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DR. MARY DALE PETERSON:

I'd like to invite, uh, Dr. Loeb and Dr. Feldman to give their presentation on converting anesthesia gas machines to ICU ventilators, the do's and don'ts of that. Thank you.

DR. JEFF FELDMAN:

Thank you. Dr. Peterson. I do want to just emphasize uh, what a privilege I feel it is to be a part of the anesthesiology community during this time. The level of engagement, the quality of the questions, the thoughtfulness on practice has been remarkable. And, um, so it's a privilege to be with everyone here and I, I hope that the information that we provide and empowers everyone, and I'm sure it will, to make the best decisions they possibly can at the bedside.

What we're going to focus on for the next few minutes is this concept of using anesthesia machines as ICU ventilators. So, why is this important? Well, we know that patients are going to, uh, die from respiratory failure because of an insufficient supply of ICU ventilators. And we also know that anesthesia machines are available. And for the most part they have ventilators that are entirely capable of keeping people alive and treating respiratory failure. And we also know that anesthesia professionals are, um, have the skills and ability to put these machines into service and ensure the safe and effective function.

Our purpose tonight is not to solve the entire problem of all the ventilator shortages but to emphasize that no patient should die from respiratory failure if there's an anesthesia machine available that could save them. And we are the ones that know where those machines are and we know how to use them. So, um, what are some of the facilitating factors that make this possible? So one is canceled elective procedures and that makes machines, disposables and personnel available to put the machines and the ventilators into the service of the patients that need them. They're also been some important facilitating steps that have happened over the last week or so. One of the first, uh, was the FDA statement that anesthesia machines can be, are now approved for the, this off-label use. So anesthesia machines are not typically labeled or permitted for use as long-term ventilators, but under, um, I think in part because of Dr. Alexis Carmer, who's one of ours at the FDA, this statement was issued early on and made it possible for the manufactures then to begin to support that. Shortly after the FDA statement, the

manufacturers issued specific guides on off-label use of their devices, and prior to the FDA statement, they would not have been able to do that.

So you can now find guidance from each of the manufacturers specifically discussing how you can use their devices for this off-label purpose. For any of you who may have tried to read some manuals on machines, you might expect that some of this guidance is not entirely user-friendly, although there is great information there and I certainly recommended that you take a look at it.

For that reason, um, we have put together reference information that was published today on the ASA website to help with the process of purposing anesthesia machines as ICU ventilators. So there are two documents that are available now on the ASA website. Uh, the first one is our longer reference, it's about six or seven pages, on, uh, all the things you need to think about in purposing your anesthesia machines as ICU ventilators. We've also created a one-page, two-sided document that's intended to be a bedside quick reference that has setup and monitoring instructions to use the anesthesia machine in that fashion, and I'll come back to a couple of details about that in a few minutes.

So there are some barriers to doing this successfully and a lot of the efforts over the last week or so have been to figuring out how to remove those barriers. One of the most important ones is getting machines to the patients or the patients to the machines. Uh, so there are a lot of machines often in many areas but they're not all in hospitals. In fact, probably less, a little bit less than half of the available machines are not in hospitals. And so an effort to find those machines and make sure that they're deployed where they're needed, uh, it's going to be an important part of this. Ensuring access to adequate disposables, um, breathing circuits and things that are for the machines may be more readily available cuz some of that can be shared with IC ventilators. Um, CO2 absorbents are unique to the machines. Um, my hope is that with the decline in elective surgery we'll have access, fairly ready access, to their supplies and to date have not been able to determine that there's a shortage but again, we may have distribution problems as one place heats up and there's a lot of need for materials and absorbance.

Protecting the machines from contamination, it's very important to keep that focus as we deploy these machines because as one patient hopefully survives and that machine is no longer needed for that patient, it can be deployed very quickly to the next patient. And so there's specific guidance on the APSF website on what you can do to protect the machine and have it ready for the next patient. Um, the good news is that if you use viral filters effectively, um, the machine is protected and you don't have to go through extensive decontamination procedures in order to deploy it again.

Other barriers, patient monitoring and documentation in many cases, we're accustomed to having our machines network to and electronic medical record where data is automatically, uh, recorded and we're standing by the machine to be able to monitor the patients. That's going to become a little bit more difficult as we try to address that, um, in the guidance as best we can. Um, and then knowledge about how to effectively use the devices in the setting of respiratory failure, patients with advanced respiratory disease. Most of these machines have very capable ventilators, but there are some differences. We've provided some guidance in the modes and the specifications.

In, in the reference material you will find contact information for the companies and I've spoken with all the major manufacturers and they are ready, um, to try to support us as best they can. Um, and then of course not every anesthesia provider is trained in ICU, or hasn't been in an ICU for a while. So comfort with the long-term management of these patients is also something that's being addressed.

So some overriding recommendations, um, we recommend that when these machines are deployed that an anesthesia professional be immediately available 24/7 to manage and monitor the anesthesia ventilator and assist with the respiratory care. At this time, we're discouraging the use of inhaled anesthetics, um, because of the physiologic consequences of those drugs in, in a critically ill patient, um, particularly if they are personnel immediately at the bedside to use them. And so we recommend that the vaporizers be either removed or empty when the machine is coming into service.

Um, I would encourage everyone to read the guidance that was posted today. There's lots of in, good information, links to resources that you may need, download the quick reference guide, modify it as you need it for your local situation and prepare in advance. Find out where the machines are, where you will use them and how you will staff it.

Um, so at this point I'm going, um, to pass this on to dr. Loeb, who has some even more specific guidance for you on, on, how to use the machines effectively.

**DR. ROBERT LOEB:**

Thank you Jeff. Um, so I'm going to get into some of the nuts and bolts of what's been published. Um, in terms of key considerations, one of the first things to recognize that you need be very careful to, with the scavenging system. Uh, anesthesia machines have scavenging systems for waste gases to collect waste gases. That's not necessary, if no anesthetics are being used and you're in an ICU.

We are, as Jeff said, not recommending, uh, delivering anesthetics that would require waste gas, uh, scavenging, and depending how you interpret things, a constant presence of an anesthesia uh, provider. Um, we all know that especially at lower flows

of inspired oxygen, uh, the patient gets can be lower than the set oxygen concentration. That is not the way ICU ventilators work and so that is one of the reasons why, uh, respiratory therapists should not just be given these machines, and, and sort of, taught to turn the dials. Uh, we need to be there.

There are a lot of long term use issues that uh, we tried to sort of foresee what would happen, you know, what the, what the issues would be but I don't have any, uh, real experience providing anesthesia for longer than 12 hours or so with uh, one of these anesthesia machine and I know what happens during that time period. We're talking much longer.

But in the ICU patient, you do want to provide humidification, um, and as you know, all ICU ventilators have active humidifiers for that purpose. Anesthesia machines are not. As you know from doing long cases, there, uh, will be the accumulation of condensed water within the, uh, breathing circuit within the tubing. And so you, it's important to just recognize that, and be able to keep, keep up with it and know how to manage it. Uh, in some places, uh, Italy for example, there have been shortages of compressed oxygen, and, uh, I'll talk a bit later about how anesthesia machines, uh, may use significantly more oxygen than an ICU ventilator. If that's a problem, things that could be done, uh, to, to help with that.

We have filters on our anesthesia machines, more than, uh, typically we were using before, uh, COVID came along, the recommendations by the APSF in that regard. But in the long-term you're going to need to have, uh, procedures for changing filters, recognizing uh, when filters become obstructed, and, and fixing those problem. Anesthesia machines are made to be tested every day. Uh, you all know you come in in the morning and start your machine and do, uh, uh, calibrate things, and it does a self-test, and you check things. Um, you're gonna need to be able to modify your procedures on how to go with the need for recalibrating self-tests. It's gonna be important, just like when we use these in the, uh, OR to do accurate pre-use tests, and self-tests and to check the compliance of the breathing circuit. Uh, especially in intensive care patients, uh, that additional compliance can really affect the, the delivery of tidal volume that they get. Um, and can affect the tidal volume measurements that are made by the machine. So, it's very important to do that and then not change the configuration of the breathing circuit after that's done.

