PH and COVID-19 as a Systemic Infection

This summer our Guest Editor, Ioana Preston, MD, Director of the Pulmonary Hypertension Center at Tufts University School of Medicine, gathered with Harrison (Hap) Farber, MD, Director of the Pulmonary Embolism Response Team (PERT) at Tufts University School of Medicine; Karen Fagan, MD, Chief of the Division of Pulmonary and Critical Care Medicine at the University of South Alabama; Ron Oudiz, MD, Director of the Liu Center for Pulmonary Hypertension at the Lundquist Institute for Biomedical Innovation at Harbor-UCLA Medical Center; and Panagis Galiatsatos, MD, Assistant Professor in the Division of Pulmonary & Critical Care Medicine at John Hopkins Medicine, to discuss the impact of COVID-19 infection on the pulmonary vasculature in general and the PAH lung in particular.

Dr Preston: Welcome to this month's roundtable titled: PH and COVID-19 as a Systemic Infection. We are fortunate to have today a group of wonderful PAH experts who, over the past year and a half, have encountered in both acute care and outpatient settings the various aspects of COVID-19 infection and its effects on the lungs and heart.

Let's start with the notion that COVID-19 infection has a predilection towards the pulmonary vasculature. What is your take on that?

Dr Fagan: I think one of the reasons that the concern for a developing pulmonary vasculopathy in COVID infection stemmed from some of the early observations of coagulopathy and the concerns about potentially having coagulopathic events within the pulmonary circulation, either macrovascular events like a venous thrombosis in a PE or microvascular in situ thrombosis and the potential impact that that could have.

I think that has been difficult to ascertain whether or not that's been the case, although I think most of us have certainly seen the incidence of PE in these patients is higher than in our normal patient population, even with appropriate prophylaxis. I think most of us adopted early on a pretty aggressive anticoagulation strategy as a preventative for venous thromboembolism for our hospitalized COVID patients.

At least the tact that we took was to be more aggressive than we normally would be for a hospitalized patient. I think that over time, as we've learned more about COVID, we've learned about some of the different pathways that seem to be important in either potentiating or even hindering things like some of the inflammatory cascade. IL-6, which has been a long-implicated potential mediator of pulmonary vasculopathy for lots of different reasons.

We know that IL-6 is an important component of the inflammatory response to COVID infection and even anti-IL-6 therapy is now recommended in some situations for hospitalized patients. Again, how that may or may not directly affect a pulmonary vasculopathy remains to be seen, but there's a lot of potential reasons why the COVID infection is something that we should look at carefully, because it may not only help us understand the pulmonary complications of COVID, but it may also help us understand PAH.

We may get some insights in mechanistically and potentially therapeutically. The anti-IL-6 therapy is something that I've been interested in for a long time as a potential for PH. To see it used in this population with good safety is something that we maybe would be able to think about, revitalizing that particular line of investigation as a therapeutic in our patients as well.

I will say clinically, the most important finding that I've seen in our patients, who are still symptomatic, particularly long-haulers who come in, is that most of their ECHOs have been very normal-looking. But if there was a common abnormality that I've seen on PFTs, it's been a decrease in the diffusing capacity for carbon monoxide.

That's quite predictable in many of these patients, which does suggest some type of underlying, potentially vascular complication. We know they're not particularly anemic. We know their other lung function looks good in their imaging—once the initial infection is resolved, it looks good.

That leaves us with pulmonary vascular insufficiency as a potential cause for a decrease in DLCO. I've seen it persist in patients. Granted, we're still pretty early in this, but I've seen that as the most common abnormality. Hap you are shaking your head to that as well.

Dr Farber: Yes. I would agree with that. We now have a group of people that seem to have a fairly common abnormality: it's their diffusion capacity. Just to what you said, Karen, I have 2 questions for you. First one is, do you think that this vasculopathy or these clots or whatever they get, do you think this is true VTE with PEs or this is in situ damage to their vessels within the pulmonary circulation and just in situ clotting because this is a vascular virus?

Dr Fagan: I think macrovascular VTE events are probably not the issue here. I think that most of the patients, particularly with these low DLCOs, don't have a history or they were prophylaxed appropriately for macrovascular events. I do think this potential for microvascular coagulopathy contributed, is possible.

I think there were a few autopsy series that showed some in situ thrombosis in patients who passed from COVID, but I think that we don't really know, and whether or not the virus itself creates an inflammatory endothelial injury that could lead to remodeling or longer-term vascular complications, remains to be seen. I just don't think we have enough time and enough information yet.

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Dr Farber: That leads to the second question. That leads to the point that obviously any coagulation in these people has become ridiculously controversial, whether you fully anticoagulate them, whether you overprophylax them or whatever. If it's mostly microvascular, I would be surprised if anticoagulating them is probably going to do much.

Dr Fagan: I agree with you, but, in these patients, I don't think that macrovascular events are uncommon. I just don't think that they're the primary cause of this long-hauler, low-DLCO kind of thing. I think that they are more common in these acutely hospitalized patients than other patients that are acutely hospitalized. I agree with you.

