



# COVID-19 Resource

## Mechanical Ventilation Sharing and Triage Recommendations for Healthcare Workers

04/22/2020



**THE OHIO STATE UNIVERSITY**  
COLLEGE OF NURSING

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

**Background:** In a disaster or crisis situation, healthcare resources such as mechanical ventilators may become scarce. The evidence on mechanical ventilation sharing as a strategy to mitigate ventilator scarcity was reviewed.

## MECHANICAL VENTILATION SHARING

No studies using one ventilator for multiple patients has been performed in humans, only in simulation and in studies with sheep (kept on a ventilator for less than 12 hours). The following are concerns with ventilator sharing:

- microbial cross contamination
- lung compliance
- distribution of PEEP & tidal volume

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

The SCCM, AARC, ASA, APSF, AACN, and CHEST\* issued a consensus statement on March 26, 2020, 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/COVID19RapidResources/Resources/Consensus-Statement-on-Multiple-Patients-Per-Venti>

### \* Legend of Abbreviations Used

SCCM	Society of Critical Care Medicine
AARC	American Association for Respiratory Care
ASA	American Society of Anesthesiologists
APSF	Anesthesia Patient Safety Foundation
AACN	American Association of Critical Care Nurses
CHEST	American College of Chest Physicians

[go.osu.edu/ebpcovid19](https://go.osu.edu/ebpcovid19)



**Background:** Mechanical ventilation sharing is **not** supported by the evidence due to lack of research. Therefore, the evidence related to best practice for triaging patients was evaluated. Below are evidence-based resources that can be integrated with clinical expertise to inform clinical decision making and reduce emotional burden of clinicians regarding the allocation of mechanical ventilators and other healthcare resources in disaster and crisis situations.

## TRIAGE

### Resource Allocation:

#### AGILITIES Score Resource Triage System

Precautions must be in place at the state and federal level to manage life-critical systems such as mechanical ventilation during a pandemic or disaster.

- The AGILITIES Score System was developed based on the requirements set forth by the US Department of Homeland Security and the triage article by Hick and O’Laughlin (2006) to use in the event of a pandemic, mass casualty event, or other catastrophic disaster.
- The AGILITIES Score System can be incorporated to ensure an equitable and transparent triage method.

The AGILITIES Scoring System:

- is meant for use in a disaster setting and used only in extreme circumstances, where this scoring flowsheet may serve as the medical record and does not require extensive time to complete like some scoring systems used in the ICU setting which are predictors of mortality,
- is an additional tool to help mitigate difficult decisions that may need to be made in a pandemic or crisis,
- assists in allocation of healthcare resources within a disaster situation, and
- does not have an age limitation and therefore can be implemented for both adult and pediatric populations.

(Wilkens & Klein, 2010; Hick & O’Laughlin, 2006)

[go.osu.edu/ebpcovid19](https://go.osu.edu/ebpcovid19)



## An Additional Proposed Framework

Biddison et al. developed a proposed framework for mechanical ventilation allocation in epidemics of novel respiratory pathogens. This proposed framework takes into account both the likelihood for long-term and short-term survival.

- Short-term assessment utilizes the SOFA score in adults and PELOD-2 in pediatrics (both described below).
- Long-term assessment takes into consideration comorbidities.
  - Certain comorbidities could indicate that even if care is successfully received inpatient, the individual would not likely survive the next 12 months due to the severity of the comorbidity.

(Biddison et al., 2019)

## Assessment of Mortality Risk:

### SOFA

#### Sequential Organ Failure Assessment Score

- SOFA evaluates the severity of the patient's illness with an assessment of six organ systems to predict short-term and long-term mortality risk.
- A change in the SOFA score is a better predictor of mortality than a fixed SOFA score; however, studies had mixed reviews on the best timeframe to assess the change in the SOFA score.
- Scores range from 1 to 4. A score greater than 2 demonstrates a higher risk of mortality.
- SOFA is available in the public domain.

**Note:** In patients with COVID-19, an elevated SOFA score, advanced age and d-dimer >1µg/mL can possibly identify those with a poor prognosis.

(Ferreira et al., 2001; Garcia-Gigorro et al., 2018; Grooth et al., 2017; Karaoke et al., 2019; Minne et al., 2008; & Zhou et al., 2020)

[go.osu.edu/ebpcovid19](https://go.osu.edu/ebpcovid19)



## CriSTAL

### Criteria for Screening and Triaging Appropriate Alternative care

- CriSTAL was created to help identify the elderly who are in the Emergency Department (ED) who may be at the end of life and benefit from end of life care as opposed to aggressive management.
- CriSTAL is easy to use and the only required laboratory test is a urinalysis.
- A separate tool is available for use when a rapid response has been initiated in the inpatient setting.

**Note:** CriSTAL is not intended to lead to withholding care from individuals but it may be a beneficial tool during this pandemic to allow health care providers to initiate conversations with patients and families earlier about end of life versus aggressive care.