It's also very important to obtain baseline flow and pressure tracings and flow volume loops when they're available. Again, because they can point to, uh, problems with water in the breathing circuit, obstructions of, uh, filters, etc. And, very important, uh, to have a manual resuscitator available with a filter on it, um because there are gonna be times when we know that you're gonna need to ventilate the patient by hand for a little while.

For instance, while doing a safe test, changing filters, uh, things like that. So, very important, just like in the OR.

Gonna just, uh, talk briefly about scavenger systems. Um, scavenger systems, uh, there are two basic types. Open scavenger systems, uh you see the, the canisters with the holes in the top. Uh, gas flows in from the APL valve and the ventilator relief valve and then gets sucked out into an active disposal system. But in the ICU, you may not, uh, be able to hook up that active component. In the OR we have what's called a, a waste anesthesia gas disposal outlet (WAGD). In ICUs they don't have that. They have suction outlets, uh, and the tubing may not be compatible. And, um, so there may be no way to hook up suction.

A closed scavenger system, it has a reservoir bag, it's on the reservoir bag that sits, usually, down on the side of the machine and if it does not have active suction going to it. It depends on valves to open to let the gas coming out of the breathing circuit into the room. It's very important that if you have one of these scavenger systems, that you remove the reservoir bag. Just take it off and leave it off, because if you leave it on especially in newer model anesthesia machines, there may be significant back pressure causing levels of PEEP of 14 cm or higher. So that's a very important consideration and something that could be a problem the right off when you start using it if you haven't dealt with it.

Uh, I did speak about humidification. It's needed in ICU patients and for the long-term to prevent mucus plugging, to prevent the effects on respiratory epithelium, um, but there are problems with humidification. Uh, it causes condensation within the tubing which then, uh, can cause, uh, obstructions to flow, um, and it causes, and there can be con, condensation in hidden parts of the, uh, breathing circuit and inside of the ventilator that can impair, uh, how the, how the machine works. The condensation can affect, uh, sensors, especially some flow sensors so that they totally fail or give erroneous readings. Uh, it can affect the valves, especially the one-way valves, uni-directional valves, and can cause them to stick, or stick open. Uh, it can have a affects on the absorbent making it not work as well as it gets, if it gets very wet and even the potential for electrical failure of components and failure of the machine.

So, it is very important not to let the machine, uh, get too wet. Um, our, uh, uh, recommendations are to discourage active humidification because that really does put a lot of humidity into the breathing circuit. Encourage the use of a heat, and, um moisture exchange unit and filter at the airway, uh, which will provide a reasonable level of humidification, uh, uh, especially at lower fresh gas flows, it'll provide a level of humidification provided by active humidifiers. And if condensation becomes a problem, to increase fresh gas flow til you find a happy medium for the upsides and downsides but I'll talk to you in a moment about, with uh, fresh gas flow.

It's also very important if you have spirometry to monitor the, uh, spirometry for signs of obstruction that filter at the airway where there's no, uh, pressure transducer downstream of that filter, so you really have to look at what happens with exhalation, some subtle signs to see if it's becoming obstructed. Uh, signs on spirometry and pressure tracings and things, of condensed water in the tubing causing bubbling and oscillations and signs if there's a leak around the endotracheal tube, which you definitely want to prevent in these uh, COVID positive, uh, patients because it, uh, means that they are aerosol, aerosolizing as that leak occurs around the endotracheal tube.

So, um oxygen consumption, uh, to ventilators, uh, nominally is the minute ventilation times the amount, the inspired oxygen concentration, so if you have, an, uh, 80% of FIO<sub>2</sub>, then, uh, it's 8% of the minute ventilation is the amount of oxygen that that ventilator is using. With a Bellows anesthesia machine, most of them are driven, the drive gas is oxygen, and so just to make the ventilator go up and down, the bellows go up and down, they use, approximately the entire minute ventilation of oxygen and then additionally, the amount of oxygen dialed on, on the flow meter, which would be your fresh gas flow, which would be your fresh gas flow times the amount of uh, FIO<sub>2</sub>, FIO<sub>2</sub> concentration.

So, nominally, that can take you up to uh, 12 liters per minute or more of oxygen being used compared to an ICU ventilator that might be down around 5 liters per minute at, at less than 100% FIO<sub>2</sub>. So, significantly more oxygen consumption. If that's a problem, worries, but with a lot of ventilators going on in the hospital, uh, this is just a compound a problem, uh, of not enough oxygen supply. We have talked with the makers of the anesthesia machine that have most ventilators in the US, and uh, most of them can change the plumbing inside the machine to use compressed air as a drive gas. It usually takes less than an hour by a trained technician, and is something that you should consider doing before you put a Bellows ventilator into service if you have time or have a, a plan for doing that if oxygen, uh, levels become low.

Once you've done that, the Bellows anesthesia machine usually gets pretty stingy and it's oxygen use. It uses the fresh gas flow times the oxygen concentration and if you go to low fresh gas flows, it can be as low as even somebody receiving fair amounts of supplemental oxygen, uh, under 2 liters a minutes of oxygen being used.

Piston and turbine, uh, powered anesthesia machines, uh, in the US just made by Draeger at this point, um, consume, uh, electricity, electrical power, to, to power ventilation. They do not consume any additional oxygen to uh, ventilate the patient above the fresh gas flow times the inspired oxygen concentration, and for that reason work better in a situation where you need to conserve uh, oxygen. It leads you to consider what sort of, uh, fresh gas flows you're going to use once you get down to this situation where, where you're uh, uh, uh thinking about it.

Using a low fresh gas flow, uh, conserves compressed gasses, may not be an issue. It humidifies the breathing circuit extremely well, in fact, maybe a little bit too well, that it means that the patient's gasses that they will be breathing will be well humidified, especially with that HME filter at the airway. It does consume CO<sub>2</sub> ... which will need to be changed depending on your flows, uh once or two more times per day, and it will increase the amount of condensate, uh, that builds up.

And so, you know, we're sort of used to running flows at, uh, one to two liters per minute. In this situation, we're not, uh, conserving anesthesia gases. We can probably liberalize it, uh, very easily and turn up the flows up, uh, a degree. Going, uh, higher with the fresh gas flows provides some humidification, but it, it may not be enough. The HME filter at the airway becomes important, there's less absorbent consumption and less condensate. And that's probably where you're going to want to be in the moderate fresh gas flow range. Turning on really high fresh gas flow is above the patient's minute ventilation, uh, is probably not a good idea. It's wasteful of gases. Uh, it will lead to an adequate within your breathing circuit, which of the problems with long-term, uh, ventilation of these patients. It is important, if you do use high flows, and you're not really using your absorbent, to still leave it in place. Don't take the absorbent out, don't, uh, take the, uh, you know, put in an empty canister. It's gonna change, uh, how the machine works. Just leave it all in place and used higher.

If there's is no condensate problem, unless with you add fresh gas flows and unless you add an active humidifier and, uh, it's important to know, that when you start turning the fresh gas flows up above 10 liters per minute in some anesthesia machines, it starts interfering with, uh, especially the expiratory portion, of uh, ventilation because, uh gasses can't, uh, get out as well, so.

I'm gonna turn it back over to, uh, Jeff.

DR. JEFF FELDMAN:

Thanks, Rich, I just have a couple of other comments and will end this part of the presentation. Just one thing to emphasize with regard to fresh gas flows, the manufacturer's guidance, depending on which one you read, particularly Draeger for example, recommends fairly high gas flows well above minute ventilation. Um, I believe their intention is to try to eliminate all humidity in the circuit and not have to worry about changing CO<sub>2</sub> absorbents. We're not recommending that. We believe that anesthesia professionals know how to use the machines and that the advantages of running lower flows to maintain humidity and reduce the, um, reduce the oxygen consumption, um, is of value. Um, you need to make a decision, individual decision, in your location, obviously. If you run out of CO<sub>2</sub> absorbents, you're going to still need a ventilator, you're

gonna need to run higher flows In order to do that safely, and those flows are going to need to exceed minute ventilation.

