FEMALE SPEAKER: Welcome to Mayo Clinic COVID-19 Expert Insights and Strategies. The following activity is supported in part by an independent medical education grant from Pfizer, Inc. and is in accordance with ACCME guidelines.

ALEXANDER NIVEN: So I think we'll go ahead and get started. Welcome to this latest edition of the Mayo Clinic COVID-19 live webinar series. This is the second of two parts on the topic of Caring for Critically Ill Patients with COVID-19, Top Lessons and Innovations. And I'll start off by passing things over to Jeff Poterucha to review a little bit about how our webinar will work.

JEFF POTERUCHA: All right. Thanks a lot, Dr. Niven. I'm Jeff Poterucha. I'm a senior education specialist in our Continuous Professional Development School. So just a few things. This webinar is accredited by the AMA for one credit. There are no relevant disclosures for today's discussion. And, of course, we'd like to thank Pfizer for their support of this educational activity.

Before we get started, I'd just like to cover a few points with you. The first is on how to claim credit. So if you would like to claim credit for this webinar today, there's a few brief things you'll need to do. The first is to visit our Mayo Clinic website, which you can see here is link ce.mayo.edu/covid0921. You'll need to log onto the site if this is your first time. This a quick, simple process for creating your own account.

After you've logged in, you'll see that there'll be an access code box on this link. So what you'll want to do is type in today's code, which is COVID0921. This will give you access to the course. You can complete our short evaluation, and then you'll be able to download your certificate. The link and the code will be dropped into the chat box throughout today's webinar. So you can just keep an out for that.

Now, during this webinar, you can probably see at the bottom of your screen right now there are two functions. There's a chat feature. And then there's a Q&A feature. So what we're going to do is if you have any technical questions or any issues that come up, please use the chat feature, and our support staff will be able to assist you with that.

If you have questions for our faculty today, what you'll want to do is use the Q&A box right there. That will go right to the faculty, which they'll monitor throughout the discussion today. You'll notice when you're in there that there is an upvote function. So if you see that there's a question that's been asked that you had also on your mind you'd like to see answered, you can go ahead and click the up arrow, and that'll get to our faculty.

I'd like to share briefly the learning objectives for today's discussion. What you'll be able to do by the end of this is review the common clinical manifestations and challenges in caring for critically ill patients with COVID-19, discuss innovative solutions to these challenges that have been implemented across the Mayo Clinic Enterprise, and identify the importance of interprofessional collaboration to successfully deliver effective critical care to COVID-19 patients across a health care system.

And with that, I'm going to bounce back to Dr. Niven, our moderator today. He is a consultant within pulmonary and critical care medicine, an associate professor of medicine, and also the Education Chair of the Division of Pulmonology, Critical Care and Sleep Medicine, as well as a critical care independent multispecialty practice. Dr. Niven?

ALEXANDER NIVEN: Thanks so much, Jeff. And it is a true pleasure and privilege to be part of a really fantastic faculty group today. It's my pleasure to introduce my colleagues here, starting with Sean Caples, who is a consultant here in the Division of Pulmonary and Critical Care Medicine, and serves actually several roles. But in this webinar, his primary capacity as of section head for critical care medicine here at Mayo Clinic Rochester, and also serves as the medical director of the Mayo eICU Program.

Sarah Bell works very closely with the good Dr. Caples and the rest of us in all sorts of issues. She, at least until recently, was the nurse manager of Enhanced Critical Care. She just recently got promoted, so hopefully we're trying to pull her back in. And is also an instructor in nursing here.

Grant Wilson is the supervisor for quality and safety for respiratory therapy here at Rochester, an instructor in Pediatrics. He's been doing some really fantastic and innovative things that you will hear about here shortly.

And Ayan Sen is joining us from Mayo Clinic Scottsdale, so he is the chair for the Department of Critical Care in Arizona. And this is dual-hatted, in terms of his academic promotions, between emergency medicine and medicine.

And last, but certainly not least, Annie Johnson is a critical care nurse practitioner in our group, and really not just the lead. I would describe her as the driving force behind our ICU Recovery Program, which has been tremendously successful here at Rochester and is rapidly becoming an enterprise-wide activity.

So before we get started, for those on the call who are less familiar with Mayo Clinic and our enterprise health care system, we wanted to spend just a minute telling you a little bit about our health care system so that you understand a little bit the context in which we will be having these discussions.

Mayo clinic has three, quote, "destination" campuses-- one in Rochester, Minnesota, one in Phoenix, Arizona, and one in Jacksonville, Florida. And then the sort of cloud-like area that you see in southern Minnesota, Iowa, and Wisconsin is the Mayo Clinic Health System, which is a network of rural access and community-based hospitals that surround Mayo Clinic Rochester. So when you hear us use these terms, that's what we mean.

The Mayo Clinic care network is actually a network of affiliated institutions that have been working with Mayo Clinic for a variety of different lengths of time. Really, these relationships offer a collaborative opportunity for us to share our systems-based practices, knowledge, and consult services in addition to a variety of different knowledge-based tools such as Ask Mayo Expert. Next slide.

Before we get started with our panelists, I think it goes without saying that it has been a brisk 2020. And the COVID-19 pandemic has really been historic in terms of its impact and disruption on health care services and, for that matter, everyday life across the globe. I think all of us have struggled to keep abreast of all of the rapidly evolving literature and innovations that have come out in this area since the pandemic hit all of our respective areas.

