for non-ventilated COVID-19 patients, or
2. Performing non-AGP on MV (closed circuit) patients with COVID-19

We suggest using surgical/medical masks, as compared to respirator masks, in addition to other personal protective equipment.
Laboratory Confirmed Influenza Infection

### Study Results

<table>
<thead>
<tr>
<th>Study</th>
<th>N95 Events</th>
<th>N95 Total</th>
<th>Face Mask Events</th>
<th>Face Mask Total</th>
<th>Odds Ratio</th>
<th>OR</th>
<th>95%-CI</th>
<th>Weight (fixed)</th>
<th>Weight (random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loeb 2009</td>
<td>48</td>
<td>221</td>
<td>50</td>
<td>225</td>
<td>0.97</td>
<td>[0.62; 1.52]</td>
<td>30.9%</td>
<td>30.9%</td>
<td></td>
</tr>
<tr>
<td>MacIntyre 2011</td>
<td>2</td>
<td>475</td>
<td>3</td>
<td>246</td>
<td>0.34</td>
<td>[0.06; 2.06]</td>
<td>1.9%</td>
<td>1.9%</td>
<td></td>
</tr>
<tr>
<td>MacIntyre 2013</td>
<td>3</td>
<td>665</td>
<td>1</td>
<td>347</td>
<td>1.57</td>
<td>[0.16; 15.13]</td>
<td>1.2%</td>
<td>1.2%</td>
<td></td>
</tr>
<tr>
<td>Radonovich 2019</td>
<td>92</td>
<td>1112</td>
<td>85</td>
<td>1181</td>
<td>1.16</td>
<td>[0.86; 1.58]</td>
<td>66.0%</td>
<td>66.0%</td>
<td></td>
</tr>
</tbody>
</table>

**Fixed effect model**

2473 | 1999

**Random effects model**

Heterogeneity: $I^2 = 0\%$, $r^2 = 0, p = 0.55$

<table>
<thead>
<tr>
<th>OR</th>
<th>95%-CI</th>
<th>Weight (fixed)</th>
<th>Weight (random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.08</td>
<td>[0.84; 1.38]</td>
<td>100.0%</td>
<td>--</td>
</tr>
<tr>
<td>1.08</td>
<td>[0.84; 1.38]</td>
<td>--</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

0.1 0.5 1 2 10
## Laboratory Confirmed Respiratory Infection

<table>
<thead>
<tr>
<th>Study</th>
<th>Events</th>
<th>Total</th>
<th>N95</th>
<th>Total</th>
<th>Odds Ratio</th>
<th>OR</th>
<th>95%-Ci</th>
<th>Weight (fixed)</th>
<th>Weight (random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loeb 2009</td>
<td>70</td>
<td>221</td>
<td>70</td>
<td>221</td>
<td>1.03</td>
<td>1.03</td>
<td>[0.69; 1.53]</td>
<td>16.2%</td>
<td>16.2%</td>
</tr>
<tr>
<td>MacIntyre 2011</td>
<td>7</td>
<td>475</td>
<td>7</td>
<td>246</td>
<td>0.51</td>
<td>0.51</td>
<td>[0.18; 1.47]</td>
<td>2.3%</td>
<td>2.3%</td>
</tr>
<tr>
<td>MacIntyre 2013</td>
<td>18</td>
<td>665</td>
<td>12</td>
<td>337</td>
<td>0.78</td>
<td>0.78</td>
<td>[0.37; 1.63]</td>
<td>4.7%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Radonovich 2019</td>
<td>300</td>
<td>1112</td>
<td>330</td>
<td>1181</td>
<td>0.95</td>
<td>0.95</td>
<td>[0.79; 1.14]</td>
<td>76.8%</td>
<td>76.8%</td>
</tr>
<tr>
<td>Fixed effect model</td>
<td>2473</td>
<td>1999</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random effects model</td>
<td></td>
<td></td>
<td>0.94</td>
<td>[0.80; 1.11]</td>
<td>100.0%</td>
<td>0.94</td>
<td>[0.80; 1.11]</td>
<td>--</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Heterogeneity: $I^2 = 0\%$, $\tau^2 = 0$, $p = 0.63$
influenza-like illness

