Evidence-based Updates on COVID-19
April 8, 2020, Special Topics: Masks, Shared Ventilators & Staffing

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Spirit of Inquiry

Colleagues are wondering….

- Is there any evidence about whether to use a homemade cloth face mask…and of so, what’s the best way to make them?
- Is there a safe way to put more than one patient on a single ventilator?
- Is there any evidence about the best way to provide healthcare staffing during a pandemic?
- Is there any evidence about “proning patients” (positioning them on their stomachs) with COVID-19 before intubation?
- What are the best practices for postmortem care of COVID-19 patients…for the hospital morgue and funeral homes?
COVID-19 Special Topics for Today

1) Homemade cloth face masks
   (Lynn Gallagher-Ford & Inga Zadvinskis)

2) Ventilator sharing during a pandemic
   (Penny Gorsuch & Jennifer Dean & Laura Weigel Moore)

3) ICU staffing during a pandemic
   (Molly McNett & Linda Connor)

Homemade Cloth Face Masks

Lynn Gallagher-Ford
Inga Zadvinskis
Homemade cloth face masks

- Recommendations for healthcare workers
- Recommendations for consumers

Based on the current evidence, the Fuld Institute for EBP recommends and supports the provision of personal protective equipment (PPE) for healthcare workers (HCWs) at all points of care and that HCWs use appropriate PPE consistently and correctly rather than homemade cloth face masks.

HCWs should consider homemade cloth face masks only as a last resort.

(03/31/2020)
Respirator: (N95 masks) A tight-fitting, fit-tested, personal protective device that filters out at least 95% of particles (including bacteria and viruses) from the air to protect the wearer.

Surgical mask: A loose-fitting, commercially made, disposable device that creates a physical barrier over the mouth and nose of the wearer to protect others from the wearer’s respiratory emissions and to protect the wearer against large droplets or sprays.

Homemade cloth face mask: A loose-fitting, homemade device that creates a physical barrier over the mouth and nose of the wearer to protect others from the wearer’s respiratory emissions and to protect the wearer from inhaling particles in the environment.

How do N95 respirators, surgical masks, and homemade cloth face masks differ in terms of their protection against the transmission of respiratory particles?

1. An N95 respirator provides adults with
   • 25x the protection of surgical masks and
   • 50x the protection of homemade cloth face mask (van der Sande et al., 2008)

2. Surgical masks offer about
   • 2x the protection of homemade cloth face masks (van der Sande et al., 2008)

3. Homemade cloth face masks provides the wearer with
   • some protection from particles in the environment
Should healthcare workers wear a homemade cloth face mask during a pandemic if nothing else is available?

Yes, if nothing else is available.

HCWs with good adherence to wearing a mask or respirator had a lower risk of respiratory infection (Yang et al., 2011).

Recommendations:

- Be vigilant about other infection-prevention measures (hand hygiene, not touching eyes or mask) because masks can give a false sense of security
- To protect against the potential increased risk of infection with a homemade cloth mask
  - Remove when the mask becomes moist
  - Only reuse if/when the mask has been appropriately laundered

(MacIntyre et al., 2015)
“The protective effect of masks is created through a combined effect of the transmission-blocking potential of the material, the fit and related air leakage of the mask, and the degree of adherence to proper wearing and disposal of masks” (van der Sande et al., 2008).

Fit and filtration make the difference!

Table 1. Synthesis Table: Level of Evidence regarding the Use of Homemade Cloth Face Masks in Healthcare Workers (HCWs)

<table>
<thead>
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<th>Level</th>
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<td>Level I: Systematic review or meta-analysis</td>
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<td>Level III: Controlled trial without randomization</td>
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<td>Level IV: Case-control or cohort study</td>
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<td>Level V: Systematic review of qualitative or descriptive studies</td>
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<td>Level VI: Qualitative or descriptive study, CPG, Lit Review, QI or EBP project</td>
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<tr>
<td>Level VII: Expert opinion</td>
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</tbody>
</table>
Table 2. Synthesis Table: Evidence regarding the Use of Homemade Cloth Face Masks in Healthcare Workers (HCWs)