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



[go.osu.edu/ebpcovid19](https://go.osu.edu/ebpcovid19)



THE OHIO STATE UNIVERSITY  
COLLEGE OF NURSING

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

## PELOD-2

### PEdiatric Logistic Organ Dysfunction 2 Score

- PELOD-2 assesses the severity of multiple organ dysfunction syndrome in the pediatric intensive care unit (PICU) in order to predict mortality over the short term.
- PELOD-2 has been adopted into some state disaster plans as a resource within the mechanical ventilator allocation guidelines.
- The score is built on an age based evaluation of 10 variables that correspond with 5 different organ systems and requires laboratory test values.
- Scores range from 0 (best) to 33 (worst) although no consensus has been reached on an appropriate cut off measurement for triage.
- PELOD-2 allows for assessment of mortality risk throughout patient admission; other validated pediatric mortality risk tools score patients at admission.
- PELOD-2 is available in the public domain.

Note: Assessing for high risk of mortality alone in the pediatric population may not have a big impact on resource allocation because pediatric mortality rates are relatively low.

(Biddison et al., 2019; Gall et al., 2016; Kim et al., 2012; Leteurtre et al., 2013; New York State Task Force on Life and the Law and New York State Department of Health, 2015; Ramazani & Hosseini, 2019)

## RECOMMENDATIONS

1. The limited evidence **does not** support placing multiple patients on one ventilator. More research needs to be completed.
2. Resource allocation tools and mortality risk assessment tools should be used to identify the most appropriate and effective use of scarce resources for triage.

[go.osu.edu/ebpcovid19](https://go.osu.edu/ebpcovid19)





We hope this pamphlet has helped answer some of the questions you may be having about the use of ventilators during the COVID-19 pandemic. Please check out the repository for more evidence-based resources to support you and your colleagues, as well as consumers.

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.

**Help this information get to the people who need it. Please consider sharing through social media and other online communication portals and follow us on our social media to be notified of updates and new resources.**



[facebook.com/osufuldebp](https://facebook.com/osufuldebp)



[twitter.com/osufuldebp](https://twitter.com/osufuldebp)

[go.osu.edu/ebpcovid19](https://go.osu.edu/ebpcovid19)



**THE OHIO STATE UNIVERSITY**  
COLLEGE OF NURSING

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

# References

- Biddison, E. L., Faden, R., Gwon, H. S., Mareiniss, D. P., Regenber, A. C., Schoch-Spana, M., . . . Toner, E. S. (2019). Too many patients...A framework to guide statewide allocation of scarce mechanical ventilation during disasters. *CHEST*, 155(4), 848-854. doi:10.1016/j.chest.2018.09.025
- Cardona-Morrell, M., & Hillman, K. (2015). Development of a tool for defining and identifying the dying patient in hospital: Criteria for screening and triaging to appropriate alternative care (CriSTAL). *BMJ Supportive and Palliative Care*, 5(1), 78-90. doi:10.1136/bmjspcare-2014-000770
- Cardona, M., Lewis, E. T., Kristensen, M. R., Skjøt-Arkil, H., Ekmann, A. A., Nygaard, H. H., . . . Brabrand, M. (2018). Predictive validity of the CriSTAL tool for short-term mortality in older people presenting at emergency departments: A prospective study. *European Geriatric Medicine*, 9(6), 891-901. doi:10.1007/s41999-018-0123-6
- Cardona, M., O'Sullivan, M., Lewis, E. T., Turner, R. M., Garden, F., Alkhour, H., . . . Breen, D. (2018). Prospective validation of a checklist to predict short-term death in older patients after emergency department admission in Australia and Ireland. *Academic Emergency Medicine*, doi:10.1111/acem.13664
- Ferreira, F. L., Bota, D. P., Bross, A., Melot, C., & Vincent, J.-L. (2001). Serial evaluation of the SOFA score to predict outcome in critically ill patients. *Journal of the American Medical Association*, 286(14), 1754–1758.
- Gall, C., Wetzel, R., Kolker, A., Kanter, R. K., & Toltzis, P. (2016). Pediatric triage in a severe pandemic: Maximizing survival by establishing triage thresholds\*. *Critical Care Medicine*, 44(9), 1762-1768. doi:10.1097/CCM.0000000000001759
- Garcia-Gigorro, R., Fuente, I. S., Mateos, H. M., Andres-Esteban, E. M., Sanchez-Izquierdo, J. A., & Montejo-Gonzalez, J. C. (2018). Utility of SOFA and  $\Delta$ -SOFA scores for predicting outcome in critically ill patients from the emergency department. *European Journal of Emergency Medicine*, 25(6), 387–393. <https://doi.org/10.1097/MEJ.0000000000000472>
- Grooth, H.-J., Geenen, I. L., Girbes, A. R., Vincent, J.-L., Parienti, J.-J., & Straaten, H. M. (2017). SOFA and mortality endpoints in randomized controlled trials: A systematic review and meta-regression analysis. *Critical Care*, 21(38), 1–9. <https://doi.org/10.1186/s13054-017-1609-1>

In 2016, The Ohio State University College of Nursing received a \$6.5 million gift from the Helene Fuld National Health Trust to create the Helene Fuld Health Trust National Institute for Evidence-based Practice in Nursing and Healthcare. The Fuld Institute for EBP is a national hub for the formation, teaching and dissemination of best practices to improve healthcare quality, safety, costs and patient outcomes. Its cores include transdisciplinary clinical practice, academics, consumer education and EBP implementation science.