<table>
<thead>
<tr>
<th>Study</th>
<th>N95 Events</th>
<th>N95 Total</th>
<th>Face Mask Events</th>
<th>Face Mask Total</th>
<th>Odds Ratio</th>
<th>OR</th>
<th>95%-CI</th>
<th>Weight (fixed)</th>
<th>Weight (random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loeb 2009</td>
<td>2</td>
<td>221</td>
<td>9</td>
<td>225</td>
<td></td>
<td>0.22</td>
<td>[0.05; 1.03]</td>
<td>4.7%</td>
<td>6.4%</td>
</tr>
<tr>
<td>MacIntyre 2011</td>
<td>2</td>
<td>475</td>
<td>2</td>
<td>246</td>
<td></td>
<td>0.52</td>
<td>[0.07; 3.68]</td>
<td>2.9%</td>
<td>4.0%</td>
</tr>
<tr>
<td>MacIntyre 2013</td>
<td>5</td>
<td>665</td>
<td>2</td>
<td>347</td>
<td></td>
<td>1.31</td>
<td>[0.25; 6.77]</td>
<td>4.1%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Radonovich 2019</td>
<td>57</td>
<td>1112</td>
<td>73</td>
<td>1181</td>
<td></td>
<td>0.82</td>
<td>[0.57; 1.17]</td>
<td>88.2%</td>
<td>84.0%</td>
</tr>
<tr>
<td>Fixed effect model</td>
<td></td>
<td>2473</td>
<td></td>
<td>1999</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random effects model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: $I^2 = 7\%$, $\tau^2 = 0.0153$, $p = 0.36$
Oxygen Targets

Mortality

SPO$_2$

90% 92% 96%
Oxygen Targets

we recommend that SPO$_2$ be maintained no higher than 96%
Oxygen Targets

we suggest starting supplemental oxygen if the SPO\(_2\) < 92%
Oxygen Targets

we recommend starting oxygen if $\text{SPO}_2 < 90\%$
SPO$_2$ and Mortality

Hypoxemia

• For adults with COVID-19 and acute hypoxemic respiratory failure despite conventional oxygen therapy, we suggest using HFNC over conventional oxygen therapy.
Hypoxemia

• For adults with COVID-19 and **acute hypoxemic respiratory failure**, we **suggest** using HFNC over NIPPV.
Hypoxemia

• For adults with COVID-19 and acute hypoxemic respiratory failure, if HFNC is not available and no emergent indication for endotracheal intubation; we suggest a trial of NIPPV with close monitoring and short interval assessment for worsening of respiratory failure.
We were not able to make a recommendation regarding the use of helmet NIPPV compared to mask NIPPV, it is an option, but we are not certain about its safety or efficacy for COVID-19 patients.
Effect of Noninvasive Ventilation Delivered by Helmet vs Face Mask on the Rate of Endotracheal Intubation in Patients With Acute Respiratory Distress Syndrome
A Randomized Clinical Trial

No. at risk

<table>
<thead>
<tr>
<th></th>
<th>Face mask</th>
<th>Helmet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>39</td>
<td>44</td>
</tr>
<tr>
<td>15</td>
<td>20</td>
<td>33</td>
</tr>
<tr>
<td>30</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>45</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>60</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>75</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>90</td>
<td>17</td>
<td>29</td>
</tr>
</tbody>
</table>

Log-rank $P = 0.02$

**JAMA.** 2016 Jun 14;315(22):2435-41
Endotracheal Intubation

• For healthcare workers performing endotracheal intubation on patients with COVID-19, we recommend endotracheal intubation is performed by healthcare worker experienced with airway management, to minimize the number of attempts and risk of transmission.
Endotracheal Intubation

• For healthcare workers performing endotracheal intubation on patients with COVID-19, we suggest using video guided laryngoscopy, over direct laryngoscopy, if available.
COVID-19 with hypoxia

Indication for endotracheal intubation?

Tolerating supplemental oxygen?

Tolerating HFNC

Not tolerating HFNC or HFNC is not available

Indication for endotracheal intubation?