<table>
<thead>
<tr>
<th>Recommendations for Consumers</th>
</tr>
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<tbody>
<tr>
<td>Wearing a homemade cloth face mask does NOT provide complete protection</td>
</tr>
</tbody>
</table>
Recommendations for Consumers

1. Stay home!
   • Avoid exposure
   • Decrease spread (without knowing it)

2. Wash your hands

Checklist: How to Make a Homemade Cloth Face Mask Work Better based on Science

<table>
<thead>
<tr>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Wash your hands before putting on and after taking off a mask</td>
</tr>
<tr>
<td>✓ Distance yourself (physically) from people</td>
</tr>
<tr>
<td>✓ Design purposefully</td>
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<tr>
<td>✓ Select a fabric that is stretchy, soft, and has a tight weave</td>
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<tr>
<td>✓ Remove mask when damp because moisture affects filtration</td>
</tr>
<tr>
<td>✓ Consider using a pantyhose tube (open on both ends) to hold the face mask in place to prevent air leakage</td>
</tr>
</tbody>
</table>

For references, see: go.osu.edu/ebpcovid19
Fabric Recommendations

- Research results vary
- Consider using a:
  - Hanes sweatshirt material (Rengasamy et al., 2010)
  - Tea towel (van der Sande et al., 2008, Davies et al., 2013)
  - Cotton blend t-shirt (Davies et al., 2013)
- The **FIT** is probably more important than the fabric


Other Design Recommendations

- Fit the mask snugly around the nose & mouth (Chughtai et al., 2013, & Davies et al., 2013)
- Use a cone or tetrahedral shaped pattern (filters the most air pollution particles) (Shakya et al., 2017)
- Remember: Any mask is better when the seal on the face is good (Cherrie et al., 2018)


Homemade Face Masks

**IF you make a rectangular-shaped mask**

- Use pleats to improve filtration efficiency (Quesnel, 1975)
- Create a mask that extends far back over the cheeks and under the chin to prevent leakage (Quesnel, 1975)


Ventilator Sharing

Penelope Gorsuch  
Jennifer Dean  
Laura Weigel Moore
Helene Fuld Health Trust National Institute for Evidence-based Practice in Nursing and Healthcare

Multiple patients to one ventilator

- Not studied in humans
- Literature:
  - Simulation or sheep
  - Maximum of 12 hours
- Concerns:
  - Microbial cross contamination
  - Lung compliance
  - PEEP & Tidal volume

(Neyman & Irvin, 2006; Paladino et al., 2008)

Consensus Statement on Multiple Patients per Ventilator
March 26, 2020

The SCCM, AARC, ASA, APSF, AACN, and CHEST issued this consensus statement on the concept of placing multiple patients on a single mechanical ventilator.

- The above-named organizations advise clinicians that sharing mechanical ventilators should not be attempted because it cannot be done safely with current equipment.
- The physiology of patients with COVID-19-onset acute respiratory distress syndrome (ARDS) is complex.
- Even in ideal circumstances, ventilating a single patient with ARDS and nonhomogeneous lung disease is difficult and is associated with a 40%-60% mortality rate.

Retrieved from https://www.sccm.org/Disaster/Joint-Statement-on-Multiple-Patients-Per-Ventilator
AGILITIES Scoring System

Recommended guidelines for framers of federal, state, local, and institutional medical resource allocation plans (mechanical ventilators).