And so what Mayo Clinic has been doing since the onset of this pandemic has been gathering our best practices and, when available, summarizing the best evidence that has been published in the literature in different areas, and providing it in a concise and readily available form for the general public through the Ask Mayo Expert COVID Navigator, the link to which is provided on this slide.

What these series of webinars is designed to do is to provide the why behind some of the information with the COVID Navigator, and also highlight evolving and emerging information as it becomes available. And so this and a variety of other resources are available through our online CPD site.

I think it goes without saying, if you could go back just for a second there, Jeff-- I think it goes without saying that the amount and rapidity of change has been a true challenge for everyone, especially in health care. And so I just wanted to highlight another available free public app, the Mayo Clinic Well Being Index, which provides some very simple tools to allow practitioners to compare their level of stress and burnout to other similar physicians across the globe. And, at least for folks in the United States, also offers confidential access to a variety of different resources to help keep us at our best performance, both for our patients and for ourselves and our colleagues, as the sprint turns into a marathon.

And with that, let's move on to the next slide. And it's my pleasure to introduce Sean Caples so that he can give you a few focused lessons from his corner of the critical care practice. I should just say upfront what we're going to do is focus three to five minute presentations from each of our faculty members, and then we're going to leave a substantial time at the end for questions. So please do use that Q&A box to enter any questions. And we will address just as many as we can in the time that we have remaining. Sean?

SEAN CAPLES: Alex, thanks so much. It's an honor to take part in this webinar. I'm going to focus on our experience in New York. And you'll see on the slide here there's a published paper in the *New England Journal of Medicine Catalyst* which highlights innovations in health care delivery.

Just to give you some context, I apologize, but I'll have to take you back to the spring of this year, at the height of COVID infection in New York City. And we got a call for help from a colleague who was close friends with one of my partners here at Mayo Clinic that they needed help. And we had been watching for weeks, hearing from friends, colleagues, family members from the East Coast how devastating things were.

And we really racked our brains for probably the order of weeks to try and figure out how we could help. We knew we couldn't get there physically. We knew we had an existing tele-ICU program, but it was pretty obvious that we couldn't implement that technology in the way that we were familiar with.

For context, tele-ICU implementation takes generally on the order of months for hardwiring of beds, developing workflows, making relationships. And that obviously couldn't apply in this situation.

So the first hurdle we had to overcome to help our colleagues in New York was to think differently about how we can deliver care. And we were able to develop, in a very short period of time, literally less than one week, we went from idea to implementation. And we did that with a development team. And the development team included people like Sarah Bell, one of the other speakers today, who's the nurse manager of our tele-ICU program. The development team also included IT specialists, administrators, credentialing specialists.

But the other key to the success of this program were folks in New York. We partnered with New York Presbyterian, who have a very well-developed infrastructure for things like information technology, EHR systems, credentialing. And we couldn't have done it without the governmental passage of legislation to simplify the process of credentialing and licensing. So literally within two days, we were able to go from no license in New York State to full licensure and credentials at the hospital.

To give you a context into what we encountered when we got to become familiar with Presbyterian, was we were just past the peak of patients who had flooded all of the ICUs in New York. Patients spilled over from a full ICU into a full PACU into a full ward on the general care floors, full of ventilated patients. And so they needed bodies to help care for these patients.

And, obviously, their intensivist staff was overwhelmed, so they recruited physicians from surgical areas, from procedural areas, from pediatrics, from medicine, residents, Fellows, to come into the ICUs and deliver ICU-level care. And those physicians were excellent, but were not accustomed to the culture of ICU that we as intensivists are familiar with and comfortable with. And so we knew right away that our approach to telemedicine in this situation was going to be different. And so we used what we like to call a light touch.

We were able to utilize tablets-- iPads, if you will-- to connect to the bedside team at Presbyterian, to round with the team twice a day. And we would bring the culture of critical care to the bedside twice a day on rounds. Things that we consider to be easy and an afterthought came to them as aha moments. And we were able to really impact care in a very simple way. So things like a spontaneous breathing trial, a sedation vacation, thromboprophylaxis, those sorts of things that might not be second nature to a pediatrician.

I should also note that our colleagues at the University of Pittsburgh were doing a parallel implementation on their end with other hospitals across the Presbyterian system.

One other very important point is that the folks on the receiving end need to be not only engaged, but bought into the concept of bringing critical care expertise to the bedside. And so we were really fortunate to have not only a colleague at Presbyterian, but a good friend who was able to really drive the ship on their end. And he was able to get us really integration within the health care team at Presbyterian.

The project lasted four weeks. And by the end of the four weeks, the patients were beginning to clear out of the general care wards, and things were coming back to some normalcy. But it was a real gratifying experience for us to think differently about delivering telemedicine care and an understanding that you can accomplish this if you've got the right team around you.

I think that's my five. Yep, that's my six minutes. So I'll stop there. Thank you.

ALEXANDER NIVEN: Thanks so much, Sean. It was a fantastic experience to be a part of. I'm going to move things to Grant next, who's going to talk a little bit about our oxygen alert system that he has been instrumental in developing.

