

RESPIRATORY THERAPIST PREPARATION AND RESPONSE TO A PANDEMIC

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Disclaimers

- I have attempted to construct this presentation with the most up-to-date information, graphics and accuracy. Understand that due to the fluidity of COVID-19, discrepancies may exist
- In effort to dispel falsehoods and halt the spread of misinformation, citations have been provided from trusted sources and/or peer-reviewed research

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Disclaimers

- The opinions presented are mine alone and may not be reflective of official statements or opinions of the American Association for Respiratory Care (AARC) the Pennsylvania Society for Respiratory Care (PSRC) or Gwynedd Mercy University
- I have no conflicts of interest to declare

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Objectives

- At the end of the lecture you will be able to:
 - ▣ Identify the four stages of the disaster cycle
 - ▣ Describe the capacities and limitations of the ability to provide mechanical ventilation in the United States
 - ▣ Discuss the theory and principles of a ventilator triage protocol
 - ▣ Apply the knowledge gained in the webinar to develop response plans in your respective RT department including cross training staff, augmenting schedules and limiting services provided.

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The Disaster Cycle

- ❑ Mitigation: work involving preventing future emergencies and/or minimizing their negative effects
- ❑ Preparation: plans made in advance of an emergency that help the organization be ready
- ❑ Response: Putting the plans in motion
- ❑ Recovery: Happens after damages have been assessed post incident and involves actions to return the affected community to its pre-disaster state



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Lessons learned



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Recovery

- Randy's Pearls of Wisdom
 - Two things that can always be improved upon post-incident
 - Communication
 - From one person
 - HCF: Public Information Officer (PIO)
 - Department: Manager/director
 - Clear, concise non-conflicting message
 - Resource management
 - Facilities (Space)
 - Personnel (Staff)
 - Equipment (Stuff)



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Timeline

- November 2019: Novel coronavirus first detected in Wuhan, Hubei Province in China
 - Patients at epicenter in Wuhan had link to live animal markets
 - Subsequent patients could not be linked to animal markets
 - Suggested community spread
 - Community spread was subsequently reported outside Hubei and in countries outside China, including in the US
 - Genetic sequences from U.S. patients are similar to those in China

<https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/summary.html>

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Timeline

- January 30, 2020: The WHO declared the outbreak a “public health emergency of international concern”
- January 31, 2020: US HHS Secretary Azar declared a public health emergency (PHE) for the United States
- March 11, 2020: The WHO publicly characterized COVID-19 as a pandemic
- March 13, 2020: President Trump declared the COVID-19 outbreak a national emergency

<https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/summary.html>

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Background

- Officially per the CDC:
 - Virus name: SARS-CoV-2 virus
 - Disease: Coronavirus disease 2019 (aka COVID-19)
 - Same family as SARS-CoV-1 and MERS-CoV
 - Now detected in more than 200 locations internationally

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Background

- How COVID-19 is spread
 - ▣ Droplet transmission
 - Cough, sneeze, aerosolization
 - ▣ Easiest transmission when patient's are sickest
 - ▣ Also thought to spread before the patient is symptomatic
 - Cough may show up prior to fever and malaise

<https://www.cdc.gov/coronavirus/2019-ncov/prepare/transmission.html>

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Background

- How COVID-19 is spread
 - ▣ Direct Contact
 - Not thought to be the main way the virus spreads
 - SARS CoV-2 can survive on surfaces
 - ▣ Aerosol: 3 hours
 - ▣ Copper: 4 hours
 - ▣ Cardboard: 24 hours
 - ▣ Plastic: 24-36 hours

van Doremalen N, et al, Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1, NEJM, 2020 DOI: 10.1056/NEJMc2004973

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Background

- Personal Protective Equipment
 - For care of patients with known or suspected COVID-19
 - N95, Eye protection, gowns, gloves
 - Facemasks are acceptable until supply is restored
 - Use homemade masks with caution¹
 - All of the above should be prioritized for aerosol generating procedures
 - Once supply is restored HCF respiratory protection programs should be restored

1. MacIntyre CR, Seale H, Dung TC, et al. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers. *BMJ Open*. 2015;5(4):e006577. Published 2015 Apr 22. doi:10.1136/bmjopen-2014-006577

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Background

- | | |
|----------------------------|----------------------------|
| □ As of 20 March 2020 (US) | □ As of 27 March 2020 (US) |
| □ Cases: 15,219 | □ Cases: 85,356 |
| □ Deaths: 201 | □ Deaths: 1246 |
| □ Mortality: 1.43%*** | □ Mortality: 1.46%*** |
| □ As of 24 March 2020 (US) | □ As of 31 March 2020 (US) |
| □ Cases: 44,183 | □ Cases: 163,539 |
| □ Deaths: 544 | □ Deaths: 2860 |
| □ Mortality: 1.23%*** | □ Mortality: 1.74%*** |