The last point that we wanted to make is what we would recommend for monitoring the function of the machine at intervals to make sure that it's continuing to function safely and effectively and the motivation behind these recommendations are a couple, a couple-fold. One is, the machines are not intended to be used for, um certainly, rarely, many, many, hours, but certainly not many, many, days. And so there are things to think about if you're going to use them in that fashion. They should work well as long as they're monitored appropriately. Um, the monitoring schedule is on the back of the quick reference guide which we published. And there's recommendations, um, for things to do at different intervals. Um, I won't go through all the details. It's described clearly in the document, um, but you'll see, for example, at hourly intervals we recommend looking for humidity and secretions in filters in the water trap, um, because that's one of the things that over time will become problematic for sure.

There's also a recommendation every 4 hours to increase the fresh gas flow to minute ventilation or above for 15 minutes. The intention of that is to dry the machine. We don't have, um, clear data to, for the duration that we've recommended but we're not using anesthetic agents and so you're not wasting a lot of anesthetic agents and we think that should get rid of most of the humidity, but you may have to modify that, um, based on your own observations.

And the last thing, just a couple of words about the self-test. Um, so the machines are designed typically to have a, a test done every 24 hours. And in many cases that's a power off to power-on self-test. You know, have you, I don't know if you've ever had to reboot your computer or turn it off and turn it on but there are computers underlying these machines, and so ideally you will cycle power at, um, 24 hour interval, and you'll need to have obviously a way of ventilating patients in between.

So hopefully these points have been helpful. Uh, the documentation that we provided go into these issues in much better detail, or much more detail and, and we hope that they will be helpful for you.

DR. JOSEPH SZOKOL:

Thank you, Dr. Feldman and Dr. Loeb for two outstanding presentations. Before we move on to the next speaker, we have a, a couple questions, and the first one is directed to Dr. Loeb. Who are the stakeholders at my facility that I should engage with the maintenance of anesthesia machines and their use in the Intensive Care Unit?

DR. LOEB:

OK, so, um, what it sounds like your asking is whether, uh, anesthesia professionals are going to be needed, uh, to provide, uh, coverage of these machines. Uh, we believe the answer is yes, that there should be somebody immediately available, really at best, uh, rounding on these machines once per hour if there's a lot of them in use. Um, and that if inhaled anesthetics are used to be really oughta consider having somebody, uh, present, uh, during the entire time. So, um, depending on, uh, which side of the coin you look at, that could be good for anesthesia professionals or a burden on anesthesia professionals. But we do believe that, uh, uh, respiratory therapists are not, are not trained in the use of these machines. They are different. The breathing circuit, rebreathing circuit is different, uh, alarms are different, so, uh, there should be somebody who is experienced in using the machine to be of assistance.

DR. JOSEPH SZOKOL:

Thank you Dr. Loeb. The next question is to Dr. Feldman and the recommendation is not to use an anesthesia machine or ventilator for two patients. What is the specifically is behind that non-recommendation?

DR. JEFF FELDMAN:

So uh, I think that the primary consideration, there a couple of primary considerations. So, one is, uh, that patients will be ventilated differentially based upon their underlying lung mechanics. And so patient, the patient that has the more compliant lungs will get much more of the breath than the patient with the less compliant lungs. Um, you may be able to find ventilation strategies to mitigate that to some extent, but this is going to be a changing physiologic scenario that's going to evolve over time. And the other major complication is the inability to monitor the individual patients effectively. So the ventilator gives you information for what's happening downstream. It's typically thinking there's one patient. Now, there's two so the monitored information on the ventilator is going to be very unreliable and it's going to be few facilities that will have the equipment to place individual respiratory monitors on each patient. Um, when I envisioned this scenario, um, tried to envision logistics of this scenario with a ventilator and tubes going to more than one patient, and now one patient's desaturating, now I've disconnected that patient. The ventilator is continuing to deliver gas to both sets of tubing while I'm trying to rescue that desaturating patient, and, um, on balance, I think a it's logistical challenge, and it's potentially unsafe because of our inability to monitor the differential effects on the ventilator on each patient. I hope it never has to happen.

DR. RICHARD LOEB:

That, that is why we did this work and people are doing a lot of work for alternative ventilators that can be used. I think it, it, really there are, are gonna be better things,

better solutions, um, even, even a, a not very sophisticated ventilator, one for each patient is a better solution.

DR. JOSEPH SZOKOL:

Thank you Dr. Loeb and Dr. Feldman. Our next presentation is by Dr. George Williams who the Chair of the Committee on Critical Care Management. Dr. Williams, will be discussing considerations when converting ORs to ICUs in collaboration with critical care teams. Dr. Williams...

DR. GEORGE WILLIAMS:

Thank you very much. And thank you president Peterson in this distinguished panel for the opportunity to come and share with you today. Um, and I'm here on behalf of the Committee on Critical Care Medicine as has already been stated. I don't have any financials disclosures, um, at all, so we'll discard that. And we will immediately get to the topic that we're discussing which is fundamentally, the functional um, execution of disaster care. And in order to facilitate disaster care, is very important for everyone in the team that suddenly finds themselves to be, um, intensivists when the day before they were general anesthesiologists, or anesthesiology care team members, is to be extremely flexible. In order for a system like this to work, um, it has to involve a lot of moving parts and a lot of adaptive behaviors in terms of locations of practice, in terms of the types of patients that we have, meaning that while there is a COVID outbreak, um, there could or could pandemic there could be a requests for the anesthesia care team to suddenly care for a COPD exacerbation or someone who had a trauma. So it's important to remember that flexibility is very, impor, very, very key to the management of this particular type of service.

Any time someone's in the ICU, it's a team sport. Um, we do have an attending physician. We have a nice routing team, but it's important member that in the ICU, much like the OR, everyone's input is extremely important. The respiratory therapist's perspective, the nurse's perspective, in, even the person that a may have examined a patient that morning's perspective. All that is very important and should be incorporated into an anesthesia, or in this case, a critical-care, plan. And so this really leads us to make sure that we appreciate everyone's limits and expertise. So, um for example, our bedside nurse is fantastic at knowing whether not a certain type of tube feed formula is being tolerated. The bedside nurse knows that the patient's sedation regimen is actually effective. It is very important not allow our singular assessment when we come to the bedside to, uh, supplant or surpass those, or people that been have working with the patient ostensibly. Furthermore, an ICU team tends to be big so you have social workers, you have respiratory therapists, occupational therapists, dietitians, pharmacists, an entire gamut of team members and that multidisciplinary aspect of

critical care is what has made critical care increasingly safe as the years have gone by. In addition it's important to remember that you can't over-communicate. In fact, over-communication is best. So if there is a concern or there's an issue that another service is helping you with, it's important to communicate a lot so that everyone's on the same page. The at one hour's different than the other hour in the ICU just like one minute is different another minute in the operating room in anesthesia, so it's very important to keep that over-communication perspective and goal in mind.

Now in terms of PPE and exposure, I won't go into great depth on this particular topic, but there are a couple of key points that we need to make sure that we emphasize. Memorizing how to don and doff PPE is not an effective or optimal way to make sure that you're protecting yourself, and by extension protecting your team members, your patients, your family. So donning and doffing PPE should include another partner or team member that's ensuring that, okay, you put on your gloves now, and you make sure that you sanitize before touching your mask, make sure you're strap is going on right. They are basically with you helping you to don and doff your PPE appropriately. Um, this is a very, very important difference compared to when we may, for example, scrub in for a surgical procedure where everyone is aware already of what is required or requested of them in order to facilitate their procedure technique. Furthermore, we want to make sure we mobilize, um, layout in leverage, leveredged technology. What this really means is that for example, if it's better for a bed to move in a different position so that you can see them better from a central station, do it. If it means taking IV pumps and putting them in the hallway with low bore or small caliber extensions in the IV so that you can adjust pumps efficiently without having to don and doff PPE to go in the room to adjust a propofol infusion or fentanyl infusion, for example, that's a very effective way to leverage technology, and many groups have been doing things like that.