I think that for my practice, we are anticoagulating fully for these patients unless there's a contraindication to prophylax them from macrovascular events, but I'm not certain that that's necessarily preventing any of the microvascular potential complications. We do know that our experience has been that they've had more macrovascular events, so preventing those is important just for their overall outcome, but whether or not it's doing much for the microcirculation, I don't know.

Dr Preston: Ron, what's your experience?

Dr Oudiz: Actually, I was going to ask Karen a question with respect to these people who we think have microvascular disease based on symptomatology and the long-haulers and the low DLCO and others. Has there been any attempt to quantify the capacity of the pulmonary circulation?

In other words, something like CPET or even just generically-exercised capacity, because you can actually quantify the amount of pulmonary blood flow that increases or the blunting of that increase. If there is an impairment, then, of course, it sets you up for possible therapies, some of which apparently already exist.

Dr Fagan: We have only recently begun to start ordering cardiopulmonary exercise testing on some of our patients to really look at that, because, again, as we've had more of these long-haulers come in, who are symptomatic, particularly with the exercise and have PFTs that may have a low DLCO or may not, trying to quantify what their exercise limitation is something that we're more recently doing.

Before we were saying, "Maybe we need just a little more time," but now we're seeing that some people with time, have their symptoms resolve and they get back to what is normal for them. There's a cohort of these people who just have persistent symptoms. We're starting to try and actually look at exactly what you suggested, which we see if we can quantify what is their exercise limitation, and is that a ventilatory defect that we're just not picking up on routine PFTs? Is it a perfusion defect, or a cardiac defect? Those are all important questions. I think that that's a really interesting area as we begin to develop these cohorts of long-haulers that how we're going to phenotype them and what we're going to look at to see what's the cause of their exercise impairment or their functional limitation. I think we've still got a lot to learn, but it's a terrific plan.

Dr Farber: In addition**,** there are both autopsy and the cardiac MRI data to show that many of these people, surprisingly, are limited, that they actually have what looks like a myocarditis or inflammatory cardiac disease from COVID-19. It's interesting that this has been reported, whether it's actually true or not.

Who are these people who are basically younger and incredibly athletic who may develop this myocarditis? The classic one here is one of the pitchers for the Red Sox and all this stuff that they had what seemed like mild disease, some of them not even sick enough to go to the hospital, and yet, six months later, they got this cardiac injury from it presumably.

Dr Preston: Yes. I think the reports on cardiac MRIs were not all coupled with symptomatic patients. Some of the MRIs were in asymptomatic patients that showed some level of cardiomyopathy if you would, or myocardial inflammation. I'm not sure if we're quite ready to correlate the involvement in cardiac disease with symptoms.

Dr Farber: Ron is the cardiologist. Have you guys seen this stuff?

Dr Oudiz: We, as a division and as a department really, recently talked about the long-term sequelae and what we're seeing and what we're not seeing. For some reason, we just have not seen what others are seeing in our division. The pulmonary division, of course, has the long-haulers that everyone is seeing, but certainly not in my PH clinic either. We haven't talked about this yet but the PH clinic, per se, is a unique group of patients because they hide and they have been paranoid for the last year and a half.

Dr Preston: Yes.

Dr Oudiz: Now that they're vaccinated, they're still not coming out. They're still at home wearing their masks and not even want to come to the clinic many times.

Dr Preston: That leads me to my next question. What is your experience in your PH patient community and how many of your PH patients have been infected with COVID?

Dr Fagan: I can say that I've only had 1 patient that was hospitalized with COVID, and that was probably actually more related to her PH than COVID itself because I think she just got very nervous and was not quite as good about managing her PH during the time that she got sick. She responded to nothing but diuresis in the hospital and got better.

I've had maybe 1 or 2 other patients with very mild disease who were managed at home. I do think that the commentary about these patients going into hiding and that were very, very self-protective is true. I think that one thing we did as a community was to get these people early on to recognize the seriousness of the infection and the potential for adverse outcomes.

Our community took that to heart and really protected themselves. There's biological possibilities as to why our patients may or may not have more severe disease, but I think the biggest reason I didn't see in my patient population was that they were very, very careful about exposure.

Dr Preston: Ron, what's been your experience?

Dr Oudiz: We've had patients who have definitively gotten symptoms, sometimes severe symptoms, but never got hypoxemic. Even with fevers and headache and the usual constitutional symptoms that they've gotten, they've not gotten more hypoxemic. Most of the time, they've stayed at home or if they've come to the ED, they've just been sent home.

We've had some patients with comorbidities, for example, our porto-pulmonary hypertension patient whose liver disease got worse and passed. I think we were initially surprised that the underlying disease for most of our patients is pretty severe. PH is one of the worst diagnoses one can have in life, and the majority of patients not only were not dying but weren't even getting hospitalized.

Dr Preston: Can you make a comparison with heart failure patients, since you're our cardiologist on the roundtable? There's been a higher incidence of hospitalization from COVID from heart failure folks.