GRANT WILSON: Thank you, Dr. Niven. And good morning, everyone. Early in the COVID pandemic, the Critical Care Specialty Council was concerned about our ability to be aware of patients with increasing oxygen needs spread out over a large area. And Dr. John Charnin from Critical Care, Todd Meyer and Alicia Ledger and myself from respiratory therapy all worked on, and designed an alert within Epic to help us with this issue. And this RT High O2 Support Alert has been in production since May of this year. And I'll go through the workflow here with this slide.

The alert was intended to help us identify patients in general care areas that were progressing to higher levels of oxygen support. And it also helped us provide the opportunity to provide an assessment via the respiratory therapist and involve the medical team. The alerts trigger based on oxygen support criteria that were predetermined by critical care. Things such as flow, oxygen device type, or FiO2 are included in that criteria.

And when the criteria is met, a Rover push notification will be sent to the respiratory therapist if they're signed into the care team for that patient. And it also generates a workless task that appears in a report that we've built. All of these criteria come from flow sheet documentation by the nurse or the therapist. Then, because it would be not practical for a therapist to sign into hundreds of patients at a time, we'd mostly get our information or get alerted to the patient by running this report. And our lead therapists-- we have a respiratory lead therapist on every shift, every day and night-- they run a report every four hours that identifies patients for follow up. And an example that report is the screenshot at the bottom of this slide.

And patients that meet our inclusion criteria for an assessment then are followed up. And we confirm that they're on the level of support in the report. And then we also can contact the medical team to make sure they're aware that their patient may be increasing in oxygen levels, and also discuss the plan of care. And as you can see in the report slide, there's a number of different devices that have triggered this one. There's a nasal cannula at 5 liters a minute. There's a reservoir nasal cannula at 6 liters a minute, a non-rebreather mask, and a nasal cannula.

Our experience has been, as we've used it for a number of months now, we get about one alert per hour. Or, when we run these reports, some are in the range of four to six alerts in that four-hour time period.

The benefits that we found-- in addition to it doing what we originally intended, alerting us to patients on specific levels of oxygen, it's also let us see patients that were inappropriately set. And this is something we struggled with prior to COVID, nurses or other care providers not familiar with some devices and setting them inappropriately, such as a simple mask. We found a number of those set in the 1-2 liter range, which puts the patient at risk for CO2 retention because the mask doesn't get flushed.

And it allows us to correct those in real time and educate the nurse right at the bedside. So that was kind of a side benefit of this alert. It's also allowed us just to connect with nurses in general and let them know we're involved or following the patients that are on the levels of support that trigger the alert, and let them know to call us if they've got questions or concerns about managing those devices.

So, yeah, that's pretty much how it works. And I'll let you move on to the next one.

ALEXANDER NIVEN: Yeah, I'm sure that there will be more interesting questions about that grant. But I think let's keep on presenting the other key take home that we have. Thank you so much for that. Sarah, do you want to go next?

SARAH BELL: Sure. Thanks, Dr. Niven. A lot of the challenges nursing has been experiencing in the ICU with COVID patients is this PPE fatigue. Wearing the N95 respirators all day. It's hot. They're hard on your face. And it gets to be a long day, a 12-hour shift in the PPE. They're hard to communicate in. Talking through a glass panel door out to the team outside of the patient's room can be complicated and difficult. And it can be very isolating in those rooms.

And then COVID has presented challenges of staffing shortages for staff who are out ill, or have COVID themselves, or have sick family members that they need to take care of. It's going to be a busy fall. And so we're dealing with staffing shortages throughout our ICUs.

During the pandemic and continuing on today, we've implemented In Touch as a video support model. And we've partnered that with our eICU program. So the picture on the screen is the tablet device that we've deployed to all of the patient rooms who are COVID positive, both in the ICUs in Rochester, the general care COVID-positive patient rooms, and also on our Florida campus. And this In Touch device allows our eICU staff to camera into the room and provide PPE kind of relief for the nurse.

So if somebody is requiring continuous observation by a nurse, we can be on the tablet and interact with the patient, hear alerts and alarms, and be able to relay out to the desk staff if somebody needs to enter the room. This allows the room nurse opportunity to exit their PPE and get a break. It also allows the nurse who may be in the room the opportunity to communicate more clearly with people outside of the room. Providers can be on a iPad or a tablet and have this up, and instead of shouting through a door they can clearly communicate via video from the nurse in the patient room and the provider outside of the patient room on their iPad.

It's also affording us the opportunity to sort of staff our ICU patients with nurses who are critically care trained and may have a nurse in the room that might not be critically cared trained, so that we can kind of provide that expertise to them in the room.

And then our eICU nurse-- the other picture on our screen here is of our eICU operations center. You can see we have multiple screens available to us so that we can have up multiple patients. We can have up diagnostic exams and imaging, bedside monitors, anything that we need to do so we can multitask and provide care to many patients over this In Touch video solution and through our eICU program.

So I'll stop there. Dr. Niven?

ALEXANDER NIVEN: Thank you so much, Sarah. It truly has been impressive to see this system in action. Next we will move to Annie, who will talk a little bit about our ICU Recovery Program. And just before Annie starts, I'll just remind individuals that as questions come up in your mind as you're listening to these presentations, please use the Q&A function down at the bottom of the screen to type those questions in. And we will answer just as many as we can once we're done with our formal presentations. Back to you, Annie.

ANDREA JOHNSON: Perfect. Thanks so much, Dr. Niven. I'm really happy to be here with everybody today.