<https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html>

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Background

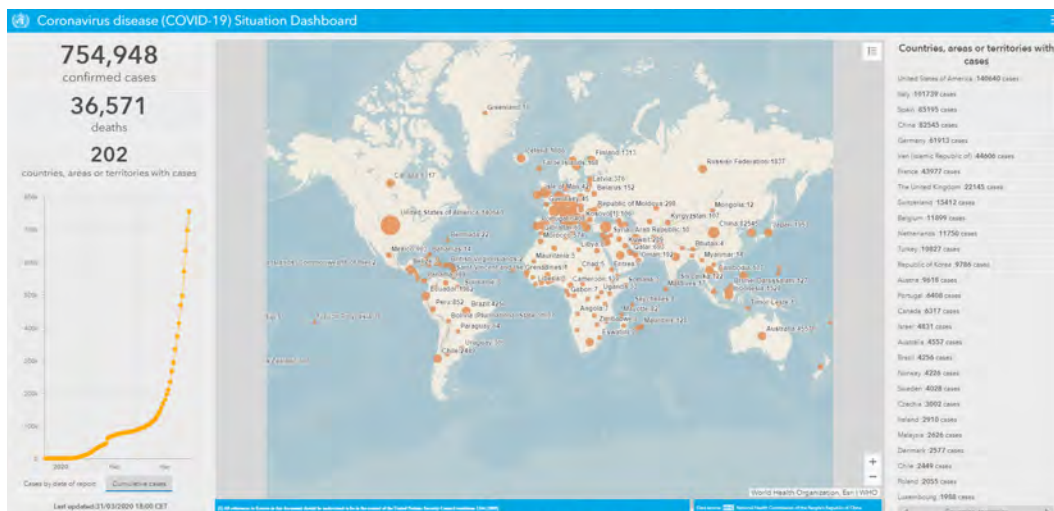
TABLE. Hospitalization, intensive care unit (ICU) admission, and case-fatality percentages for reported COVID-19 cases, by age group — United States, February 12–March 16, 2020

Age group (yrs) (no. of cases)	%*		
	Hospitalization	ICU admission	Case-fatality
0–19 (123)	1.6–2.5	0	0
20–44 (705)	14.3–20.8	2.0–4.2	0.1–0.2
45–54 (429)	21.2–28.3	5.4–10.4	0.5–0.8
55–64 (429)	20.5–30.1	4.7–11.2	1.4–2.6
65–74 (409)	28.6–43.5	8.1–18.8	2.7–4.9
75–84 (210)	30.5–58.7	10.5–31.0	4.3–10.5
≥85 (144)	31.3–70.3	6.3–29.0	10.4–27.3
Total (2,449)	20.7–31.4	4.9–11.5	1.8–3.4

Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States, February 12–March 16, 2020. MMWR Morb Mortal Wkly Rep. ePub: 18 March 2020. DOI: <https://dx.doi.org/10.15585/mmwr.mm6912e2externalicon>

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Global Situation 31 MAR 2020



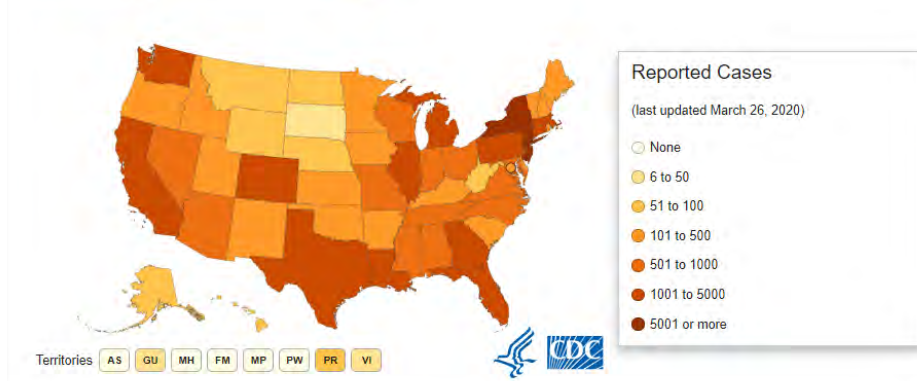
Graphic Courtesy of WHO: <https://experience.arcgis.com/experience/685d0ace521648f8a5beeee1b9125cd>

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COVID-19 in the United States

COVID-19 Cases in the U.S.

[Cases in U.S.](#) [Situation Summary](#)

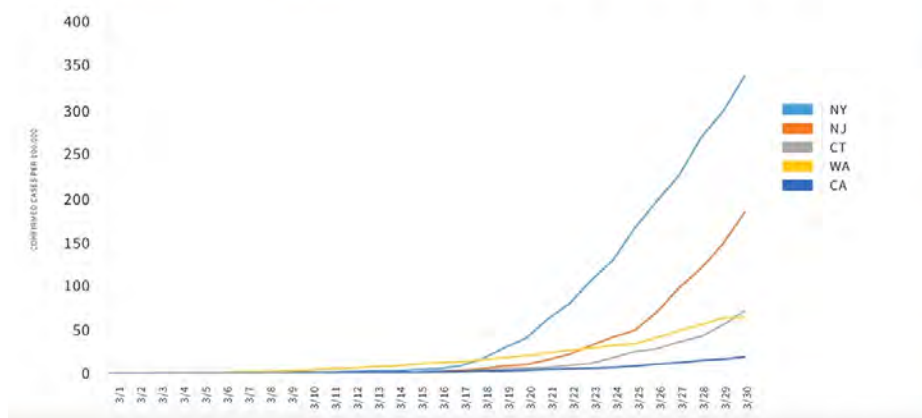


<https://www.cdc.gov/coronavirus/2019-ncov/index.html>

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COVID-19 in the United States

CUMULATIVE CASES PER 100,000: NY, NJ, CT, WA, CA

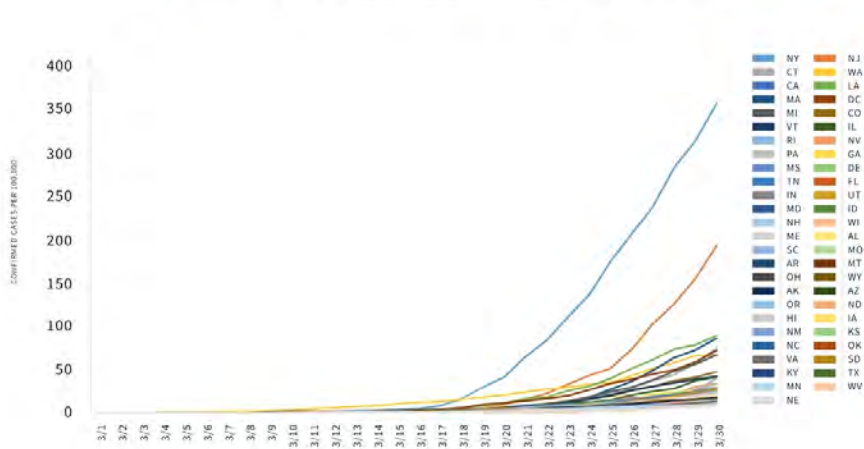


Data per White House Corona Virus Press Briefing 31 March 2020

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COVID-19 in the United States