We recognize that aerosolization procedures such as intubation, is one of the procedures that we can help facilitate increased droplet spread, so we want to avoid that. But furthermore, minimizing bronchoscopy is a very key thing and most COVID patients really don't have a great deal of mucus plugging. If it's indicated, sure, but realistically bronchoscopy is a fantastic way to make sure we mobilize droplets and that should be avoided unless absolutely indicated for the patient's care.

And then additionally, a very important rule many people that present on emergency service, say this three times - don't become a victim, don't become a victim, don't become a victim. So it may be very tempting to say this patient is suddenly hypotensive, I don't have time to don or doff my PPE. I'm going to run in the room and save that patient. That could end up making you a victim, which thereby doesn't help that patient. It doesn't help other patients that you are that precious resource to help facilitate ongoing care for. So, it's very important to keep that in mind and I want to thank my

colleague the medical co-director of our transient ICU, Dr. Alexander Escala for allowing me to take an image of him in his PPE on a case the other day. Now the path of physiology of COVID is very, very unique, it's highly transmissible. And this is more transmissible than most of the recent epidemics that we've seen with SARS or with H1N1 or MERS, and really one of the things that's a very important factor that is the Spy protein that, uh, COVID actually has.

The Spy protein is highly adaptive and changes a lot, there's lots of different morphologies on the same virus, on the same inoculum that can occur, and that is what facilitates COVID being so easily transmitted between people and easily transmitted, um, between different species. We do believe that COVID came from bats. Most of the genome is consistent with that in terms of previous epidemics, or for example, we look at, uh, SARS. 80% of the genome is similar to, um COVID and for MERS, 50% of genome is similar to COVID, but because of that modification in the Spy protein and an increased affinity for the Ace-2 receptor, the, the COVID the virus is very, very, uh, easily spread. And too, if we look at, for example, SARS, the COVID virus is actually ten to twenty times faster spread than, than SARS was. Just to give a perspective of that and that is related to the affinity for the Ace-2 receptor.

There's a diagram, um, that demonstrates different tissues that have high relative receptor affinity. And these are primarily associated with, for example, type 2 alveolar pneumocytes which are in the lung, and we certainly expect that, but they are in other places as well. For example, the esophagus. the sm, the, um, intestine and particularly the absorptive ... in the ileum. And also there is expression in the heart as well. There's even some suggestion of expression in the kidneys in terms of how to reset the Ace-2 receptors. And when we look at that as described here by Rothman, et al, it indicates why we see so much multi-organ dysfunction in addition to the pulmonary dysfunction that we see when it comes to COVID-19. So for example, this is why touching your face is so important to avoid because the mucosa in the skin of your mouth is actually has high Ace-2 receptor expression and allows for that Spy protein that we talked about to very readily facilitate binding to the Ace-2 receptor.

Getting back to the overall structure of the critical care world and our role as general anesthesiologists, um, in that particular, in this particular surge staffing that we're specifically looking at, there's a tier staffing strategy for pandemics that has actually been uh, published by the Society of Critical Care Medicine. In full disclosure, I am a member of the Society of Critical Care Medicine, as well as the ASA, and it shows here tier staffing model for pandemics. It is very important to note here that this is a triangular structure in order to leverage all the tools and personnel in the hospital. Of course, we have fellowship trained critical-care physicians and, ideally, those could be resources to any ... teams that are suspected to, um, staff or provide critical-care services suddenly, but anesthesiologists, every anesthesiologist in the United States of

America has been required to do several months of critical-care during a residency and as such we are all by trait, automatically intensivists, automatically critical-care physicians.

So, as anesthesiologists, a general anesthesiologist is at the top of this pyramid and of course, we have the rest of our team members that we can coordinate with and we can direct. For example, one, we have respiratory therapists, other APPs, um, our nurse anesthetists, and anesthesiologist assistant colleagues. Um, we may have residents on the team. And so there's all sorts of ways to structure that, or if we have a, for example, a physician with a very non-critical-care background, for example, that may suddenly be asked to help in a surge situation. We're properly trained to be able to provide that coverage, that expertise, to care for those patients and by automatically doing that, we can flex and cover a lot more patients to provide a lot more critical care when it's needed.

So getting to the actual clinical course, um, this slide actually is adapted from Lancet 2020's March 11th paper that discussed the clinical course as ascribed by intensivists and multidisciplinary team members in Wuhan China. We'll also notice that I put Italy on there. The primary part of the slide is Wuhan, and I will mention the parts that are in Italy. I think this slide is very, very important to look at because it shows that most of our ICU admission occur around one week into the clinical, uh, course, if not more. So, for example, if we look at the patients that survived we start seeing substantial amounts of dyspnea at around day 7, and then ICU admission around day 12.

So these patients have been really uh, working to breed for quite some time before they are actually escalated to the ICU and when we think about it 80% of patients are asymptomatic but 20% of patients that have COVID will be admitted to a hospital and the most common issue they have is hypoxia. This is normally treated with anywhere between 2 or 1 to 6 liters per minute of nasal cannula oxygen. We'll talk about that a little bit later. And then we see, furthermore, that we have sepsis and ARDS tending to take place around day 9 and day 10. And then of course, we have our admission, uh, administration of systemic corticosteroids because of the shock, not because of the lung disease, and then the patients that survive usually around day 22 is kind of what they saw, but in non-survivors we see the sepsis and ARDS once again, but we start seeing acute cardiac injury, acute kidney injury, secondary infection which is very, very important, we'll talk about that in a moment as well, but we see, those other organ systems besides just the lung becoming important motivators or factors towards mortality of these patients. Furthermore, you'll see in the red located there, um, for non-survivors, we also see the Italian experience, and this is why I put it in red there. The Italian experience saw a lot of pulmonary embolism and an underlying hypercoagulable disorder manifested by and increased maximum amplitude on a thromboelastogram and this was refractory to administering therapeutic Lovenox, administering aspirin based on

the discussions with those physicians, there wasn't an attempt to administer ... or other ... Inhibitors. However, they were reluctant to do that because in autopsies, they appreciate a lot of pulmonary hemorrhage as well. So there seems to be a very difficult medium ground in order to achieve in the Italian experience.

Futhermore, in the Italian experience, most patients end up having ICU admissions a little bit closer to day 5 and day 6, whereas in Wuhan, we see that occurring a lot later. So, we can see different expressions and different morphologies of the virus depending on where the patients are, what region they're in, so we could see variability for patients that we have here in the United States and indeed that is already started to happen.

When we look at types of ventilation, we need to address a couple of important things. Non-invasive ventilation is certainly important and is certainly a part of the armamentarium for caring for these patients. However, when we look at the types of options we have high-flow nasal cannula. It is important to remember that when we say high-flow nasal cannula we're talking about techniques like vapotherm or humidified 20, 30 liter per minute types of high-flow. Not the high-flow where they give you the can but it's still running at 4 liters per minute from the wall. And those are really effectively pause or pressure modalities because for every 10 liters of flow that you administer, you actually add one centimeter of water pressure. So for example, a patient has 20 liters of flow in terms of their high-flow nasal cannula they're effectively having 2 centimeters of positive pressure within an inspired breath and 2 centimeters of water pressure for PEEP, effectively 4 and 2 if you roughly estimate that. So this is, high-flow nasal cannula is still something that has the potential to mobilize secretions, once again, um, in the mouth or pharynx.