Sequential (Sepsis-Related) Organ Failure Assessment (SOFA) Score

- Evaluates the severity of the patient’s illness with an assessment of six organ systems
- Daily assigns 1 to 4 points depending on level of dysfunction: respiratory, circulatory, renal, hematologic, hepatic and CNS
- Predictor of short-term & long-term mortality
- △SOFA is a greater predictor of mortality than a fixed SOFA score
- Literature is mixed on timeframe
- SOFA Score >2 is a higher risk for mortality
- In COVID-19, elevated SOFA, advanced age and d-dimer >1µg/mL can identify those with a poor prognosis
**CriSTAL**

- Criteria for Screening and Triaging Appropriate Alternative care
- Identify elderly who would benefit from end of life care
  - Age ≥ 65
  - VS
  - Blood glucose, urinalysis
  - Medical history
  - Frailty assessment
  - ECG
- Rapid response inpatient
  - Score > 6

(Cardona-Morrell & Hillman, 2015; Cardona et al., 2018; Cardona et al., 2019)

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**Framework for allocation of mechanical ventilation**

1. Likelihood for short term survival
2. Likelihood of long-term survival

- Pregnancy
- Consider life stage
- Exclusion

(Biddison et al., 2019)
Pediatric Triage Considerations

Many disaster management plans do not fully incorporate pediatric patients into the disaster planning process (Hamele, 2018)

- Tools are available for:
  - Assessing healthcare resource consumption
  - Predicting risk of mortality in pediatrics

AGILITIES in Pediatrics

- AGILITIES tool differs from the validated pediatric mortality risk tools because the score assesses resource utilization rather than mortality risk (Wilkens & Klein, 2010)
  - Advantages:
    1. No age limitation
    2. No laboratory values (quick!)
    3. Continuous assessment
- Assesses: relative health, duration of time on mechanical ventilation, and patient’s use of resources and provider’s time during a crisis to determine a triage score (Wilkens & Klein, 2010)
Pediatric Mortality Prediction Tools

• Valid tools are available to assess pediatric mortality risk (Ramazani & Hosseini, 2019; Kim et al., 2013)
• Some states use one of the tools in the pediatric triage guidelines (NY state, 2015; Biddison et al., 2019)

Limitations:
1. Not valid tools for triage-only have been validated in pediatric intensive care unit
2. Require laboratory test results for assessment (time)
3. Pediatric mortality rates are relatively low—may not decrease demand of resources

<table>
<thead>
<tr>
<th>Tool</th>
<th>PELOD-2</th>
<th>PIM3</th>
<th>PRISM III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validated Tool for PICU setting</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Validated Tool for Triage</td>
<td></td>
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<tr>
<td>Annual License Required ($)</td>
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<td>x</td>
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<tr>
<td>Calculates Mortality Risk</td>
<td></td>
<td>x</td>
<td>x</td>
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<tr>
<td>Calculates Severity of Multiple Organ Dysfunction</td>
<td>x</td>
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<tr>
<td>Timeframe Assessed</td>
<td>Throughout</td>
<td>Admission</td>
<td>Admission</td>
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<tr>
<td>Laboratory Tests Needed</td>
<td>x</td>
<td>x</td>
<td>x</td>
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</table>

(Leiteurtre et al., 2013; Straney et al., 2013; Kim et al., 2012)

PEdiatric Logistic Organ Dysfunction Score

PELOD-2

• Variables:
  • Neurologic*: GSC & pupillary reaction
  • Cardiovascular: Lactatemia & MAP
  • Renal: Creatinine
  • Respiratory*: PaO2, PaCO2, & Invasive ventilation
  • Hematologic: WBC count, & Platelets
• Scores range from 0 (best) to 33 (worst)
• Equation available to calculate probability of death

* = highest contribution to mortality according to multiple regression score

(Leiteurtre et al., 2013)
Staffing ICUs During Pandemic, Disaster and Crisis Conditions

Molly McNett
Linda Connor

Staffing Models
Abundant literature on staffing ratios and impact on patient, clinician, organizational outcomes that can inform recommendations during “usual care”.

However, we are not in a state of “usual care”
Staffing Models
What are recommendations during a pandemic?