CUMULATIVE CASES PER 100,000: ALL STATES



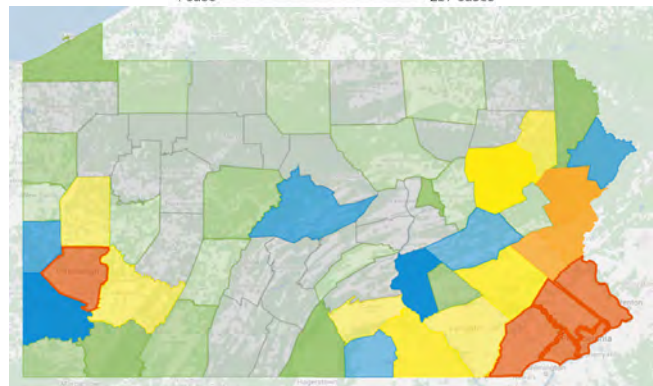
Data per White House Corona Virus Press Briefing 31 March 2020

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Counties Affected in Pennsylvania

- 25 March 2020
- ▣ 44 of 67 counties affected
- ▣ Positive cases: 1,127
- ▣ Negative cases: 11,193
- ▣ Deaths: 11
- ▣ Mortality: .97%

Map Key

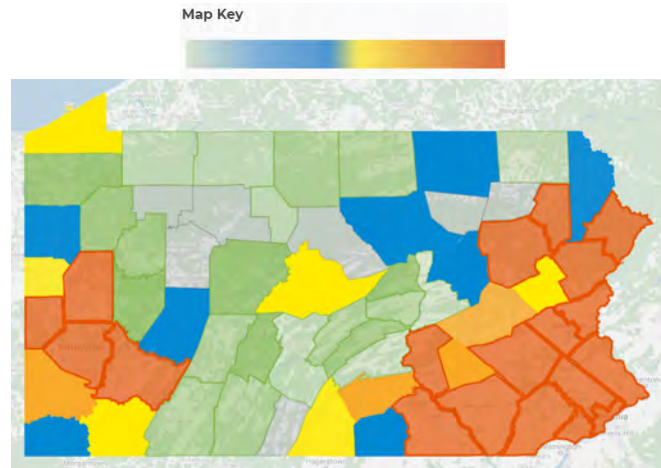


<https://www.health.pa.gov/topics/disease/coronavirus/Pages/Coronavirus.aspx>

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Counties Affected in Pennsylvania

- 31 March 2020
 - ▣ 60 of 67 counties affected
 - ▣ Positive cases: 4,843
 - ▣ Negative cases: 37,365
 - ▣ Deaths: 63
 - ▣ Mortality: 1.30%



<https://www.health.pa.gov/topics/disease/coronavirus/Pages/Coronavirus.aspx>

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Federal Responses

- 29 Disaster declarations
- Army Corps of Engineers
 - ▣ Field hospitals in NY, MI, NJ, LA
- USNS Mercy and Comfort
- Industry response
 - ▣ Ford, GM, GE, 3M
 - ▣ Distilleries
 - ▣ Sporting goods



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AARC

- In contact with Federal Government
- Professional collaborations
- Numerous interviews and press releases
 - Forbes
 - USA Today
- AARC.org
 - Strategic National Stockpile training videos
 - COVID-19 Updates
 - Links to CDC

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State Response

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PSRC

□ Resources

□ www.psrc.net/covid19links

- CDC guidelines
- Society of Critical Care Medicine
- Utilizing Respironics V60 for Invasive Ventilation
- Vortran Automatic Resuscitator
- Prone Positioning
- Strategic National Stockpile Ventilator training



□ RT's available/RT's needed initiative

□ PEMA

□ What the PSRC does

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Pennsylvania Bureau of Occupational and Professional Affairs

□ Licensure

□ < 4 years expired

- May apply for a temporary license without hoops
 - Expires when pandemic is resolved
- Details forthcoming-email the Executive Director if interested

□ PA has already begun to reroute DMV workers to medical licensure boards

□ Retirees, educators and students

□ Temporary licenses during pandemic

□ Telemedicine approved for all licensed HCP's***

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Status of Mechanical Ventilators in the US

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Numbers

□ Estimates only

□ Approximately 160,000

- 62,000 full feature ventilators¹
 - ~29,000 (46%) with pediatric/neonatal capabilities
- 98,000 additional that are not full feature¹
 - Provide basic functions

□ Strategic National Stockpile

□ Approximately 18,000 in the stockpile

1. Rubinson L, Vaughn F, Nelson S, et al. Mechanical Ventilators in US acute care hospitals. *Disaster Med Public Health Prep* 2010;4(3): 199-206.doi:10.1001/dmp.2010.18

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The Strategic National Stockpile (SNS)

- \$7-\$8 billion in supplies
- Location(s)?
- Massive stores
 - Medications
 - Supplies
 - Ventilators
- 12 hour push-pack
 - Initial store of equipment that can be in the area within 12 hours
 - Mechanical ventilators are **NOT** included in this
 - Requested separately

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The Strategic National Stockpile (SNS)

- Full stockpile can be on the ground within 48 hours
- Will take longer for supplies to get where they are needed
 - Storage, processing, documentation, delivery



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The Strategic National Stockpile (SNS)



Fig. 3. Strategic National Stockpile ventilator air cargo container.