Consider:⚠️ a trial of NIPPV

Do it: Monitor closely at short intervals

Do not: Delay intubation if worsening

Expert in airway to intubate

Use N-95/FFP-2 or equivalent and other PPE/infection control precautions

Minimize staff in the room

Consider:⚠️ if available

Video- laryngoscope

Do it:

Monitor closely for worsening

Target SPO₂ 92 to 96%

Appropriate infection control precautions

Do not:

Delay intubation if worsening
Acute Respiratory Distress Syndrome
We recommend using low Vt (4-8 mL/kg) and Targeting Pplat <30 cmH₂O
We recommend using low Vt (4-8 mL/kg) and Targeting Pplat <30 cmH₂O

we **suggest** using a higher PEEP strategy

Mod-Severe ARDS
We recommend using low Vt (4-8 mL/kg) and Targeting Pplat <30 cmH₂O

We suggest using a higher PEEP strategy.

We suggest using a conservative, over a liberal, fluid strategy.

Mod-Severe ARDS
Prone Ventilation

• For mechanically ventilated adults with COVID-19 and moderate to severe ARDS, we suggest prone ventilation for 12 to 16 hours, over no prone ventilation.
Neuromuscular Blocking Agents (NMBA)?
NMBA

• For MV adults with COVID-19 and moderate to severe ARDS, we suggest using as needed intermittent boluses of NMBA, over a continuous NMBA infusion, to facilitate protective lung ventilation.
NMBA

• In case of persistent ventilator dyssynchrony, requirement of ongoing deep sedation, prone ventilation, or persistently high $P_{plt}$; we suggest using a continuous NMBA infusion for up to 48 hours.
Corticosteroids
Steroids in ARDS - Mortality Outcome

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Corticosteroids</th>
<th>Control</th>
<th>Weight</th>
<th>Risk Ratio M-H, Random, 95% CI</th>
<th>Risk Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liu 2012</td>
<td>2</td>
<td>12</td>
<td>7</td>
<td>3.0%</td>
<td>0.33 [0.08, 1.31]</td>
</tr>
<tr>
<td>Meduri 2007</td>
<td>15</td>
<td>63</td>
<td>12</td>
<td>12.6%</td>
<td>0.56 [0.30, 1.03]</td>
</tr>
<tr>
<td>Rezk 2013</td>
<td>0</td>
<td>18</td>
<td>3</td>
<td>0.7%</td>
<td>0.08 [0.00, 1.32]</td>
</tr>
<tr>
<td>Steinberg 2006</td>
<td>26</td>
<td>89</td>
<td>26</td>
<td>19.7%</td>
<td>1.02 [0.65, 1.62]</td>
</tr>
<tr>
<td>Tongyoo 2016</td>
<td>34</td>
<td>98</td>
<td>40</td>
<td>26.8%</td>
<td>0.86 [0.60, 1.23]</td>
</tr>
<tr>
<td>Villar 2020</td>
<td>33</td>
<td>139</td>
<td>50</td>
<td>26.0%</td>
<td>0.66 [0.45, 0.95]</td>
</tr>
<tr>
<td>Zhao 2014</td>
<td>9</td>
<td>24</td>
<td>13</td>
<td>11.3%</td>
<td>0.84 [0.43, 1.61]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>443</td>
<td>408</td>
<td>100.0%</td>
<td>0.75 [0.59, 0.95]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>119</td>
<td>151</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau^2 = 0.02; Chi^2 = 7.69, df = 6 (P = 0.26); I^2 = 22%
Test for overall effect: Z = 2.36 (P = 0.02)
Steroids in ARDS - DMV

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Corticosteroids</th>
<th>Control</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Total</td>
</tr>
<tr>
<td>Meduri 2007</td>
<td>5.25</td>
<td>1.46</td>
<td>63</td>
</tr>
<tr>
<td>Rezk 2013</td>
<td>10.6</td>
<td>4.4</td>
<td>18</td>
</tr>
<tr>
<td>Tongyoo 2016</td>
<td>11.8</td>
<td>7.8</td>
<td>98</td>
</tr>
<tr>
<td>Villar 2020</td>
<td>14.3</td>
<td>13.3</td>
<td>139</td>
</tr>
<tr>
<td>Zhao 2014</td>
<td>10.5</td>
<td>4.6</td>
<td>24</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>342</td>
<td></td>
<td>303</td>
</tr>
</tbody>
</table>