CPAP and BiPAP have been really frowned upon that this point in terms of health care provider risk because putting a CPAP or BiPAP mask on the face helps mobilize droplets and therefore is thought to be very, very concerning in terms of potential to infect nurses, physicians, that are taking care of these patients. If it's given, it needs to be given in a negative pressure room. But once again, there is other concerns with that, because the general consensus has been external positive pressure has not really resulted in prolongation or prevention of ICU stays referred universally. There sometimes has, has, it is has been effective talking to different centers in terms of their experiences, but CPAP and BiPAP are actually very similar to the face tent that you'll see here.

In this face tent, for example, that was demonstrated on the University of Chicago website, you'll study the, then the medical ICUs in the Chicago area as well as one of our own an, anesthesiologists and ASA members, Dr Pete Papadakis, as well as Dr. Biltwell ... , and so, a lot of our, we do have people that have experience with these, and you see in these face tents, on the news in Italy, um, particularly see when you see

them, uh, walking around or, or not in the ICU yet. One of the limitations of these face tents is that you really can't exceed around 10 to 12 centimeters of positive pressure and the patients that have come to the ICU after being on face tents for several days actually had more ... recruitment more acute lung injury and therefore the experience has been that these, uh, individuals actually deteriorate more and have, uh, more mobility associate with their stay. Italy was using it because they didn't have any other options but is important for everyone to know that this is a viable way to provide positive pressure ventilation externally without having the droplet dispersal, um to the health care providers. Final note on this these, these, these particular face tents are not generally available in the United States. Most of the manufacturing base for this is in Europe.

So when we look at a ventilator waveform, for example, we can see here, this is a, um, a uh, an assist control sort of waveform, where we have the nice classic upstroke, um, and of course we have our baseline PEEP for example, let's say 5 centimeters of water pressure, and then we have the peak inspiratory pressure which is that very, very tip of the waveform and then our plateau directly after it. The plateau pressure is the way that we can actually determine compliance. You'll hear a lot of discussion with compliance when you talk to respiratory therapists or pulmonologists, and compliance as it has been mentioned already very efficaciously and early by, um, by our previous presenters, is a way to determine how much change in volume you get for change in pressure. If a patient's lungs are less compliant, you have to get a lot more pressure to get a lot less volume and it becomes very, very clear that that patient is sicker. So, plateau pressure's a way to actually measure that and we can actually do a breath hold, or inspiratory pause, if it's available. If you're using an ICU vent, it's very easy to measure that, but we also have ways of looking at our anesthesia machines.

So in the picture right here, you'll see an example of a waveform for a patient on volume control. You'll see the peak there, you see a plateau, is not as exaggerated as the one I just showed in the previous diagram, but it's clearly right there and that's a way for us to determine our plateau pressures and see how much compliance we actually have.

Futhermore, it's important to keep in mind that there are other instances that we tend to see in terms of this waveform. We can see poor compliance man, manifested by very very high plateau pressure, and the PEEP pressure would still be low because that doesn't necessarily mean their tubing kinked or they're actually have a mucus plug. But on the other hand if you have high air resistance, you have that very, very high PEEP pressure, which can skew your average pressures, you need to make sure to look at the plateau pressure to assess this. And, compliance in COVID patients tends, appears to be variable based on experiences in Wuhan, in Italy, in, uh, New York as well as in California from the various practices that we've been able to speak to, as well.

So we'll get to that in just moment, but I think we should go back to the fundamentals of what was discussed in the ARDS net trial. In the ARDS net, the clinical network had done a lot of work with this. It's generally, uh, taught to most of our residents and discussed in most of our MOCA activities in general, but we have this nice PEEP table here as well as a calculation of what volume you should use. I'll get rid of this kind of complex part on the lower left side and say listen, it's very easy to calculate ideal body weights by using a formula based on the metric system. In terms of someone's, uh, if you have ideal body weight for males, you take their height minus 100, you can very easily calculate ... minus 100, you can very easily calculate their ideal body weight. True to form, for females it's minus 105, so I'm sorry but once again, that's a very easy way to calculate ideal body weight. So, for example, if a patient is 177 centimeters, and they're a male, the ideal body weight is 77 kilograms. If they're a female, their ideal body weight is 72 kilograms. But, the ideal body weight is, what should we use when we're calculating the actual 6 ml's per kilogram of tidal volume that we are generally trying to target in ARDS patients.

And this is important, because we're effectively talking about maybe a small person trapped in a, a large body. For example, if we have an obese patient. This ARDS net, uh, clinical net, ARDS net clinical network provided, um, summary data there in terms of how to wean PEEP. And, you wanna have a lower PEEP or higher PEEP, and I wanna show both of those because there has been incredible variability in terms of COVID patients. Some COVID patients have demonstrated very, very good compliance, very, very high compliance to where you don't need a lot of PEEP at all, the fact is, it's very, very unusually low PEEP in these patients, ventilator oxygenate, are relatively well, or may be they don't oxygenate very, very well, but if you go up on PEEP, they actually will oxygenate worse, because you're keep moving from x zone two up into to x zone one, in our in our theoretical of pulmonary anatomy.

So keeping that in mind, there's a series of hypoxia therapies that we use commonly in the ICU, but the goal is always to reduce ventilator induced lung injury and reducing ventilator induced lung injury really means that we're trying to avoid re-recruitment. Every time we have an alveolus that have collapsed and we re-expand that alveolus, then we are essentially inducing release of of TNF-Alpha, recruiting more alvular pneumocytes, for example, type 2 pneumocytes, the very same ones that are up regulated and activated by Ace-2 receptor ... that we talked about a little bit earlier, and the description of the pathogenesis and, and the pathophysiology of the virus. And so really, we want to make sure they choose a PEEP as soon as possible in order to facilitate that. That means we're intubating relatively early. We're not letting patients languish on a floor for extended periods of time if they're getting more than requiring 6 liters of nasal cannula oxygen is really, and in particular they start showing signs of accessory muscle usage, there's no point in prolonging it, these patients tend to

deteriorate very quickly. We should intubate them earlier than later from the consensus looking all the centers that have taken care of these patients.

So choosing PEEP and aggressively making sure we manage PEEP appropriately is important. And we have to use our plateau pressures, we have to look at our compliance, to determine how much PEEP is needed and make sure not over, hyperventilating the patient. Recruitment maneuvers are very, very important. Simple on-going, um, pulmonary toileting is a commonly used word, for making sure that we're making sure a patient is suctioned, that respiratory therapist, or in this case, perhaps our anesthesia care teams are regularly going and evaluating these patients. So recruitment rules should not be underestimated and sometimes that means mild bagging, suctioning every 12 hours, every shift. Something should be done to make sure that the lungs are healthy because positive pressure physiology is not normal negative pressure physiology where we're breathing not intubated, so it's important to try to recruit alveolae and keep them recruited.

Going on to the next phase. Prone is, in terms of the ... is really prone positioning. We'll talk about prone a little bit more, but prone positioning should be on the list and if we're going to do prone positioning it normally takes deep sedation and anesthesia care teams are ideally suited to manage prone positioning patients. In fact, we do it all the time in the operating room. We think about our spine cases, our posterior cervical fusions, or things of that nature we regularly prone patients, directly we regularly screen for pressure injuries, we regularly work as a, as a team to facilitate that turning in an effective fashion. So as a team, as an anesthesiology team, I think we're perfectly suited to do that because we know how to make sure there's no pressure on the eyes, no pressure on other sensitive organs as we all know from our baseline education.

... blockade sometimes is required for treatment of prone patients. But if deep sedation's adequate, there's a lot of benefits and not necessarily giving neuromuscular blockade, primarily because long-term administration of neuromuscular blockade is associated with critical care polyneuropathy or otherwise sometimes stated as critical care myopathy. These patients, though they survive their stay in the ICU, they end up being weak for many, many years or have to go to the long care facility. And this is normally diagnosed ... as well. Nitric oxide has been discussed is commonly used in general for hypoxic patients but one of the difficult things with Covid is that Covid patients normally don't really have a lot of hypoxic pulmonary vasoconstriction. So nitric oxide doesn't really seem to have an effect, particularly talk to our intensivists colleagues in Italy. Furthermore, ECMO is going to be the last step in terms of artificial lung management, which we'll talk more about in a moment as well.