Malatino, EM, Strategic National Stockpile: Overview and Ventilator Assets, Respiratory Care January 2008, 53 (1) 91-95

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The Strategic National Stockpile (SNS)

□ Ventilators

□ Selection criteria for the SNS

- Must be able to treat respiratory insults from numerous causes
 - Chemical, Biological, Nuclear, Incendiary, etc
 - i.e. ARDS scenarios
- Must have capabilities for treating pediatric and adults
- Capabilities desired included, but were not limited to:
 - Audible alarms
 - Ability to administer PEEP
 - Extended battery life
 - Technical support
 - Portability
 - Small storage footprint

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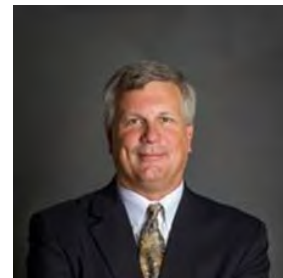
The Strategic National Stockpile (SNS)

- Ventilators in the SNS
 - Not full featured
 - No 'advanced modes'
 - Not a full function ICU ventilator
 - 'Need' versus 'want/like' scenario
 - Have internal batteries
 - Internal compressors
 - Draws in room air
 - Contamination concerns
 - Must use filters
 - HME's

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The Strategic National Stockpile (SNS)

- Ventilators in the SNS
 - Puritan Bennett LP-10: ~2000
 - Old school
 - Separate PEEP valve
 - Not intrinsic in the ventilator
 - Attaches to the circuit
 - Must account for when setting sensitivity
 - Must set 'Low pressure' alarm above PEEP setting
 - Low pressure alarm will sound otherwise
 - No oxygen blender
 - Oxygen must be bled into the circuit
 - Effects tidal volumes

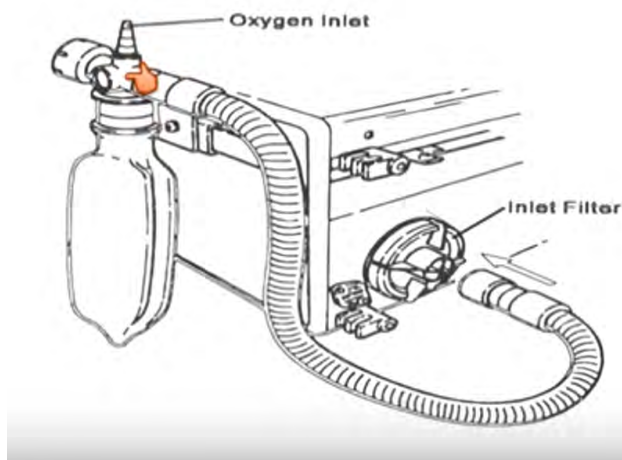


<https://www.aarc.org/resources/clinical-resources/strategic-national-stockpile-ventilator-training-program/>

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The Strategic National Stockpile

LP-10



<https://www.aarc.org/resources/clinical-resources/strategic-national-stockpile-ventilator-training-program/>

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The Strategic National Stockpile (SNS)



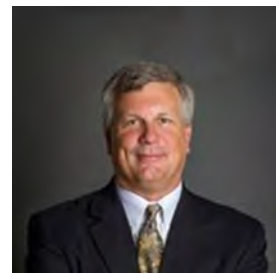
Malatino, EM, Strategic National Stockpile: Overview and Ventilator Assets, Respiratory Care January 2008, 53 (1) 91-95

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The Strategic National Stockpile (SNS)

□ Impact Eagle 754: ~2000

- Military ventilator
 - CCATT
- Can use high or low pressure oxygen
- Flow limited to 60L/min
- Use with closed circuit suction can cause shut-off
 - Safety mechanism
 - Just turn it back on
- NOT pediatric friendly when using internal air compressor
 - <300ml Vt



<https://www.aarc.org/resources/clinical-resources/strategic-national-stockpile-ventilator-training-program/>

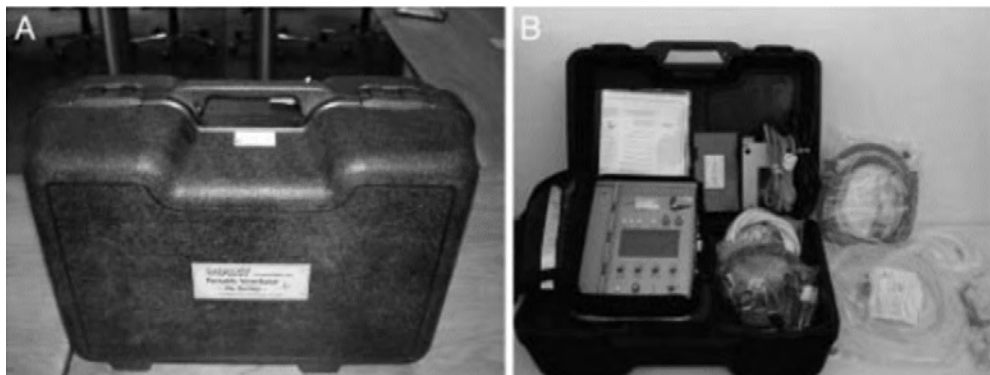
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The Strategic National Stockpile (SNS)



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The Strategic National Stockpile (SNS)



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The Strategic National Stockpile (SNS)

- LTV 1200: ~14,000
 - Home care/transport vent
 - Pediatric friendly
 - VC, PC and PS
 - PEEP compensated
 - Bias flow of 10L/min
 - Will waste gas if that becomes a concern
 - Can be turned off
- Training videos on all three are available at
 - www.AARC.org
 - www.PSRC.net



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The Strategic National Stockpile (SNS)