Heterogeneity: $\tau^2 = 9.22$; $\chi^2 = 31.72$, df = 4 ($P < 0.00001$); $I^2 = 87\%$
Test for overall effect: $Z = 3.37$ ($P = 0.0008$)
Steroids for Viral ARDS - Mortality

All observational studies

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>log(Odds Ratio)</th>
<th>SE</th>
<th>Weight</th>
<th>Odds Ratio IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brun-Buisson 2011</td>
<td>0.9517</td>
<td>0.3066</td>
<td>21.5%</td>
<td>2.59 [1.42, 4.72]</td>
</tr>
<tr>
<td>Cao 2016</td>
<td>0.6152</td>
<td>0.3849</td>
<td>19.1%</td>
<td>1.85 [0.87, 3.93]</td>
</tr>
<tr>
<td>Kim 2011</td>
<td>0.5878</td>
<td>0.4892</td>
<td>16.2%</td>
<td>1.80 [0.69, 4.70]</td>
</tr>
<tr>
<td>Li 2017</td>
<td>-0.4005</td>
<td>0.1919</td>
<td>24.6%</td>
<td>0.67 [0.46, 0.98]</td>
</tr>
<tr>
<td>Martin-Loeches 2011</td>
<td>0.0953</td>
<td>0.4023</td>
<td>18.6%</td>
<td>1.10 [0.50, 2.42]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td></td>
<td></td>
<td>100.0%</td>
<td>1.40 [0.76, 2.57]</td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.35; Chi² = 17.29, df = 4 (P = 0.002); I² = 77%
Test for overall effect: Z = 1.09 (P = 0.28)
Direct Evidence

Retrospective study
N=201
with COVID-19 pneumonia

Corticosteroids

• For mechanically ventilated adults with COVID-19 and ARDS, we suggest using systemic corticosteroids over not using corticosteroids.

• Remark: The majority of our panel support a weak recommendation (i.e. suggestion) to use steroids in the sickest patients with COVID-19 and ARDS. However, because of the very low quality evidence, some experts on the panel preferred not to issue a recommendation until higher quality direct-evidence is available.
## Steroids for Viral Pneumonia - Mortality

### All observational studies

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>log(Odds Ratio)</th>
<th>SE</th>
<th>Weight</th>
<th>Odds Ratio IV, Random, 95% CI</th>
<th>Odds Ratio IV, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1.1 Influenza</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delaney 2016</td>
<td>0.6152</td>
<td>0.2561</td>
<td>8.8%</td>
<td>1.95 [1.12, 3.06]</td>
<td></td>
</tr>
<tr>
<td>Delgado-Rodriguez 2012</td>
<td>1.2149</td>
<td>0.4518</td>
<td>7.6%</td>
<td>3.37 [1.39, 8.17]</td>
<td></td>
</tr>
<tr>
<td>Jung 2011</td>
<td>1.1282</td>
<td>0.4107</td>
<td>7.8%</td>
<td>3.09 [1.36, 7.02]</td>
<td></td>
</tr>
<tr>
<td>Kim 2011</td>
<td>0.7885</td>
<td>0.3872</td>
<td>8.0%</td>
<td>2.20 [1.03, 4.70]</td>
<td></td>
</tr>
<tr>
<td>Liem 2009</td>
<td>1.4134</td>
<td>0.6543</td>
<td>6.2%</td>
<td>4.11 [1.14, 14.82]</td>
<td></td>
</tr>
<tr>
<td>Unko 2011</td>
<td>1.1929</td>
<td>0.9628</td>
<td>4.0%</td>
<td>3.20 [0.50, 21.78]</td>
<td></td>
</tr>
<tr>
<td>Tsai 2020</td>
<td>1.6154</td>
<td>0.3786</td>
<td>8.0%</td>
<td>5.02 [2.59, 10.54]</td>
<td></td>
</tr>
<tr>
<td>XI 2010</td>
<td>1.3002</td>
<td>0.6685</td>
<td>6.1%</td>
<td>3.67 [0.99, 13.60]</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>56.7% [2.76, 3.89]</td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.00; Ch² = 6.13, df = 7 (P = 0.52); I² = 0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 6.81 [P &lt; 0.000001]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1.1.2 Corona/SARS/MERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alfaraj 2019</td>
<td>1.3455</td>
<td>0.3457</td>
<td>8.2%</td>
<td>3.84 [1.95, 7.55]</td>
<td></td>
</tr>
<tr>
<td>Alghamdi 2016</td>
<td>1.0716</td>
<td>1.5877</td>
<td>2.3%</td>
<td>2.92 [1.01, 8.59]</td>
<td></td>
</tr>
<tr>
<td>Arabi 2017</td>
<td>-0.4943</td>
<td>0.1904</td>
<td>9.1%</td>
<td>0.61 [0.42, 0.89]</td>
<td></td>
</tr>
<tr>
<td>Ayueung 2005</td>
<td>3.0691</td>
<td>1.4122</td>
<td>2.7%</td>
<td>20.70 [1.30, 329.63]</td>
<td></td>
</tr>
<tr>
<td>Chen 2006</td>
<td>-2.4859</td>
<td>1.2617</td>
<td>3.2%</td>
<td>0.08 [0.01, 0.98]</td>
<td></td>
</tr>
<tr>
<td>Yam 2007 HC</td>
<td>0</td>
<td>0.5567</td>
<td>6.0%</td>
<td>1.00 [0.33, 3.03]</td>
<td></td>
</tr>
<tr>
<td>Yam 2007 MP</td>
<td>-1.3853</td>
<td>0.6495</td>
<td>6.2%</td>
<td>0.25 [0.07, 0.89]</td>
<td></td>
</tr>
<tr>
<td>Yam 2007 F</td>
<td>-1.772</td>
<td>0.9385</td>
<td>4.8%</td>
<td>0.17 [0.03, 0.96]</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43.3% [0.32, 2.17]</td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 1.24; Ch² = 38.32, df = 7 (P &lt; 0.00001); I² = 82%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 3.37 [P = 0.71]</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100.0% [1.03, 3.03]</td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.80; Ch² = 75.61, df = 15 (P &lt; 0.00001); I² = 80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 2.06 [P = 0.04]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for subgroup differences: Ch² = 3.48, df = 1 (P = 0.02); I² = 81.8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Corticosteroids