Recovery from critical illness has been a focus of conversation amongst critical care professionals for the past several years. So it's not necessarily a new conversation amongst many of us. But, now more than ever, post-ICU recovery is gaining really much more mainstream attention, not only with non-critical care providers, but really with the general public as well. And this is really in large part and thanks to the pandemic, of course, and the extra spotlight that's been focused on critical care over the past several months.

Recovery from critical illness that is secondary to COVID-19 is not entirely unlike recovery from any other critical illness, really. Of course, there are some special considerations that we do have to keep in mind. But those just really largely deal with the unknown. We don't really quite know yet what we don't know about recovery for our post-COVID, post-ICU patients.

Over the past five years or so here at Mayo Clinic in Rochester, we've really been building the foundations for post-ICU follow-up. It was about a year ago that we saw our very first patient in our outpatient setting and our newly developed Mayo Clinic ICU Recovery Program. We were seeing patients. We were plugging away. We were getting people into this face-to-face clinic.

And then, all of a sudden, about March 2020, like everything else, it just came to a screeching halt. We took a momentary pause from our clinic, just kind of put the brakes on everything just to evaluate things. But it quickly became really evident that, now more than ever, our post-ICU services were really badly needed.

So it really was just in a matter of days, we took what had been a three-hour face-to-face inpatient appointment and turned it into a virtual 60-minute follow-up appointment that was done either via video chat with our patients and family members, or through just a simple telephone conference call. And really, from that moment on, we haven't looked back. And we have kept all of our post-ICU follow-up appointments virtual from that point on. And we have a very full, busy, flourishing clinic in that manner.

The key in evaluating post-ICU patients, no matter which route you choose to do so-- so if you're seeing patients physically face-to-face or if you're committing to virtual-- the key is to make sure to assess the most commonly affected domains of the human experience. And we know from pre-COVID post-ICU research and experience that those domains are physical, cognitive, and mental health. So I'm just going to quickly walk you through our virtual post-ICU appointments and what we do in them so you have a sense of what we do and how we address those specific domains.

Prior to our patients' scheduled appointments, they all receive standardized questionnaires to complete. And those questionnaires really focus on mental health aspects. So we're looking at things like anxiety, depression, PTSD, amongst a few other things. The patients submit these. And they're reviewed by our team with the patient during their appointment.

Right now, we are scheduling virtual telephone conferences for all of our patients. And then our entire team, which includes myself, our pharmacist, and our occupational therapist, join the patient-- and ideally, if possible, a family member, caregiver, loved one as well-- all on the phone call, all at the same time.

And we start out the appointment with the patient recapping what life has been like for them since being home from the ICU. We hear it in their own words. We get a really good sense from them how they are doing. We offer ICU debriefing, both for the family member and the patient as is needed. And then I complete a focused head-to-toe review of systems with them.

Next, our pharmacist completes a full medication therapy management assessment. She answers any questions related to medications and provides counseling on things such as smoking cessation and immunizations.

And then to wrap up the appointment, our occupational therapist completes a functional reconciliation. And she really focuses on the patient's physical and cognitive recovery. She does this via a really focused interview with a patient, as well as administering the MoCA-Blind to get a general sense of what our patient's cognitive functioning is like. Our occupational therapist also does a return to work assessment for all the patients who that is appropriate for.

And then, at the end of that appointment, each patient receives an individualized recovery plan to move forward with.

It's really important to note that our clinic, and many like it, function primarily as assessment and referral clinics. So that's kind of an important key takeaway. We do offer some immediate interventions with things like medication changes, prescriptions as needed, the ICU debriefing and education, of course. But really our main focus is to really zoom out and get a really clear picture of the patient's overall recovery story, and then connect them with appropriate resources as needed. Some examples of referrals that we have made for our patients include things like physical therapy, neurology appointments, speech language pathology, pulmonary, return to work programs, et cetera.

Along with this virtual clinic appointment that we have created for our patients, we have also developed a couple other exciting programs I'll just highlight really quick. We developed remote patient monitoring. This is a program where patients are discharged home. They're discharged home with equipment that measures the vital signs and then also a tablet. And for 30 days they check their vital signs, and they answer a series of questions on this tablet. They're followed very closely by a nursing team. And if there's any concerning trends, either in their vital signs that are being checked or in the questionnaires that they're submitting, the nurses are able to flag that, intervene, and then escalate any of those concerns as appropriate.

And then the other program that we've created is called an interactive care plan. It's essentially an app that patients go home with. And again, they're followed for 30 days. They don't do vital signs checks necessarily, but they do do a symptom checker frequently with us. That is sent directly back to our team, and if anything is flagged and is concerning we get notified right away so we can intervene and connect with those patients.

So those are just some extra ways that we're staying connected to our post-ICU, post-COVID patients.

So to summarize this, the overall key takeaways for everybody here today really should be that post-ICU follow-up can be as simple or as complex as your team is able to support. It can really honestly be a telephone call with a qualified team on one end talking to the patient and the family member, or it can be as sophisticated as the apps and other monitoring programs, whatever your team can support. The main focus, again, should be on assessing for physical, cognitive, and mental health, and in connecting patients to available resources if deficits are identified in those assessments.