- All are maintained by the SNS
 - Battery charging
 - Routine maintenance
- All are gas efficient- Low gas consumption
- Circuits are not interchangeable*
- Do they work?
 - 1200: A/C: 35, Vt: 500, PEEP: 20, PIP: 63, FiO₂: 100, C_I:1.2ml/H₂O
 - 754: A/C: 35, Vt: 500, PEEP: 20, PIP: 63, FiO₂: 100, C_I:1.2ml/H₂O
 - 754: A/C: 50, Vt: 250, PEEP: 20, PIP: 42, FiO₂: 100, C_I:1.2ml/H₂O



<https://www.aarc.org/webcasts/mass-casualty-ventilation-and-the-strategic-national-stockpile/>

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The Strategic National Stockpile (SNS)

- Other respiratory supplies are in the SNS
 - Hand held nebulizers (T-tube and aerosol masks)
 - Cure-it-all (Albuterol)
 - Suction machines
 - Suction catheters and Yankauers
 - O₂ cannulas/masks
 - Airways
 - ETT, oro-/nasopharyngeal airways
 - Laryngoscopes
 - N95 masks and other PPE
 - Resupply kits

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The Strategic National Stockpile (SNS)

- What RT supplies are **NOT** in the SNS
 - ▣ Oxygen concentrators
 - ▣ Oxygen cylinders
 - ▣ Medical air compressors
- Cost to HCF's for SNS supplies?
 - ▣ \$0
- SNS will reclaim ventilators after use
 - ▣ HCF has to clean them

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The Strategic National Stockpile (SNS)

- Dissemination
 - ▣ Requests for the SNS come from the State
 - ▣ HCF's do not directly request them
 - ▣ Order of request
 1. HCF emergency management coordinator
 2. Regional office
 - ▣ County Emergency Management Coordinator
 - ▣ Check county website for who this is
 3. State Coordinator
 4. US Department of Health and Human Services



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The Strategic National Stockpile (SNS)

□ Dissemination (cont.)

- DHHS disseminates ventilators based on need
 - NO hoarding
 - Every state doesn't get the same amount (pro rata)
 - DHHS decides who gets them and how many
- The State decides where the ventilators are delivered
- You can't pick or choose which ones you get
 - Depends on what ventilators are in the closest stockpile
- One ventilator is not deployed over another
- 5-36 hour time to deploy



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The Strategic National Stockpile (SNS)

□ COVID-19 response as of 31 Mar 2020

- Ventilators distributed to the following states:
 - NY: 4400
 - IL: 450
 - MI: 400
 - NJ: 300
 - LA: 150
 - CT: 50
- 10,000 being held in reserve
- 333 tons of cargo shipped to support state's PPE needs

Sources: Data per White House Corona Virus Press Briefing 31 March 2020
 DHHS website: <https://www.phe.gov/about/sns/Pages/responses.aspx>

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Ventilator Triage Protocols

- Designed to provide guidance for making triage decisions
 - ▣ Up to your HCF to implement
- Assumes the following
 - ▣ Implemented during the initial days to weeks of an influenza pandemic
 - ▣ The critical care system is overwhelmed
 - ▣ Protocol applies to ALL patients
 - Not just those with the contagion
 - ▣ People still have MI's, trauma, seasonal flu, etc.
 - All patients must share a single pool of resources

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Ventilator Triage Protocols

- Based on Sequential Organ Failure Assessment (SOFA) score
 - ▣ Mortality prediction score
 - ▣ Based on the degree of dysfunction of six organ systems
 - Respiratory
 - Coagulation
 - Liver
 - Cardiovascular
 - Central Nervous System
 - Renal
 - ▣ The higher the score, the higher the predicted mortality

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Ventilator Triage Protocols

Table 1
The Sequential Organ Failure Assessment (SOFA) score

SOFA score	1	2	3	4
Respiration^b				
PaO ₂ /FIO ₂ (mm Hg)	<400	<300	<220	<100
SAO ₂ /FIO ₂	221-301	143-220	67-141	<67
Coagulation				
Platelets × 10 ³ mm ³	<150	<100	<50	<20
Liver				
Bilirubin (mg dL)	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular^b				
Hypotension	MAP <70	Dopamine ≤5 or dobutamine (att)	Dopamine >5 or norepinephrine ≤0.1	Dopamine >15 or norepinephrine >0.1
CNS				
Glasgow Coma Score	13-14	10-12	6-9	≤6
Renal				
Creatinine (mg dL) or urine output (mL/d)	1.2-1.9	2.0-3.4	3.5-4.9 or <500	>5.0 or <200

MAP, mean arterial pressure; CNS, central nervous system; SaO₂, peripheral arterial oxygen saturation.

^aPaO₂/FIO₂ ratio was used preferentially. If not available, the SaO₂/FIO₂ ratio was used.

^bVasopressor medications administered for at least 1 hr (dopamine and norepinephrine μg/kg/min).

Jones AE, Trzeciak S, Kline JA. The Sequential Organ Failure Assessment score for predicting outcome in patients with severe sepsis and evidence of hypoperfusion at the time of emergency department presentation. *Crit Care Med.* 2009;37(5):1649–1654. doi:10.1097/CCM.0b013e31819def97

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Ventilator Triage Protocols

- “Development of a Triage Protocol for Critical Care During an Influenza Pandemic”¹
 - ▣ Developed in Canada in 2004 in response to SARS-CoV-1
 - ▣ Comprised of the following:
 - Inclusion criteria
 - Exclusion criteria
 - Minimum qualifications for survival
 - Prioritization tool

1. Christian, Michael D et al, Development of a Triage Protocol for Critical Care During an Influenza Pandemic. *CMAJ* 2006; 175(11) 1377-1381