It's important to keep in mind that prone positioning has been demonstrated to be effective and has been demonstrated with control trials, ... analyses, the most recent

being perceived which is pictures here in the New England Journal medicine published in June of 2013. And this is where they actually had multiple ICUs in France, they recruited approximately 230 patients and the randomized to proning for 16 hours versus not proning. And 50% reduction in mortality. Prone positioning is something we should absolutely be doing for these patients when we can. And it's been born out in terms of the experience that we see both in our other International destinations as well here in United States. Just remember, it's very easy to pull things out use some possible have things like rota beds, which are pictured here for my hospital for example. One of the things about rota beds is that there's not a lot of them. So this is a luxury that your might have in some patients, but it's just good old-fashioned vigilance, just like on the logo for anesthesiology with the light house that we take, that we support... The risk for injuries in ... over there to make sure those risks are mitigated.

Another physiological benefit of prone positioning, it's important to recall that when we have these patients, there's a lot of inhibition of hypoxic pulmonary vasoconstriction, particularly the more sedated they are. In the operating room we use our volatile anesthetic. Same thing happens if you have a heavily sedated patients in intensive care unit as shown by this diagram, which featured from up-to-date online. We can see that for example the dorsal ... in supine position where all the blood is. But anatomically it's much easier for the ventral component of the chest ... you move because that's what we're designed to do. So because of that we end up getting over distention or ... one in the ventral component and then we end up getting a collapsed alveoli with ... blood flow shut or west zone three in the posterior components. So we take those patients and invert them, we treat those and make them prone we get a lot more aeration or ventilation of lung that's actually maybe healthier, but also is balanced with the posterior or the dorsal aspect of the lung as well. And therefore these patients can a potentially have better oxygenation from now.

Now it's important to make sure we look at ventilator sharing, and ventilator sharing is something that's been discussed already quite a bit so I won't belabor it very much. We do encourage you elevation of ventilators in the community. We had a very spirited discussion about this in the committee of Critical Care Medicine. And we really feel that this experimental therapy, just like the ASA joint position that was just published with the Society of Critical Care Medicine ...chest and .... So our respective this is not something that we could really do and I believe that Dr. Feldman has already answered those questions effectively. I will go ahead and move on beyond this slide.

ECMO something very important to discuss and that's because it certainly is our go-to to have a functional artificial lung with someone that has such profound ARDS that they're not able to oxygenate any further. SEE centers our experience in ECMO and some of the groups that we didn't talk to did indicate that they are experienced ECMO centers, but they functionally couldn't facilitate ECMO because they have so many

patients so quickly that they had to decided they were going to provide ECMO for one patient, and basically lose the ability to care for 2 3 or 4 patients if their nurses were stretched. And these are in hospitals where they start off with 20 ICU beds ended up with a hundred ICU beds. So because of that ECMO is is, has some viability issues. We don't know the actual outcomes with Covid in terms of CHMO. We cannot assume that putting someone on ECMO would actually make the Covid patient do better, for reasons we talked about, for example, in terms of cardiac injury myocarditis, renal dysfunction, etc. But a couple of important points. If you have existing programs, that's fine, if from a local decision standpoint that someone wants to do ECMO. But if you're in a hospital where everyone's looking at planning, starting an ECMO service this is not the time to do it. It takes a very experienced team and it's very easy to start having a lot of issues of PPE on that. So this is something that should be left to the hospitals. There's not a consensus statement on that, decrying or supporting EMO. But, CPR is one thing where there seems to be a little bit more of a consensus in that. If we have someone who's coding, and we're going to look at putting them on ECMO, or emergently crashing on ECMO, the amount of PPE consumed for that would really potentially be hazard in terms of providing PPE later, on top of the staffing issues we talked about a little bit earlier. So in summary some centers are doing ECMO, it is a viable option if it is in place, but if there's a large surge most centers have found it difficult realistically to maintain that globally. And of course you include ECMO for the patients that have ECMO, that would have a known diagnosis that would benefit from ECMO in the first place such as bridge to transplant. And we look at the ICU service overall, it's important to keep in mind that we have the systems and so we just want to ... the systems. Always work in system. For example, cardiovascular norepinephrine is definitely our first line, in terms of vasopressor, and really a lower mat goal is fine unless there's some reason medically that you think someone needs the higher mat goal. Sixty to sixty-five is ideal. Beware of preload, because the more preload we give yes, that can work in terms of cardio function but want to make sure we're very, very concerned about volume, which I'll talk about in a minute. If peak gets high, and there's a very compliant lung, sometimes we end up seeing right heart distress. And so make sure to take out a bedside Echo and look at the right heart particularly if you're concerned about cardiac function.

In terms of endocrine, steroids have a role in shock. They do not have a defined role in terms of the acute lung injury associated with Covid. And if you're looking at your endocrine system during rounds, don't forget about the thyroid. Everyone thinks about glucose, everyone thinks about adrenergic functionality but thyroid dysfunction can also contribute to critical care dysfunction and critical care disease as well.

In terms of renal, conservative fluids are, appear to be the best from all the consensus that we actually haven across the world. The left arm is better, in face sometimes people are actually diuresing. Of course this is not doable if the patient if in shock, but

less fluid means more compliant lungs, more compliant lungs mean lower driving pressures, more ability hopefully to oxygenate. Crystalloids in the critical care community have been accepted. And so colloques are certainly reasonable, but in terms of randomized control trials, there's no mortality benefit to give colloids over crystalloids. And crystalloids are a lot cheaper and in a certain situations you might not have very much ... to give. You want to avoid the starts, because there's a lot of ...

Balanced crystalloids have definitely been much more well-received. For example plasma has a normal pH or normal .. so that peaks of 7.4, saline has a pH of 5.0 to 5.5... Ringer's 6.5. So they're those are essentially acidic compounds and we really want to, we really try to encourage not using those.

Fifteen percent of patients that have Covid will have acute kidney injury and will require continuous ... replacement therapy.

So, in general, follow the consensus. Make sure ... give prophylaxis, nutrition, antibiotics etc. And prepare yourself for this. I mean if your surgery volume has gone down now, it's very reasonable to call your ICU team and say hey, can I shadow you for rounds one day. Just get that muscle exercise again. And see what works in your institution. There is no one-size-fits-all way to scale up in this particular fashion.

The ASA has provided resources, the specific education resource we have for this is ... ICU or Covid activated scaling of anesthesiology responsibility for ICU program. And this will include essentially snapshots of what to do, common do's and don'ts for each system if you find yourself suddenly rounding as intensivists tomorrow or next week ,etc. The respiratory and pulmonary section are available on the on the ... ICU part of the website. And the rest of the system will be up tomorrow. And this is available for all ASA members free of charge. We also developed this in conjunction with SCCM, the Society of Critical Care Medicine and the Society of Critical Care Anesthesiologist and Anesthesia Patient Safety Foundation. This has been a very very tremendous work and we really appreciate all those societies working together to build this product for all of our members.

So in summary, don't become a victim, don't become a victim, don't become a victim. Be early. Be aggressive. Be early and aggressive in terms of critical care. We know what to do. We do it all the time in the OR. You're ready for this. And leverage the team and ask for help. If you need a consultant ,or something, you get in over your head if there's sort of any guardrails that you seem like you've gotten past, ask for help. If you have anesthesiologists, intensivists in your department, call them. And that's part of your plan. It's okay to call the intensivist there as well. If you're starting renal replacement, getting CT scans, ... or things like that, it's very reasonable to go ahead

and call an intensivist, so that way you have that resource so you don't have to have any needs not met.

So with that being said, thank you very much and I'll return the presentation back to our moderator.