Level of Evidence:
Observational
Expert Opinion

Based on previous pandemics, projected scope and impact of pandemic, resources, severity of disease

Pandemic Staffing Models
Synthesis of Evidence: ICU Staffing During Pandemic, Disaster and Crisis Conditions

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<tr>
<td>Care team model</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Expand clinician expertise (Expand the scope of practice pharmacist role, train non-ICU staff to provide ventilator care)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Tiered staffing strategy (see Figure 1)</td>
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<td>X</td>
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<tr>
<td>Limit routine services (elective surgery, clinic visits)</td>
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<tr>
<td>Curtail administrative and teaching responsibilities</td>
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<td>Cancel staff vacation and leaves</td>
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<tr>
<td>New divisions of labor (reassign staff) based on the skill sets needed rather than traditional roles or functions of providers</td>
<td>X</td>
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<tr>
<td>Assess resource commitments based on Treater, Time, Treatment and Threat (see Table 2)</td>
<td>X</td>
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<tr>
<td>Legend: X = Recommended practice</td>
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Image credit: https://twitter.com/PannuJasleen
Recommendations for Intensive Care Unit (ICU) Staffing in Pandemic, Disaster and Crisis Conditions

Based on the evidence, we recommend

- Implement a care team model
- Expand clinician expertise
- Use a tiered staffing strategy
- Limit routine services
- Curtail administrative and teaching responsibilities
- Cancel staff vacation and leaves
- Reassign staff

Pandemic Staffing Models

Image source:
Key Components to Consider When Assessing Resource Commitments

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
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<tbody>
<tr>
<td>Treater</td>
<td>The amount of staff expertise required to provide critical care</td>
</tr>
<tr>
<td>Time</td>
<td>The amount of staff time required to manage the patients</td>
</tr>
<tr>
<td>Treatment</td>
<td>The amount of resources required to manage the patients</td>
</tr>
<tr>
<td>Threat</td>
<td>Any risks to the provider or patient generated by the situation due to infrastructure damage, imminent dangers to providers and patients, or a high risk of disease transmission without appropriate personal protective equipment (PPE) available</td>
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</table>

Hick et al., 2014.

Synthesis of Evidence: Strategies to Support Staff During Pandemic, Disaster and Crisis Conditions

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<tbody>
<tr>
<td><strong>Provide childcare support for staff</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td><strong>Provide on-site respite (food, quiet spaces)</strong></td>
<td>X</td>
<td>X</td>
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<tr>
<td><strong>Provide on-site housing</strong></td>
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<tr>
<td><strong>Vary the length of shifts</strong></td>
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<tr>
<td><strong>Drive staff to and from the hospital</strong></td>
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<td><strong>Plan in advance</strong></td>
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Legend: X = Recommended practice
Recommendations/Strategies for Intensive Care Unit (ICU) Staff Support During Pandemic, Disaster and Crisis Conditions

Based on the evidence, we recommend:

• Provide childcare support for staff
• Provide on-site respite (food, quiet space)
• Provide on-site housing
• Vary the length of shifts
• Drive staff to and from the hospital
• Plan in advance

Innovation

Consider innovative solutions generated by ICU nurses in the field who are currently managing COVID-19 patients in order to achieve the following:

• Reduce unnecessary use of personal protective equipment (PPE)
• Promote staff safety and readiness
• Reduce foot traffic
  o Improve staffing ratios (isolation patients are 1:1)
  o Utilize a runner (a nurse who is not assigned a patient, but is designated to help 2-3 other nurses)
  o Clumping of activities (reduce # of times nurse has to enter the room, patient gets to rest)
  o Video monitoring (a camera in the room allows team to assess the patient while outside the room)
  o Use a team approach to consolidate care (1 person inside the room, one helper outside)

Newby, JC, Mably MC, Carlisle BA, Olson D, Lan BE. Reflections on Nursing Ingenuity During the COVID-19 Pandemic. Journal of Neuroscience Nursing; 2020. DOI: 10.1097/JNN.000000000000052
We believe that evidence is an especially powerful tool in a time like this. We hope that putting these evidence-based resources into your hands will help you make the best decisions possible while caring for COVID-19 patients and families.

Helene Fuld Health Trust National Institute for Evidence-based Practice in Nursing and Healthcare

References


References


References


References


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