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Ventilator Triage Protocols

- “Development of a Triage Protocol for Critical Care During an Influenza Pandemic”¹
 - Inclusion Criteria (Patient must have one of the following)
 - Refractory hypoxemia
 - SpO₂ <90% on non-rebreather or FiO₂ > 0.85
 - Respiratory Acidosis (pH <7.2)
 - Clinical evidence of impending respiratory failure
 - Inability to protect or maintain airway

1. Christian, Michael D et al, Development of a Triage Protocol for Critical Care During an Influenza Pandemic. CMAJ 2006; 175(11) 1377-1381

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Ventilator Triage Protocols

- “Development of a Triage Protocol for Critical Care During an Influenza Pandemic”¹
 - Exclusion criteria
 - Severe trauma
 - Severe burns with any 2 of the following:
 - > age 60
 - >40% total body surface area affected
 - Inhalation injury
 - Cardiac arrest: unwitnessed, witnessed with unsuccessful resuscitation, or recurrent cardiac arrest
 - Severe cognitive impairment
 - Advanced untreatable neuromuscular disease
 - Metastatic malignant disease or irreversible immunocompromise

1. Christian, Michael D et al, Development of a Triage Protocol for Critical Care During an Influenza Pandemic. CMAJ 2006; 175(11) 1377-1381

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Ventilator Triage Protocols

- “Development of a Triage Protocol for Critical Care During an Influenza Pandemic”¹
 - Exclusion criteria (continued)
 - End-stage organ failure meeting the following criteria
 - Heart: Class III or IV heart failure
 - Lungs:
 - COPD with FEV1 of <25% predicted or PaO₂<55mmHg
 - Cystic Fibrosis with post-BD FEV1 of <30%
 - Pulmonary Fibrosis with VC or TLC <60%
 - Pulmonary hypertension with right atrial pressure >10mmHg
 - Age >85
 - Elective palliative surgery

1. Christian, Michael D et al, Development of a Triage Protocol for Critical Care During an Influenza Pandemic. CMAJ 2006; 175(11) 1377-1381

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Ventilator Triage Protocols

- “Development of a Triage Protocol for Critical Care During an Influenza Pandemic”¹
 - Minimum qualifications for survival
 - Reflects a ceiling on the amount of resources that can be expended on any one person
 - Rooted in approach exercised in war zones and refugee camps
 - Reassessment at 48 and 120 hours (Day 2 and 5)
 - Cut-off ceiling of a SOFA score of 11 or higher or any other exclusion criteria.

1. Christian, Michael D et al, Development of a Triage Protocol for Critical Care During an Influenza Pandemic. CMAJ 2006; 175(11) 1377-1381

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Ventilator Triage Protocols

□ “Development of a Triage Protocol for Critical Care During an Influenza Pandemic”¹

□ Minimum qualifications for survival (cont.)

- Attempts to identify at an early stage
 - Patients who are not improving
 - Patients who are likely to have a poor outcome
- Under normal conditions it can take days or weeks of intensive care before this poor outcome occurs
 - During a pandemic, several other patients could have had their lives saved during this time

1. Christian, Michael D et al, Development of a Triage Protocol for Critical Care During an Influenza Pandemic. CMAJ 2006; 175(11) 1377-1381

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Ventilator Triage Protocols

□ Prioritization tool

Triage code	Criteria	Action or priority
Blue	Exclusion criteria met or SOFA score > 11*	<ul style="list-style-type: none"> • Manage medically • Provide palliative care as needed • Discharge from critical care
Red	SOFA score ≤ 7 or single-organ failure	Highest priority
Yellow	SOFA score 8–11	Intermediate priority
Green	No significant organ failure	<ul style="list-style-type: none"> • Defer or discharge • Reassess as needed

Note: SOFA = Sequential Organ-Failure Assessment.

*If an exclusion criterion is met or the SOFA score is > 11 anytime from the initial assessment to 48 hours afterward, change the triage code to Blue and proceed as indicated.

Christian, Michael D et al, Development of a Triage Protocol for Critical Care During an Influenza Pandemic. CMAJ 2006; 175(11) 1377-1381

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Alternate Interventions

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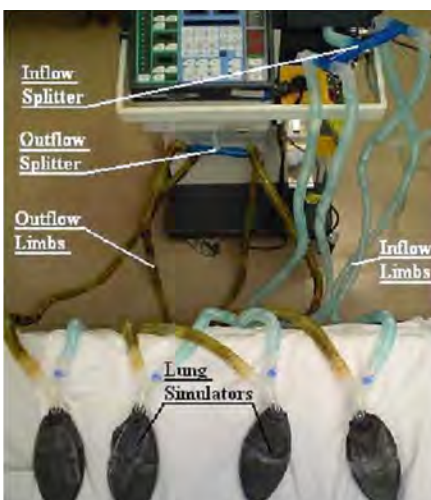
Non-Invasive Ventilation?

- ❑ Lack of efficacy and potential complications¹⁻⁴
 - ❑ Higher ventilating pressures
 - Gastric insufflation
 - ❑ Aerosol generation
- ❑ Intubation rates increase with ARDS severity⁵
- ❑ NIV failure rates increase with ARDS severity⁶
 - ❑ Predictors: Age, APACHE II, Comorbidities, severe ARDS

1. Ferrer AJRCCM 2003, 168:1438-44
 2. Keenan CCM 2004, 32:2516-2523
 3. Rana CCM 2006;10(3):R79
 4. Antonelli CCM 2007;35:18-25
 5. Thille, A.W., Contou, D., Fragnoli, C. et al. Non-invasive ventilation for acute hypoxemic respiratory failure: intubation rate and risk factors. Crit Care 17, R269 (2013). <https://doi.org/10.1186/cc13103>
 6. Jamoussi A, Bouker N, Ayed S, Merhebene T, Khelifi JB, Besbes M, Predictive factors for non-invasive ventilation failure during acute respiratory distress syndrome ERJ Open Research Feb 2020, 6 (suppl 4) 32; DOI: 10.1183/23120541.RFMVC-2020.32

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Multiple patients on one ventilator?