DR. SZOKOL:

Thank you, Doctor Williams for a fantastic presentation. So, a couple questions, who are the stakeholders that need to engage when redeploying to the critical care unit?

DR. WILLIAMS:

Great question. The stakeholders are really kind of everyone that could actually be there. Your nurse are going to be absolutely key. You need to talk to your chief of critical care for the hospital or whoever actually runs the ICUs there, no matter what department they're in, and make a plan together. And also don't be don't be afraid to engage your consulting services with that whole team: your administration, infectious disease doctors. All those people need to be aware of a plan and help you build a plan that works for your institution. You can't do this alone. It's just like enhanced recovery after anesthesia and surgery. It takes a team. Make sure engage administration, nursing, your consultants that are in the hospital.

DR. SZOKOL:

Thank you. Another question. What is the mortality rate for patients that are placed on ventilators who have Covid-19?

DR. WILLIAMS:

So this is a highly variable question. Um, if we and I'll have to, I don't have that specific number off the top of my head. But we looking at twenty percent of patients that are hospitalized. And out of those twenty percent, we only have about a fourth of those that end up requiring critical care management. And that critical care management is primarily laid to respiratory failure. So you're looking at about that fraction that actually has acute lung injury and ARDS. So when we look at our one percent mortality we're talking about one percent, one percent of that or four or five percent, which correlates with around a twenty-five to thirty percent mortality with ARDS. And that is what we see in the background literature. Um, ARDS previous mortality before proning has been suggested to be forty to sixty percent. Um so, I hope those mathematics, and I apologize for doing my head while I was talking, but I hope those mathematics help in

terms of the rough mortality. We're going to have to be very concerned about making sure ... mortality in those patients.

DR. SZOKOL:

Thank you. Now we're going to go to some other Q&A questions. And one is from Luke Janick from Chicago. He says: can you comment on the recent move to have at all people in the hospital wear a standard mask at all times to reduce transmission. Partners Healthcare led the way. Other healthcare organizations have done such. American College of Emergency Physicians recommends facemasks all the time. Where does the ASA stand on this? And maybe that's best for Dr. Peterson.

DR. PETERSON:

Uh, thank you, Joe. We do not have a stance on that yet. We've been mostly following, um, CDC criteria with the one sort of variation in that all aerosolized producing procedures, um, we are recommending the higher protection with the N95 mask face shields, knowing that there're shortages of those and a lot of people are having to reuse those. There is good guidance on the APSF website on reusing, uh, the N95s. You know, we are still dealing with shortages of PPE. We have some promises from 3M and Honeywell that they're making millions and millions of masks. Um, we're not there yet. Thank you.

DR. SZOKOL:

So a follow-up question to uh N95s. How do you sterilize the N95 for reuse? And maybe Dr. Peterson again?

DR. PETERSON:

So I would refer you to the APSF website. There's various methods. I know today that, um, we got some guidance from the inventor of the N95 mask, who was mostly recommending the baking process. You know you don't want to come near metal, or whatever, but it gives specifics on how many degrees centigrade for thirty minutes. Um, there is sterilization that can also, um, that can also be used as well. But you know some people are using UV. Um he put that at a lower category but I know some institutions, such as University of Nebraska has a protocol for UV sterilization also. Um all that can be found on the web site.

DR. SZOKOL:

Thank you. So our next question is: if my hospital does not allocate any N95 masks to anesthesiologists and residents for patients that are not suspected or confirmed to be Covid-19, do we have the right to demand for those masks to be available for all cases since there existing number of asymptomatic Covid patients.

DR. PETERSON:

So once again, that's where our guidance moved toward recommending it for all patients because of what we're seeing in communities, we're behind in testing, um, we don't know who's positive and who isn't. We know that people can be asymptomatic, especially children can be asymptomatic virus shedders. And so because of that, and because we're inches from the airway during aerosolized generating procedures, that's why ASA came out and said, um, we really believe they need the higher protection. And that is consistent, at least the last part, with CDC guidance that with, you know, suspected Covid, well, you know, at a certain point everybody may be suspect if you have wide community spread.

I've had some emails today from colleagues, you know, asking about it. I'll just reiterated: here are our guidances. Please go back to your administration and your teams and explain to them we're not talking about everybody in the operating room having an N95 and you could, you know, parse it out by the individuals doing the intubations and extubations. You can have intubation teams. There are various ways that you can conserve the N95.

Another question I've been asked is: well what about other people that see us with that and then they're wearing a regular mask? Well if you read the CDC guidance, all of our outpatient clinics, ERs, whatever, those staff are wearing regular mass and face shield unless you're doing a highly aerosolizing procedure like intubations. So it really depends on what kind of contact you're having with the patient, what kind of PPE you would be wearing

DR. SZOKOL:

What's the best way to use a HEPA filter during a general anesthetic?

DR FELDMAN:

So the term HEPA filter, um, really just refers to a high-efficiency particulate. Basically, it's a generic term for filters that filter very effectively, but, there's a variety of performance that falls under that rubric. So what you really want to do is understand the viral filtration efficiency of the filters that you put on the machine. And there's very specific guidance now on the APSF website describing what you can use, how you

should use it, etc. There's two places that you need to protect. One is the gas, exhaled gas entering the machine. And that's pretty easy to protect with a high quality mechanical filter at the end of the excretory lens. And I say mechanical filter because I'm distinguishing it from an electrostatic filter that generally don't perform as well. The other nice thing about the filter at the end of the excretory limits is that it doesn't impose any dead space on the airway, so you have a lot of flexibility on the devices you can put there. Having an HME filter at the airway is also useful, both for adding to the protection of the anesthesia machine as well as protecting the sample of gas that goes to your gas analyzer. In some machines that sample gas is designed to re-enter the circuit. And so you want to protect it from viral spread as well. So there are more details on this and I'll just refer you to the APSF website because we tried to put lots of good detail on this topic there.

DR. SZOKOL:

Thank you. Dr. Feldman. The next one I think is for Doctor Williams. How do you triage a Covid patient who should or should not be placed on a ventilator?

DR. WILLIAMS:

That's a fantastic question and a very important one. Essentially when it comes to a Covid patient triage, like you said, most of them will actually do fine with simply nasal canal oxygen and supportive care in the hospital floor. But if we have a patient, if you have a Covid patient, who is requiring six liters of oxygen via nasal cannula or more, really remember that nasal canal oxygen caps out at thirty-five percent for a normal patient with normal breathing. So you're really saying that they need more oxygen than thirty-five to thirty-six percent. And automatically those patients that are requiring that, um, we would normally escalate them without Covid, to a vending mask or face mask, but in this case that's actually not going to be helpful because the lung injury process has already taken place. So the key thing is, if you have increasing work of breathing, if you have respiratory distress and they're already getting on the high side of nasal canal oxygen as described, they need to be intubated. And when you put them on mechanical ventilation. if at all possible, that's effectively, it's actually a more simple triage system than we have in many of our critical care scenarios that we address every day?

DR. SZOKOL:

Thank you, Doctor Williams. So doctor Peterson, I turn it over to you.

DR. PETERSON:

Thank you Joe. And I want to thank really all of our panelists, and really all the people behind the scenes to create all the educational materials, trying to get it up on websites as quickly as possible, all the groups that we're working with to get, um, joint statements together. This week, every day, I've been talking with somebody from the White House team, um, really trying to get more information and in trying to get it out to you all.

Now I have a surprise for you tonight. I didn't know if it could happen, but our Surgeon General Jerome Adams has a few moments that he can share his thoughts with you. Thank you Jerome so much for being with us here tonight.

DR. ADAMS:

Thank you very much. Doctor Peterson. I just really appreciate the opportunity to address each and every one of you. And I want to start off by just saying thank you to the ASA leadership. Thank you to all of you all as providers out there for all that you've done to help us through what is truly a difficult and an unprecedented situation. We know that in recent history, never has it been more important for Americans to reach across the lines that divide us: geography, race, party philosophy. It's through hard actions and strong partnerships at the federal, state, and local levels that we're going to get through this. And it's through division, It's through a lack of coordination, that we're going to struggle to get to the other side.