And then, finally, some special post-COVID considerations for these patients really include screening for ongoing cardiopulmonary dysfunction-- the persistent cough, breathlessness, fatigue that patients might experiencing. Screening for thromboembolisms that we know can develop in this specific patient population, and then screening for the psychosocial sequelae that really develop in a lot of our post-ICU patients, but especially in light of different isolation that's going on right now for all of our patients during these times, and also for the family members. There's also social stigma that we can't forget about that is linked to COVID-19 for your patients and family members.

And then, finally, just committing yourself to learning about the unknown in the recovery. And this really just starts with committing to focusing on follow-up for these patients.

ALEXANDER NIVEN: Fantastic. Thank you so much, Annie. And we'll move to our last speaker, certainly not least. Dr. Sen, do you want to talk a little bit about the ECMO team and the experience that you guys have had with COVID ECMO transport down in Arizona?

AYAN SEN: Most certainly. Thank you, Alex. And a great opportunity for me to be here and joining this webinar.

From ICU recovery to a group of patients who would certainly need ICU recovery, yes, it's the ECMO patients, patients who were cannulated for ECMO as a result of COVID ARDS. Now, interfacility transport of a critically ill patient with ARDS has been described in the past. And cannulation of patients on ECMO has also been done in many different parts of the country, as well as the world. It was first described in the 1970s and '80s but, really, the process started in the year 2000s, mostly, as centers started having more ARDS centers of excellence.

But when COVID hit us, I think the big question that came to everybody's mind was is this something that actually works? And more so, what are the resource implications of sending a whole team when there is a call for a patient who potentially is failing the mechanical ventilator and transport the patient with full PPE? And how safe would it be, not just for the patient, but for the staff as well?

Well, from looking at the ELSO registry and the website as of today morning, they're about 2,584 patients worldwide confirmed, or suspected, who have been put on ECMO. And the survival to discharge, as of now, is about 53%. Something close to about 600 patients are still in hospital at this time.

So the question came to us-- and we've got a transport team in Arizona for the last 15 years-- is this something we can do? Is this something that's feasible? Especially because when we started seeing some of the surge down in Arizona, we were not entirely certain that we would be able to accommodate the group of patients who required a lot of resource management.

But we did, because we wanted to take care of our patients, especially the young ones, who were being referred from other regional hospitals in the valley. And so we relied on the ELSO-- the national Extracorporeal Life Support Organization-- guidelines that provided us with some information around which are the groups of patients which potentially could benefit from this very resource-intensive therapy.

And so, based on that, the next big question was, OK, we have these clinical guidelines. So what could be a potential inclusion criteria, and what should be exclusion criteria? But the next big question came in was what is our capacity? As a 300-plus-bed hospital, as the numbers started increasing, would we be able to support caring for these patients? So this set of guidelines that you have on the slide were published in the latest ELSO update as well, that describe four different levels, conventional to crisis capacity and some of the expectations that can be set as we manage the expectations of, not just the family members, but other regional hospitals as well.

The first stage is where your capacity exists and you can have judicious patient selection and the same time ECMO can be offered for the right patient population, as well as for non-COVID indications. But as you move to the tier 1 and tier 2, certainly your criteria or ability to care for these patients definitely becomes a lot more challenging. So we decided as a hospital that we would limit the number of COVID patients to five who could potentially be supported in our institution by this resource-intensive technology.

And so you may feel, well, is this fair? How did we make those decisions? The reality is we actually relied on a state surge line that was created based on the orders from the Arizona Department of Health. And the surge line coordinated all the ECMO centers in the valley. And we were able to decide which hospital has a bed available. Maybe Banner Phoenix has a bed available while Mayo doesn't, or Mayo could take a patient from Tucson. So we kind of strived to do that resource sharing through the surge line which could distribute patients.

As of now, we have done about five transfers to Mayo Clinic Arizona in the last few months. We've done a lot more ECMO patients, but five who have been cannulated in the referral hospital and brought in by our team. And the picture you see is our team getting ready for transport.

Obviously, before we embarked on this process, although we've had a team for about 15 years, we wanted to ensure that all the due diligence was paid to manage PPE. And that included having some checklists instituted. What should be our modus operandi before leaving the hospital? What kind of resources would we need, as well as the donning and doffing process when we arrived at the hospital? Who would be in the ambulance? And how would we ensure the doffing is done appropriately to prevent any kind of aerosolization and spread of the virus? Because, if you remember, in March and April, we were still trying to argue and debate is this a droplet or is this an aerosol-generating virus. And we wanted to take most precautions as well as we could.

We kind of did a SWOT analysis of what we learned from the past several months of taking care of these patients and bringing them, with full PPE, to our institution. Our strengths were that we do have a designated team, a team that comprises an intensivist, a cardiothoracic surgeon, ECMO-specialist nurses-- perfusion. And this designated team would take triaged calls, ensure that they met all the criteria for escalation of care to ECMO, and bring the patient back. So the collaborative team model that we have really made a lot of sense. And our overall outcomes through this pandemic has been commensurate with what's been reported, survival of discharge being about 60% or so at this time, and some patients still being on the circuit.

Some weakness, definitely, is absence of a dedicated team, and dedicated team meaning physicians or nurses waiting for an ECMO call that's not feasible in the structure that we are in. And sometimes the team could be very busy doing other things, including surgeries, at the same time, and couldn't pull through a team to provide resources to the other hospital.