<https://onlinelibrary.wiley.com/doi/epdf/10.1197/j.aem.2006.05.009>

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Multiple patients on one ventilator?

- ❑ Splitters and adaptors used to ventilate 2 or 4 patients
- ❑ Originated as a bench study on test lungs
 - ❑ Sheep were further studied
- ❑ Used but not studied in humans
 - ❑ Mass casualty shooting in Las Vegas
- ❑ Must double or quadruple set V_t
- ❑ **MUST** have patients with same body habitus
- ❑ Never been tested in ARDS scenarios

<https://onlinelibrary.wiley.com/doi/epdf/10.1197/j.aem.2006.05.009>

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Multiple patients on one ventilator?

NO

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Multiple patients on one ventilator

- Joint statement compiled by the following:
 - The Society of Critical Care Medicine (SCCM)
 - American Association for Respiratory Care (AARC)
 - American Society of Anesthesiologists (ASA)
 - Anesthesia Patient Safety Foundation (APSF)
 - American Association of Critical-Care Nurses (AACN)
 - American College of Chest Physicians (CHEST)
- “The above-named organizations advise clinicians that sharing mechanical ventilators should not be attempted because it cannot be done safely with current equipment”

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Vortran Go2Vent

- ❑ Short term use
- ❑ Pressure cycled
- ❑ Constant flow
- ❑ Position sensitive
- ❑ Ranges
 - ▣ PIP: 10-45cmH₂O
 - ▣ PEEP: 1/5 of PIP (2-9cmH₂O)
 - ▣ RR: auto adjusting
 - ▣ FiO₂: 50% or 100%
 - ▣ 50cmH₂O pop-off valve



Vortran Go2Vent User guide: https://3ae9a7bb-a7ff-44f5-89b9-6a830b38c121.filesusr.com/ugd/a51c58_9dbe6b70c8ef47ac94f647bf1fe52f37.pdf

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Vortran Go2Vent

- ❑ Questionable efficacy in ARDS scenarios
- ❑ Uses a LOT of oxygen to power
 - ▣ 50psi at 40L/min will drain an H cylinder in 3 hours
- ❑ No alarms
 - ▣ Must buy separately
 - Monitors apnea only
- ❑ Variable performance



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Vortran Go2Vent

- Passive lung model study of 8 combinations at 20 or 40L/min
 - ▣ 4 compliances (14, 28, 46, and 63 mL/cm H₂O)
 - ▣ 2 resistances (20 and 42 cm H₂O/L/s).
- Parameters measured
 - ▣ Tidal volume, RR, i-time, e-time, PIP, intrinsic PEEP
- Calculated
 - ▣ (T_i/T_{tot}), minute ventilation, minute alveolar ventilation, and P_{aCO_2}

Mark D Babic, Robert L Chatburn, James K Stoller, Laboratory Evaluation of the Vortran Automatic Resuscitator Model RTM; Respiratory Care Dec 2007, 52 (12) 1718-1727

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Vortran Go2Vent

- Results assuming the model lung represented a 68-kg adult
 - ▣ The measured VT: 1.7 mL/kg to 16.7 mL/kg
 - ▣ T_i/T_{tot} was greatly affected by the input flow
 - At 40 L/min the average T_i/T_{tot} was 30%
 - At 20 L/min T_i/T_{tot} was 52%
 - ▣ As the load increased, V_t decreased and frequency increased
 - At 40L/min
 - ▣ Minute ventilation ranged from 5.2 L/min to 11.3 L/min
 - ▣ Minute alveolar ventilation ranged from zero to 9.8 L/min
 - ▣ Calculated P_{aCO_2} ranged from 100 mm Hg to 16 mm Hg

Mark D Babic, Robert L Chatburn, James K Stoller, Laboratory Evaluation of the Vortran Automatic Resuscitator Model RTM; Respiratory Care Dec 2007, 52 (12) 1718-1727

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Areas of Concern for Respiratory Therapists

- Three S's
 - Space
 - Hospital
 - Department
 - Staff
 - Absenteeism
 - Accommodations
 - Expertise
 - Stuff
 - Equipment storage
 - Procuring

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Space

- Increasing critical care capacity
 - Disaster preparedness committee in HCF needs to plan for this
 - Managers: You **MUST** have a seat in your HCF's disaster planning sessions
 - Conversion of 'regular' rooms to ICU beds
 - OR's into ICU rooms
 - Cancellation of elective procedures
- Space for staff that are staying in HCF
 - Fear of going home
 - Showering facilities
 - Sleeping areas

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Space

- Close PFT lab for non-essential studies (Per ATS)
 - Only for pre-op screens, 'emergent' PFT's for asthma, etc.
 - Infection control for PFT machines
 - Infection control for staff
 - Gowns, masks, gloves
 - Is this *really* the best use of PPE at this time?
 - Use the lab as sleeping quarters for staff?
- Storage of extra equipment
 - Where are you going to put it?

