

Joint Statement on Multiple Patients Per Ventilator

March 26, 2020: The Society of Critical Care Medicine (SCCM), American Association for Respiratory Care (AARC), American Society of Anesthesiologists (ASA), Anesthesia Patient Safety Foundation (ASPF), American Association of Critical-Care Nurses (AACN), and American College of Chest Physicians (CHEST) issue 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 nonhomogenous lung disease is difficult and is associated with a 40%-60% mortality rate. Attempting to ventilate multiple patients with COVID-19, given the issues described here, could lead to poor outcomes and high mortality rates for all patients cohorted. In accordance with the exceedingly difficult, but not uncommon, triage decisions often made in medical crises, it is better to purpose the ventilator to the patient most likely to benefit than fail to prevent, or even cause, the demise of multiple patients.

Background: The interest in ventilating multiple patients on one ventilator has been piqued by those who would like to expand access to mechanical ventilators during the COVID-19 pandemic. The first modern descriptions of multiple patients per ventilator were advanced by Neyman et al in 2006¹ and Paladino et al in 2013.² However, in each instance, Branson, Rubinson, and others have cautioned against the use of this technique.³⁻⁵ With current equipment designed for a single patient, we recommend that clinicians do not attempt to ventilate more than one patient with a single ventilator while any clinically proven, safe, and reliable therapy remains available (ie, in a dire, temporary emergency).

Attempting to ventilate multiple patients would likely require arranging the patients in a spoke-like fashion around the ventilator as a central hub. This positioning moves the patients away from the supplies of oxygen, air, and vacuum at the head of the bed. It also places the patients in proximity to each other, allowing for transfer of organisms. Spacing the patients farther apart would likely result in hypercarbia.

Spontaneous breathing by a single patient sensed by the ventilator would set the respiratory frequency for all the other patients. The added circuit volume could preclude triggering. Patients may also share gas between circuits in the absence of one-way valves. Pendelluft between patients is possible, resulting in both cross-infection and over-distension. Setting alarms can monitor only the total response of the patients' respiratory systems as a whole. This would hide changes occurring in only one patient. The reasons for avoiding ventilating multiple patients with a single ventilator are numerous.

These reasons include:

- Volumes would go to the most compliant lung segments.
- Positive end-expiratory pressure, which is of critical importance in these patients, would be impossible to manage.
- Monitoring patients and measuring pulmonary mechanics would be challenging, if not impossible.
- Alarm monitoring and management would not be feasible.
- Individualized management for clinical improvement or deterioration would be impossible.
- In the case of a cardiac arrest, ventilation to all patients would need to be stopped to allow the change to bag ventilation without aerosolizing the virus and exposing healthcare workers. This circumstance also would alter breath delivery dynamics to the other patients.
- The added circuit volume defeats the operational self-test (the test fails). The clinician would be required to operate the ventilator without a successful test, adding to errors in the measurement.
- Additional external monitoring would be required. The ventilator monitors the average pressures and volumes.
- Even if all patients connected to a single ventilator have the same clinical features at initiation, they could deteriorate and recover at different rates, and distribution of gas to each patient would be unequal and unmonitored. The sickest patient would get the smallest tidal volume and the improving patient would get the largest tidal volume.
- The greatest risks occur with sudden deterioration of a single patient (e.g., pneumothorax, kinked endotracheal tube), with the balance of ventilation distributed to the other patients.
- Finally, there are ethical issues. If the ventilator can be lifesaving for a single individual, using it on more than one patient at a time risks life-threatening treatment failure for all of them.

References

1. Neyman G, Irvin CB. A single ventilator for multiple simulated patients to meet disaster surge. *Acad Emerg Med*. 2006 Nov;13(11):1246-1249.
2. Paladino L, Silverberg M, Charcaflieh JG, et al. Increasing ventilator surge capacity in disasters: ventilation of four adult-human-sized sheep on a single ventilator with a modified circuit. *Resuscitation*. 2008 Apr;77(1):121-126.
3. Branson RD, Rubinson L. One ventilator, multiple patients: what the data really supports. *Resuscitation*. 2008 Oct;79(1):171-172; author reply 172-173.
4. Branson RD, Rubinson L. A single ventilator for multiple simulated patients to meet disaster surge. *Acad Emerg Med*. 2006 Dec;13(12):1352-1353; author reply 1353-1354.
5. Branson RD, Blakeman TC, Robinson BR, Johannigman JA. Use of a single ventilator to support 4 patients: laboratory evaluation of a limited concept. *Respir Care*. 2012 Mar;57(3):399-403.