The size of the hospital is also a challenge sometimes, and the ICU size. As I mentioned, we made a cut of about five patients with COVID ARDS that our team could take care of, especially because we were fast draining nursing resources who were being pulled to take care of non-ECMO COVID patients as well.

But it has brought open a lot of opportunities that we can explore and we hope to explore in the future. And that's increased regional collaboration, how we could potentially help other institutions out, other states out. And I think our surge line system in Arizona did work well. There are more opportunities to expand on that and explore other possibilities like air transport and all because we've had very good successes by ensuring our staff have been kept safe by creating those guidelines and checklists of PPE management.

Not something which we should forget about is that of the PPE use and exposure. There's a lot that goes in. We need to have resources. And in times when there is lack of resources, I think crisis capacity doesn't warrant institutions that should use ECMO as an offer to patients.

And we have to be mindful also the prolonged ECMO runs for some of these patients are fatigue, burnout, some of the resource implications for other patients, and ethical issues around selection and exclusion and inclusion criteria needs to be kept in mind in terms of the threats to this lifesaving technology that comes with a lot of challenges.

So I'm going to stop here, and happy to take further questions.

ALEXANDER NIVEN: Thanks so much, Ayan. And I think if we can take down the slides at this point, we have a little bit over 15 minutes to answer as many questions as we can. And there's certainly a lot of them in the queue. I'm going to go sort of from the top of the screen down in order because certainly the thumbs-up, if you haven't noticed it, also helps to prioritize questions that more people are interested in.

Unfortunately, I have no special knowledge in terms of the ongoing vaccine work that's out there, other than there is a lot of it going on from a variety of different companies. Is there anyone else on this call who can speak to that? Otherwise, I'm afraid we probably need to table that topic.

AYAN SEN: Yeah, there is a Moderna Phase III that's ongoing in the United States, and the Oxford vaccine outside. So still early days, I would think. We'll get to more, I'm sure, in the next couple of months.

ALEXANDER NIVEN: Yeah. I listened to a presentation from Anthony Fauci a few weeks ago. And he listed actually six different initiatives that are ongoing, some of them fairly promising. And short of that, I'm not going to speculate on timeline because I think that's anyone's guess.

The next question that has moved to the top is asking about new treatments, talking about convalescent plasma, dexamethasone, and remdesivir, and what else. And perhaps I'll ask Ayan, followed by Sean, to comment on that real briefly.

AYAN SEN: Yeah, I think we, as an institution-- as everybody knows, we were part of the expanded access support that we initiated with using convalescent plasma. Dr. Joyner was the principal primary investigator on that. And we've been using convalescent plasma with all our patients. And we've had some good retrospective data that showed some reasonable outcomes.

I think many trials are still being planned and ongoing. And I think, again, that would give us more indication of the real value of that therapy. As everybody knows, the FDA did approve it for emergency use access, which changes things slightly. And I think more data needs to be available before we can say for certain that it definitely makes a huge improvement on overall outcomes.

Steroids, definitely, I think has had a big impact, and in my personal experience, as well, over the last few weeks, where we have started using a lot more. We've been able to anecdotally see more improvement in their pulmonary function and ventilator wean and all. But again, I think we'll have more information and data as we look at the SSCM Virus Registry, which has 20,000-plus patients, that would provide a great add for us while we await more and more trials to be published in this domain.

SEAN CAPLES: Alex, the only thing I'll add to that is there are some newer trials that are launching. We're part of a national consortium on a monoclonal antibody. It's one of the mAbs. I would butcher the name if I tried to say it. But I think there's a train of thought that interrupting the inflammatory cascade with monoclonal antibodies could have an effect on outcomes. But it's very early. I think we've only recruited one patient, so far, across our health system. But that's something that will be coming down the pipe.

ALEXANDER NIVEN: Thanks to you both. The next question really is headed towards Annie Johnson with regards to what sort of things that you've been looking at in COVID patients post recovery. I guess I'll just add an editorial comment to the question, which states that when patients re-intubate in the ICU for more than seven days their outcome is very poor. I think that that's still a bit of a moving target.

I think one of the challenges that many health systems encountered early in the pandemic was an overwhelming volume of patients, and considerable challenges in terms of wrapping our arms around this new disease process. But certainly, best supportive care using evidence-based critical care practices and then the advances that we've been able to identify with remdesivir, dexamethasone, and perhaps convalescent plasma I think has really moved the needle in terms of our perspective towards mechanically-ventilated patients and their survival with COVID.

So they survive their hospitalization and come to you, Annie. What are the specific things that you're thinking about and dealing with with COVID patients?

ANDREA JOHNSON: Yeah, so we treat these patients really very much like we treat all of our post-ICU patients. So we make sure that we're assessing for the physical, cognitive, and mental health [INAUDIBLE] from critical illness. We cover those baselines.

And then, just like we do for any post-ICU patient, we individualize their assessment. So we look specifically at what they were admitted with and for, and kind of their ICU story. So if they developed terrible delirium, we will kind of work through that a little bit, et cetera. So we really individualize this.

For our post-COVID patients, I am being more specific in looking and assessing, like I had mentioned, the cardiopulmonary functioning. So really it may be digging a little bit deeper into breathlessness, cough, oxygen need requirements still, kind of that functional assessment and being very thoughtful of screening for any concerning signs for potential clots. We have seen that in a patient, specifically, who developed lower extremity DVTs and then ended up with bilateral PEs after being home recovering from COVID.