<https://www.thoracic.org/professionals/clinical-resources/disease-related-resources/novel-coronavirus.php>

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Staff

- Managers
 - Communication
 - Inform your staff of your HCF's policies and updates
 - Daily status reports (per shift)
 - Triage your staff
 - Identify those that are most familiar with ARDS scenarios
 - ACCS credential
 - Assign them to critical care areas with COVID-19
 - Rotate shift assignments
 - Don't have all of them on one shift

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Staff

□ Managers

□ In-services on

- ARDS management
 - Attempt to get everyone up to speed
- SNS ventilator videos
 - AARC & PSRC websites
- Proper use of PPE
 - Gloves, Gown, masks
 - Fit testing
 - Powered Air Purifying Respirator (PAPR)



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Staff

□ Plan for job absenteeism

- Expect 40-50% absence
 - RT illness from COVID-19
 - Family reasons
 - Care of infected family
 - Child care
 - Immunocompromised family
 - Cowardice
- HR policy and enforcement?
- Plan scheduling contingencies ahead of time
 - Staff staying at the HCF?
- Schedule rotation

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Staff

□ Augmented job responsibilities

- Put your RT's managing the vents and more advanced critical care
 - While some are better than others, we have all had mechanical ventilation in school
- ECMO monitoring
 - Started in some hospitals
 - Degree of overlap
 - Familiarity with A&P, oxygenation goals, monitoring, etc.

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Staff

□ Augmented job responsibilities

- Convert HHN to pMDI's/DPI's for suspected COVID-19 pts
 - HHN aerosol generator
 - 1-5µm particle size
 - Generates patient cough
- RN's, LPN's, CNA's, MA's for 'routine care'
 - HHN's Inhalers, O2 titrations/checks, etc.

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Staff

□ Project XTREME

- “Cross-training Respiratory Extenders for Medical Emergencies”
- DVD included in all SNS vent kits
- Developed in 2006 in response to avian flu
- Provides ‘just in time’ training to non-RT healthcare professionals for RT jobs
 - NP/PA
 - Non-critical care RN’s
 - Physical Therapists
- Not designed to make everyone an RT

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Staff

□ Project XTREME

- Infection Control (7:42)
- Terms and Definitions (8:54)
- Manual ventilation (7:00)
- Mechanical ventilation (16:00)
 - Reviews ventilators in SNS (LP-10 and 754)
 - LTV1200 not included
- Airway maintenance (7:00)
- Suctioning (5:30)

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Staff

- Project XTREME in PA
 - Moot point
 - Pennsylvania licensure requirements
 - NO exceptions for emergencies/disasters
 - Authors' own study
 - My own opinion***
 - May have application dependent on your healthcare facility
 - Use with caution

Table 4. Competency Ratings: Training DVD and Lab Scores by Profession

	Second-Year RT Student	General Internist	Non-critical Care Nurse	Physician Assistant	Nurse Practitioner	Veterinarian	Physical Therapist
DVD Question-Based Competency Test Scores							
Infection control	95%	100%	94%	95%	100%	99%	95%
Terms and definitions	99%	100%	89%	95%	90%	97%	87%
Manual ventilation	93%	95%	92%	90%	95%	94%	86%
Mechanical ventilation	89%	98%	86%	87%	83%	89%	87%
Airway maintenance	97%	93%	86%	85%	95%	97%	85%
Airway suctioning	96%	98%	89%	100%	100%	94%	90%

<https://www.aarc.org/wp-content/uploads/2014/11/01-project-xtreme-model-for-health-professionals.pdf>

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Staff

- Down time
 - Avoid staff burnout
- Cavalry?
 - PSRC initiative
 - Teachers
 - Students
 - Retirees
 - Out of state practitioners
 - Relaxed rules on licensure for out of state RTs practicing in PA

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Stuff

- Inventory your department's equipment
 - Mechanical ventilators
 - NIV
 - Disposables
 - Circuits for the above
 - Oxygen
 - O2 delivery devices
 - Suction catheters
- Plan for a significant increase in demand/usage
 - 20%? 50%? 100%?

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Stuff

- Equipment
 - YOYO 72hrs
 - Deliveries
 - Plan for contingencies for resupply
- Oxygen vendor capabilities
 - Liquid Oxygen, cylinders
 - Ensure they can keep up with surge in demand
- Have area managers on speed dial for mutual aid
 - What equipment are your neighbors using?
 - Interoperability?



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Stuff

- Ventilators
 - Orders that manufacturers cannot fill
 - Triage the HCF's and SNS's
 - 'Sicker' patients get the advanced ones
- PPE
 - Masks
 - N95
 - PAPR
 - Training & Disinfection
- School donations



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Respiratory Therapist's Response

All RTs....
Look in the mirror



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Respiratory Therapist's Response

□ All RTs

- Look in the mirror
- Critically assess yourself
 - Are you able to operate in the following conditions?
 - Do you **know** the operation, maintenance and nuances of the mechanical ventilators in your facility?
 - Could you manage a mechanically ventilated patient independently?
 - Could you manage a mechanically ventilated patient in an ARDS scenario?
 - Do you know how to set-up and manage a patient in prone positioning?



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Respiratory Therapist's Response

- If you answered 'no' to any of the above, NOW is the time to get up to speed
 - You are going to be relied on to make critical decisions under circumstances you may not be used to
- Review policies within hospital
- Review PPE policies
 - Donning and doffing PPE
 - Proper order
 - How to take off your mask, etc.
- Review, refresh, re-familiarize pathophysiology of ARDS
 - How to manage/treat patients with refractory hypoxemia
 - ECMO
 - Prone ventilation
- Know your limitations



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Respiratory Therapist's Response

- Mention of 'respiratory therapist' and 'mechanical ventilator' in the media recently?
- *"It shows the depth and dedication of the American people to the healthcare providers, because they can see the strain this puts on every nurse, doctor and respiratory therapist, pharmacist and lab technician that are working together to stem the tide of unrelenting sick people coming to their doors.*
 - ▣ Dr. Deborah Birx, 31 Mar 2020
- If you want respect, now is the time to earn it



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Conclusion

- Thank you
 - ▣ For what you do
 - ▣ For the sacrifices that you are making
 - ▣ For doing your job to the best of your ability
 - ▣ For your dedication to your facility, your colleagues and your patients
- We will get through this
- Wash your hands and Be Prepared...

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Questions?



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