• For mechanically ventilated adults with COVID-19 and respiratory failure (without ARDS), we suggest against the routine use of systemic corticosteroids
### COVID-19 with mild ARDS

- **Do:**
  - Vt 4-8 ml/kg and $P_{plat} < 30$ cm H$_2$O
  - Investigate for bacterial infection
  - Target SPO2 92% - 96%

- **Consider:**
  - Conservative fluid strategy
  - Empiric antibiotics

- **Uncertain:**
  - Systemic corticosteroids

### COVID-19 with Mod to Severe ARDS

- **Consider:**
  - Higher PEEP
  - NMBA boluses to facilitate ventilation targets
  - if PEEP responsive
  - Traditional Recruitment maneuvers
  - Prone ventilation 12 - 16 h

- **Consider:**
  - if proning, high $P_{plt}$, asynchrony
  - NMBA infusion for 24 h

### Rescue/Adjunctive therapy

- **Consider:**
  - if proning, high $P_{plt}$, asynchrony
  - NMBA infusion for 24 h
  - STOP if no quick response
  - A trial of inhaled Nitric Oxide
  - follow local criteria for ECMO
  - V-V ECMO or referral to ECMO center

---

**Don’t do:**

- Staircase Recruitment maneuvers

- **Consider:**
  - Short course of systemic corticosteroids
Antibiotics

• For mechanically ventilated patients with COVID-19 and respiratory failure, we suggest using empiric antimicrobials/antibacterial agents, compared to no antimicrobials.

• Remark: if the treating team initiates empiric antimicrobials, they should assess for de-escalation daily, and re-evaluate the duration of therapy and spectrum of coverage based on the microbiology results and the patient’s clinical status.
Therapy

For critically ill adults with COVID-19, we suggest against the routine use of standard intravenous immunoglobulins.

For critically ill adults with COVID-19, we suggest against the routine use of convalescent plasma.