So I ask questions, and I assess very specifically for things like that. I would say that probably is unique in the COVID patients. I don't necessarily do that as in-depth for all of our post-ICU patients. There is questions that will kind of lead us that way, but I'm a little bit more focused on that.

Being very thoughtful of pulling in family members, and assessing family members and asking how they are doing. A thing to really remember is that a lot of these family members have also been sick. So we've had family members who their whole family was sick. For example, a mom and all of the children were sick at home. And dad was also sick, but got sicker and ended up getting shipped off and into our ICU. So now she's at home, sick, taking care of her sick children and her family, yet bearing the burden of worrying about her husband, who is in the ICU, even sicker than them.

So following up with a family member, and assessing how they're doing, and connecting them with support, such as therapy, social work, support groups. I can't stress that enough, getting people into support groups for this type of thing. So those are some of the more unique looks that I will take for patients who are post-COVID. Otherwise, we really kind of adhere to our main post-ICU follow-up for these patients.

And as far as that initial comment about patients not doing well, Dr. Niven, I'll kind of echo what you said. We don't really know yet. I'll tell you, doing post-ICU follow-up work, you will learn that we are really terrible at guessing which patients are going to do great. You'll hear the patient's ICU story, and you'll think, oh, my gosh. They're never going to be OK. And you'll follow up with them, and they'll be like, I'm great. I'm fine. I have no problems. So it is really hard to know. That's what makes follow-up so important for these patients.

ALEXANDER NIVEN: Thanks, Annie. And I guess I'll just chime in one other comment, putting my hat on as the medical director of RPFT Lab. We have actually been encouraging delaying pulmonary function testing for at least 90 days after diagnosis, largely in recognition that COVID, likely similar to other viral-related pulmonary infections, will have bronchospasm and transient effects that will take a while to recover. The general guidance is at least six to eight weeks.

And obviously, testing is a real challenge in these folks because we know that COVID patients can remain PCR positive for an extended period of time. So because of those two things, mixed benefits and challenges logistically in terms of testing these folks prior to pulmonary function testing, we've been trying to delay those assessments a little bit.

Moving on to the next question, which asks about Mayo's COVID-19 critical order set. And what therapies do you initiate for virtually all patients, intubated and non-intubated, admitted to the ICU? And perhaps we'll roll in a question about proning in there, as well, that's further down.

But I want to turn to Grant first, since he hasn't had an opportunity to speak, followed by Sarah. And then I'll open it up to the ICU directors.

GRANT WILSON: Was there a question you wanted me to address?

ALEXANDER NIVEN: Well, just thinking about some of the stereotypical things that you do in respiratory therapy with regards to enhancing both safety and efficacy management of COVID-19 patients who are mechanically ventilated.

GRANT WILSON: Sure. Just kind of along the lines of this high oxygen device alert, we had alerts, prior to COVID, for ventilator settings. Two of them. One is a high tidal volume alert. If we set a tidal volume above 8 ml's per kilo, for instance, we get an alert.

But the other one that we saw increase quite a bit through COVID was the high plateau pressure alert. And we track that as a quality metric for our department. We express it as number of alerts per ventilator day. And we run that across the enterprise.

But what was interesting, in August, in particular-- I run those reports-- we saw a quite a bit higher ratio than the cumulative ratio for the past year in Arizona and Florida, when they had their surge and had a big increase in ventilator patients. So it was kind of interesting to see that.

Anyway, my area of expertise is more along the medical record and helping pull data out of it, and do these alerts versus the clinical side.

ALEXANDER NIVEN: Sarah, do you want to talk about some of the common things that we do for intubated patients?

SARAH BELL: Sure. And even non-intubated patients, there's been a lot of questions about proning. We're proning early and often. Immediately when a patient is even admitted to our general care area, maybe just on a nasal cannula, we're putting them on a proning schedule.

For the patients who are intubated, we try to prone them for three-hour periods of time, with a two-hour break in between. We find that their breathlessness, shortness of breath, and oxygenation greatly increases when we can prone them immediately and often.

As a transition potentially to the ICU, and they end up on a high-flow nasal cannula or BiPAP, we don't go away from proning. We try to keep them in that prone position as they tolerate it. We can do different positioning with pillows to try and keep them primarily on their belly. And really the key to the prone is keeping their chest cavity up in the sense that it can be like free falling. So stacking pillows on their upper sternum, on their bellies, so that that chest can really expand down and help them out.

When they become intubated, we'll prone them for 16-hour stretches at a time. Typically, they're deeply sedated, a lot of times paralyzed. And we'll prone them. We have a special pillow that their face will lay into. We make sure that they don't have any major pressure points where we're putting Mepilex and different type of padded borders on bony prominences to avoid pressure injury.

One thing in COVID that we've noted is we're having a lot of chin deep tissue injuries from proning. And that wasn't usual when we would prone ARDS patients before COVID. So we're seeing some of those clotting tendencies, even in their chin, from the pillow. And so an intubated patient will be proned about 16 hours straight, and then we'll flip them back for about six hours, and then go for another 16 hours straight again.