Although I'm here to provide an update on Covid-19, as a member of the President's Coronavirus task force, many of you know that I am a still practicing anesthesiologist at Walter Reed Medical Center and that I actually took care of suspect Ebola patients back during the time of Ebola. I also will be the first to acknowledge as a former State Health commissioner that I know from first-hand experience, this crisis won't be solved from Washington DC or from the CDC in Atlanta. It's going to be solved at the community level because that's where the capacity is, that's where the resources are.

I know that folks expect the federal government to provide and we are doing everything we can to provide. but I think it's important to point out that the national stockpile purchases one tenth of one percent of all of the supplies in the entire country. The other 99.9% are in the commercial and private markets. And so a lot of the capacity that folks are looking for is already out there. It's sitting on shelves and surgery centers. It's sitting in hospital. It's just misaligned and that's something that I really want you all to think about how you can help us fix that misalignment, the resource capacity.

The stories we're hearing from our partners and our colleagues in New York City are just horrifying, not something that we'd ever want for any of our friends or family

members or ourselves. But just a few hours away, in Western New York, there a hospital that are laying off nurses and doctors, furloughing them, because of decreased capacity. So there is a misalignment. There is not a lack of resources. We just need to make sure they're getting to the right place.

I do want to point out that I hope there are not places in the country that are still doing elective surgeries, because it's important understand there's supply and there's demand. And we are focused in every way shape and fashion to make sure supplies are getting where they need to get to. Nine million N95 masks have gone out of out of the national strategic stockpile. We've worked with 3M and Honeywell to increase production of masks to the point where they're going to be putting out a hundred million N95 masks a month. We've sent four thousand ventilators to New York City. And we've worked closely with the AFA to convert and make anesthesia ventilator is available.

But the fact is, we're not going to supply our way out of this problem. The way to solve this problem isn't to wait till everyone gets sick and if they have a ventilator for them in PPE for them. The way we get out of this crisis is to lower demand.

Covid-19 as now spread all over the globe. In the US, ten thousands of cases have been reported in all 50 states and DC, Puerto Rico, Guam, and the US Virgin Island. We passed the 80,000 mark for cases today and unfortunately the grim threshold of one thousand deaths. And we expect more cases in the weeks ahead and deaths in the weeks ahead. Many of you all hear me on the Today Show on Monday morning saying that this week was going to be bad. I wanted folks to be prepared for that. Next week is going to be bad also, just in different places than where it's been bad this week. That's why it's so critical that we take a few simple steps to slow the spread of the virus, to flatten the curve as you've heard many of us say. And I asked you to go to [coronavirus.gov](https://www.coronavirus.gov) look at those plans, put them into action in your homes, in your community, in your hospitals immediately. This is a proactive and protective plans for the nation and I absolutely need you to share it with your members in your network and use your voice and your policies and your programs to drive its adoption.

There are still far too many cases of people doing elective surgery, of people playing basketball, of people going to the beaches, of people checking out cherry blossom. And every single one of those situations is a potential opportunity for Coronavirus to be spread into our communities and a potential opportunity for someone to need a ventilator or to need care from one of you all and to put you at risk. You are an extremely important piece of this puzzle, both as a provider but also as a community voice who can help people understand the importance of everyone paying attention to these mitigation efforts.

By social distancing along with good hand and cough hygiene, we know we can dramatically reduce the spread of this disease. We've seen it in China. We've seen it in South Korea. We've seen it now in New York where their cases have leveled off. So we know this works. We just have to commit to it and do it.

And so the good news, the good news is that when you do these things we see that the course of this disease runs about six to eight weeks from the time you leaned into social mitigation. That's about how long it took China from the time they got serious about social distancing and mitigation. That's about how long it took South Korea. Again Italy, we're starting to see it hit its peak and it's starting, hopefully, to come back down/ And even in New York City they leveled off In New York, folks need to remember they didn't really go to aggressive social distancing and mitigation until about a week ago. What we're seeing is that the numbers that you see today reflect what happened one to two weeks ago and it's why we need to get serious about this now even if you don't live in a place where you see increase cases at the at the moment.

I want to finish with a point about testing. Testing is ramped up across the country significantly. We have confirmed over 500,000 test that have been done in our country, which is more than have been done in all of South Korea. You may have heard the president say that we've done more tests in the United States in the last eight days than South Korea did in eight weeks and they're put up at the standard for mass testing. Now, I recognize that South Korea smaller country than ours. Proportionally South Korea in their initial surge tested about 1 in 200 people and that's what they called mass testing ou surveillance. That would be for us about one-and-a-half to two million tests in this country and we're pushing a million tests right now based on estimates. Not all tests are reported, but about ten percent of tests are coming back positive, which means if you take the number of positive and multiply them by ten, that's the number of test that you can expect to be done, or number of cases that you are you expecting tests to be done.

We now have 80,000 positives in the US which means we've probably done about 800,000 test in this country. And by this time next week, we expect to be close to 2 million. That will allow us to be a lot more strategic in our recommendations. We don't need to treat Boise Idaho the way we treat New York City. It will also allow us to give more information to the people who need it the most. Most people don't need to be tested. Most respiratory symptoms are due to other causes. Again ninety percent of people who have been tested are testing negative even if they have symptoms. Right now we recommend testing for hospitalized patients and for symptomatic healthcare workers, followed by people who have symptoms and are at high risk of more severe outcomes. That includes individuas who live in long-term care facilities, those over 65 or with chronic conditions, with compromised immune systems and First Responders. Again, you can get all this information and more at [coronavirus.gov](https://www.cdc.gov/coronavirus).

As anesthesiologists, I also want to hit one more point. You may have heard me last week encourage the nation to go out and give blood. Social distancing does not have to mean social disengagement. You can make an appointment at your blood center to space out people who come in and you can still give blood. As someone who did trauma anesthesia for ten years, I know how critical it is to have that blood when you need it. So it's a great way to encourage people in your communities to stay connected and to stay involved.

I want to thank you all again for the opportunity to address you and for your support of this whole of America response. Please know your efforts to communicate our work on the stuff that can be taken to slow the spread of Covid-19 are going to be critical. Please always remember supply and demand -- we will not supply our way out of this problem. And if that's the only part of this we lean in to then we're always going to be behind the curve. By working together and supporting each other and our neighbors, we will get through this and I'm confident that we can flatten our curve in all states across the country and get through this with as few deaths as possible.

So thank you again for the opportunity. We need you to take an inventory of where all the ventilators are in your community. We know that from talking to New York., a lot of the leader still don't realize that you can use anesthesia ventilators, a lot of them don't know that they're anesthesia ventilator in surgery center sitting unused, a lot of them don't know that there's a PPE and ventilators one to two miles away from where they're struggling to actually meet the needs that they have. So we need everyone in communities across America to take stock of which surgery centers are closed, which dentist offices are closed, where ventilators might be, where extra staff might be, and give this information to your Governors and State Department so that if, unfortunately, you all go the way of New York and some places will go in that direction, some are going to have curves like New York other ones are going to have curves that are going to be better, but you want to be prepared. Part of being prepared is knowing where your resources are and being able to deploy them quickly. I look forward to continuing to work with the American Society of Anesthesiologists, with the American Association of nurse anesthetists, with quad A, with our anesthesia text, and with everyone out there who can show what we can bring to the table at this time of crisis.

DR. PETERSON:

Dr. Jerome Adams, thank you so much for spending the time with us. And in this very incredible time that we're dealing, and with all your leadership that you have given to our nation.

DR. STRIKER:

American Society of **Anesthesiologists**<sup>®</sup>

Thanks for joining us. We'll continue to keep you updated here on Central Line. And, for more information, you can find video of the original Town Hall at [asahq.org/covid19info](https://asahq.org/covid19info) where additional Covid-19 resources can also be found. Stay safe and join us again soon.