For critically ill adults with COVID-19, we suggest against the routine use of lopinavir/ritonavir.
Therapy

• Insufficient evidence to support recommendations for:
  – Antivirals
  – Hydroxychloroquine
  – Immunomodulators
Hemodynamic Support

• For the **acute resuscitation** of adults with **COVID-19 and shock**, we **suggest** using a conservative, over a liberal fluid strategy

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>N of participants (studies)</th>
<th>Relative effect (95% CI)</th>
<th>Certainty of the evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause Mortality</td>
<td>637 (9 RCTs)</td>
<td>RR 0.87 (0.69–1.10)</td>
<td>VERY LOW</td>
</tr>
<tr>
<td>Serious Adverse Events</td>
<td>637 (9 RCTs)</td>
<td>RR 0.91 (0.78–1.05)</td>
<td>VERY LOW</td>
</tr>
</tbody>
</table>
Hemodynamic Support

• For adults with **COVID-19 and refractory shock**, we **suggest** using low-dose corticosteroid therapy (“shock-reversal”), over no corticosteroid therapy.

• Remark: typical corticosteroid regimen in septic shock is intravenous hydrocortisone 200 mg per day either as an infusion or intermittent doses.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Nº of participants (studies)</th>
<th>Relative effect (95% CI)</th>
<th>Certainty of the evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term Mortality (&lt;90 days)</td>
<td>7297 (22 RCTs)</td>
<td>RR 0.96 (0.91–1.02)</td>
<td>MODERATE</td>
</tr>
<tr>
<td>Long-term Mortality (&gt;90 days)</td>
<td>5667 (5 RCTs)</td>
<td>RR 0.96 (0.90–1.02)</td>
<td>MODERATE</td>
</tr>
<tr>
<td>Serious Adverse Events</td>
<td>5908 (10 RCTs)</td>
<td>RR 0.98 (0.90–1.08)</td>
<td>LOW</td>
</tr>
</tbody>
</table>
Special Thank You

• Guidelines panelists
• Methodologists
• SCCM and ESICM
• Colleagues around the world caring for patients
CDC COVID-19 Resources

- Coronavirus Disease 2019 Website
  https://www.cdc.gov/COVID19

- Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease

- Information for Clinicians on Therapeutic Options for COVID-19 Patients

- Healthcare Professionals: Frequently Asked Questions and Answers

- Discontinuation of Transmission-Based Precautions and Disposition of Patients with COVID-19 in Healthcare Settings

- What Healthcare Personnel Should Know about Caring for Patients with Confirmed or Possible COVID-19 Infection

- Interim Guidelines for Collecting, Handling, and Testing Clinical Specimens from Patients Under Investigation for COVID-19

- Rapid Guidelines for Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with COVID-19
To Ask a Question

- **Using the Webinar System**
  - Click on the Q&A button in the Zoom webinar system.
  - Type your question in the Q&A box.
  - Submit your question.
  - You may also email your question to coca@cdc.gov.

- For media questions, please contact CDC Media Relations at 404-639-3286 or email media@cdc.gov.

- **For more Clinical Care information on COVID-19**
  - Call COVID-19 Clinical Call Center at 770-488-7100 (24 hours/day).
  - Refer patients to state and local health departments for COVID-19 COVID19 testing and test results.
    - Clinicians should NOT refer patients to CDC to find out where or how to get tested for COVID-19 OR to get COVID-19 test results.
Today’s COCA Call Will Be Available On-Demand

When:  A few hours after the live call

What:  Video recording

Where:
On the COCA Call webpage at
https://emergency.cdc.gov/coca/calls/2020/callinfo_040220.asp

On COCA’s Facebook Page immediately after the live call at
https://www.facebook.com/CDCClinicianOutreachAndCommunicationActivity/
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Monthly newsletter that provides information on CDC training opportunities, conference and training resources, the COCA Partner Spotlight, and the Clinician Corner.

As-needed messages that provide specific, immediate action clinicians should take. Contains comprehensive CDC guidance so clinicians can easily follow recommended actions.
COCA Products & Services

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CDC Clinician Outreach and Communication Activity

Monthly newsletter providing updates on emergency preparedness and response topics, emerging public health threat literature, resources for health professionals, and additional information important during public health emergencies and disasters.

Informs clinicians of new CDC resources and guidance related to emergency preparedness and response. This email is sent as soon as possible after CDC publishes new content.

COCA Now
CDC Clinician Outreach and Communication Activity

CDC's primary method of sharing information about urgent public health incidents with public information officers; federal, state, territorial, and local public health practitioners; clinicians; and public health laboratories.
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  - Emerging public health threats
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