## Mission

We dream, discover and deliver a healthier world through transdisciplinary education, research and policy focused on evidence-based decision making.

[go.osu.edu/ebpcovid19](https://go.osu.edu/ebpcovid19)





# References

- Hick, J. L. & O’Laughlin, D. T. (2006). Concept of operations for triage of mechanical ventilation in an epidemic. *Society for Academic Emergency Medicine*, 13, pp.223-229. DOI: 10.1197/j.aem.2005.07.037
- Jankowski, K., & Bryden, D. C. (2019). Using a CriSTAL scoring system to identify pre-morbid conditions associated with a poor outcome after admission to intensive care in people 70 years or older. *Journal of the Intensive Care Society*, 20(3), 231-236. doi:10.1177/1751143718804678
- Karaoke, E., Kyriazopoulou, E., Tsangaris, I., Routsis, C., Vincent, J.-L., & Giamarellos-Bourboulis, E. J. (2019). The early change of SOFA score as a prognostic marker of 28-day sepsis mortality: Analysis through a derivation and a validation cohort. *Critical Care*, 23(387), 1–8. <https://doi.org/10.1186/s13054-019-2665-5>
- Kim, K. M., Cinti, S., Gay, S., Goold, S., Barnosky, A., & Lozon, M. (2012). Triage of mechanical ventilation for pediatric patients during a pandemic. *Disaster Medicine and Public Health Preparedness*, 6(2), 131-137. doi:10.1001/dmp.2012.19
- Leteurtre, S., Duhamel, A., Salleron, J., Grandbastien, B., Lacroix, J., & Leclerc, F. (2013). PELOD-2: An update of the pediatric logistic organ dysfunction score. *Critical Care Medicine*, 41(7), 1761-1773. doi:10.1097/CCM.0b013e31828a2bbd
- Minne, L., Abu-Hanna, A., & Jonge, E. D. (2008). Evaluation of SOFA-based models for predicting mortality in the ICU: A systematic review. *Critical Care*, 12, 1–13. <https://doi.org/10.1186/cc7160>
- Neyman, G., & Irvin, C. B. (2006). A single ventilator for multiple simulated patients to meet disaster surge. *Academic Emergency Medicine*, 13(11), 1246-1249. doi:10.1197/j.aem.2006.05.009
- New York State Task Force on Life and the Law and New York State Department of Health. (2015). Ventilator allocation guidelines. Retrieved from [https://www.health.ny.gov/regulations/task\\_force/reports\\_publications/docs/ventilator\\_guidelines.pdf](https://www.health.ny.gov/regulations/task_force/reports_publications/docs/ventilator_guidelines.pdf)
- Paladino, L., Silverberg, M., Charchafli, J. G., Eason, J. K., Wright, B. J., Palamidessi, N., . . . Manoach, S. (2008). Increasing ventilator surge capacity in disasters: Ventilation of four adult-human-sized sheep on a single ventilator with a modified circuit. *Resuscitation*, 77(1), 121-126. doi:10.1016/j.resuscitation.2007.10.016
- Ramazani, J., & Hosseini, M. (2019). Comparison of the predictive ability of the pediatric risk of mortality III, pediatric index of Mortality<sub>3</sub>, and pediatric logistic organ dysfunction-2 in medical and surgical intensive care units. *Journal of Comprehensive Pediatrics*, 10(2) doi:10.5812/compreped.82830



# References

- Society of Critical Care Medicine, American Association for Respiratory Care, American Society of Anesthesiologists, Anesthesia Patient Safety Foundation, American Association of Critical Care Nurses, & American College of Chest Physicians. (2020, March 26). Consensus statement on multiple patients per ventilator. <https://www.sccm.org/Disaster/Joint-Statement-onMultiple-Patients-Per-Ventilator>. Retrieved March 26, 2020, from <https://www.sccm.org/COVID19RapidResources/Resources/Consensus-Statement-on-Multiple-Patients-Per-Venti>
- Wilkens, E. P., & Klein, G. M. (2010). Mechanical ventilation in disaster situations: A new paradigm using the AGILITIES score system. *American Journal of Disaster Medicine*, 5(6), 369-384. Retrieved from [www.scopus.com](http://www.scopus.com)
- Zhou, F., Du, R., Liu, Y., Liu, Z., Xiang, J., Wang, Y., Song, B., Gu, X., Guan, L., Wei, Y., Li, H., Wu, X., Xu, J., Zhang, Y., Chen, H., & Cao, B. (2020). Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. *The Lancet*, 395, 1054–1062. [https://doi.org/10.1016/S0140-6736\(20\)30566-3](https://doi.org/10.1016/S0140-6736(20)30566-3)