And then we had a first last week, where we had a patient on ECMO. And they were maxing out their requirements on ECMO, and we decided to try and prone that patient. And before we switched them from kind of a VB circuit to a more arterial-based ECMO, we proned them and had substantial results, actually. And that's something we're looking to maybe protocolize moving forward. We proned them on the ECMO circuit just like we would have normally, 16 hours, and then back for six, and then back over again. And their PO2 had major benefit from that.

ALEXANDER NIVEN: I think in the interest of time, since we just have a few minutes left, I'm going to address the anticoagulation questions that are in the queue right now, and then pass things over to Sean and Ayan to continue the discussion in terms of standards of care, especially when it comes to Connected Care.

I just wanted to highlight, in the Ask Mayo Expert COVID Navigator, there's actually a very detailed algorithm that has been put together by a collaborative group that I had the honor to be part of with regards to risk stratification in venous thromboembolism prophylaxis. I will highlight the fact that systemic anticoagulation for prophylactic indications remains a very controversial practice, and has been associated with some increased bleeding events in the literature. And so we do not do that as part of our routine algorithm.

We risk stratify people by largely ICU status and D-dimer level to determine the intensity of prophylactic doses of either unfractionated or low molecular weight heparin. And there is a risk stratification tool called the Improved VTE Score. If that score is greater than 3 at the time of discharge, we continue prophylaxis for 45 days. So that addresses the post--

FEMALE SPEAKER: Your conference is scheduled to end in two minutes.

ALEXANDER NIVEN: So I'm going to throw things to Sean next, asking about the single best tool to implement from Connected Care in the hospital and home environment. And then any last best practices with regards to standard measures.

SEAN CAPLES: Thanks, Alex. I think our experience early on, with New York and other sites, has allowed us to gain some comfort with communicating via a tablet. And it's uncomfortable. I think what I've observed, that sort of communication can undermine usual best practices.

A good example is I think we became more heavy-handed with sedation with benzodiazepines, for example, early on in the pandemic because we weren't in the room often. We weren't able to interact with the patient as much as we normally do.

It takes a lot of emotional effort to become comfortable with that. So I would encourage everyone to utilize that sort of technology across their practice.

ALEXANDER NIVEN: Ayan, thoughts from Arizona?

AYAN SEN: Yeah, I think having consensus guidelines and protocols are always beneficial to try and ensure that there is some synergy between the different teams and maybe different ICUs that are taking care of these patients. And we know very well that it's been so difficult to tease out what works and what doesn't work with the plethora of evidence being published in different journals. But I think we're in a better spot now, six months down the line, to know what doesn't work. And I think that's where we need to be very cautious about because, ultimately, first do no harm.

FEMALE SPEAKER: Your conference is now over. Goodbye.

AYAN SEN: --expectation. And that's just my closing remarks.

ALEXANDER NIVEN: Thanks, Ayan. I think they just pulled the plug on us here.

MALE SPEAKER: We are still connected. We are still connected.

ALEXANDER NIVEN: Oh, good. Then I want to cover one last question because I think it's an incredibly important one, and indulge everybody's permission just to continue for a minute or two more.

There's several questions here with regards to diversity and the health care disparities that have clearly been highlighted by the COVID-19 pandemic. So there was questions with regards to, basically, how to facilitate communication with non-English-speaking patients within our ICUs, and then other challenges and solutions to address the health care disparity gap. And maybe I'll just turn to Sarah for a minute to ask how we communicate, and then just open it up to the rest of the panel in terms of other considerations.

SARAH BELL: Sure. We're using virtual interpreters. So for our patients who are COVID positive in a hospital, they obviously can't have any visitors or anything like that, and that includes-- a lot of our interpreter staff has been removed to be a remote provider. So utilizing the equipment in the room that we use for eICU with a camera, we can get an interpreter on there to provide that interpretation between the care team and the patient.

And then we also, for connecting our family members to the patient, we are utilizing Zoom. So each patient has an iPad that's designated to them. And then we can host Zoom calls between their loved ones and the patient several times throughout the day, or to connect with the care team as needed as well, so that they can see their family members and have that kind of video update.

ALEXANDER NIVEN: Ayan, any thoughts from Arizona? You have a very large non-English-speaking community down there.

AYAN SEN: Yeah. We have been using, as Sarah mentioned very similarly, virtual tele-interpreters. And many of our staff also are multicultural and speak different languages.

But also, we have collaborated with our colleagues from the Navajo Nation. We've had a lot of patients being brought down to Arizona, especially in Phoenix hospitals. And we have collaborated with the community to try and ensure that we have the reach with them, too, to help them address some of the health care disparities. And we have reached out to them by providing education and other means to ensure that the challenges with COVID are something that we can work on together, and cut down some of the health care disparities that we see, and provide support for Mayo Clinic. And hopefully other institutions are also doing the same.

ALEXANDER NIVEN: Well, thank you very much. I think, out of respect for our faculty and our attendees' schedule, we'll need to bring this great conversation to a close. I think we could keep on going for another couple of hours, if we were able to. Thank you very much for everyone who participated in this conversation, and for all the thoughtful questions.

And just a reminder that this COVID-19 live webinar series is an ongoing activity. So for those of you who had questions in the chat box with regards to workforce management, we have a whole hour dedicated to this topic from 11 o'clock to 12 o'clock Central Standard Time on September 28.

So thank you very much, again, to everybody for joining and participating. Have a fantastic rest of your Monday.