Dr Oudiz: We did see a bump there. I think they are a little bit different. A lot of the heart failure patients were decompensated, of course, those that got infected. Our service was busy, not just with COVID patients that had other cardiac diagnoses but a lot of heart failure. Without epidemiologic numbers, it's difficult to say anything other than this observation. It does seem to be different than in my clinic, PH patients with their right heart failure.

Dr Preston: Hap, were you going to add something?

Dr Farber: No, I would echo what everybody else has said. I've been amazingly impressed with how few PH patients have ended up in a hospital during this. I could think of only 2, and neither one of them ever ended up in an ICU. Most of the people who got infected, and they were very small numbers that stayed at home and were okay.

As Karen pointed out, we all tried to make some biological argument for why they didn't do poorly. Either vessels were all damaged already so the virus could not get into it, or these people are really good at hunkering down and hiding.

Dr Preston: Karen, how were you able to follow them from the distance, your PH patients, during the pandemic?

Dr Fagan: Initially, our hospital shut down our clinics for the most part, and so we were forced to pretty much do everything virtually. The patient population that I serve down here, a fair number of them are very under-resourced and have very limited, if any, access to internet technology like Zoom and other things like that.

I would say that 75% of our virtual visits were conducted over the phone, while the ones that we were able to do via Zoom left me a little bit more comforted that I was able to at least see our patients and have a little more visual impression of what they look like and things like that, than on the phone.

When we were able to go back to live visits, the vast majority of our patients came back immediately to in-person visits. I think because again, part of it is an access issue to technology in some of the patients that we serve. It was difficult because so much of what we do when we're with a patient is visual. So much of our assessment in our exam even occurs without ever touching a patient.

It's about looking at them, seeing how they're sitting, seeing what their nail beds look like while we're chatting, and doing other things. So much of that was hard to interpret over the phone for us. In the virtual visits, it was hard, too, but at least there was a little bit more that we were able to get.

I understand and appreciate the need for that. Hopefully, we'll never have another pandemic that will force everyone in the same way, but there were some limitations. I was grateful to at least be able to interact with my patients at all and to at least get some assessments.

Dr Preston: Ron, what's been your experience, and what were your hurdles during distance and tele-follow-up?

Dr Oudiz: In our county clinic, we had phone visits only. We didn't have video. That I think is huge in trying to assess right heart failure because you can't look at the edema. You can't even really do the eyeball test to just see how the patient looks. There have been some cases where when we did have phone visits, I said "You need to come in."

In part because of the history, of course, what they verbally told me, but also how they looked. If you know your patients, you can see sometimes subtly, sometimes obviously, that things aren't going so well. That wasn't great. I just phoned a patient yesterday who I haven't physically seen in over a year.

We're vaccinated, they're vaccinated, they just don't want to come in. In this case, to be fair, part of it was transportation. She's married, her husband works, and she doesn't have any family or friends that can drive her on the days we gave her. My instructions were, "You're coming in next time because we need to see you. There are serious, active problems." Even if there aren't active problems, it's a long time. Normally we see stable patients every 3 months. A year is really just way too long to not have set your stethoscope and hands on the patient.

Dr Preston: Hap, what has been your experience with your patients? Many of them are underserved. They're socially not a wealthy population or a well-off population. How did they behave?

Dr Farber: I think obviously we had similar experiences to what Ron and Karen have already talked about. I think a couple of the things that I think need to be emphasized was that doing it by phone alone was just—you just couldn't tell anything. I think, Ron, you probably had this too. When you call them up on the phone, they tell you they are ok. Because they want you to think they're

doing great, they tell you they're doing great no matter what. Whether they're doing good or bad, they're telling you, "Yes, I'm fine."

We do ours through Doximity here. Most of the time it works pretty well because you can at least see the patient, which is helpful. We've also gotten spouses or significant others on Doximity with the patient. We have taught their significant others or their spouse how to put their thumb on the patient's leg so I can see if they have edema or to see on the phone if they look any different. I think the hardest part has been 2 things. One is that oftentimes, especially if you can't see them or can't see them well, it's very hard to tell whether they've gotten worse because their disease is worse or whether they've just been inactive because of COVID and haven't done any physical activity.

Dr Farber: The other part of that equation is most of them have gained weight because they've been less active. They tell you their weight is up 10 pounds. It's hard to determine, is it fluid? Is it because they've just been sitting in front of the refrigerator? It's hard to tell.

The third thing we're faced with now, a lot of our patients live far away. They had gotten so used to this Doximity and tele-thing. They don't want to come in now at all. They want to do everything over telehealth because that way they don't have to drive 4 to 6 hours. They say, "No. We're not coming in. We're doing this forever." Like Ron, there are patients I haven't seen in, God knows how long, a year, a year and a half, 2 years. That's worrisome. Ron, I guess these people have proven they're survivors. They're still out there in a year and a half.

Dr Preston: That tells us how much we do for them…

Dr Farber: Yes.

Dr Oudiz: They're there and then they're not. Who's to say what's going to happen tomorrow?

Dr Preston: That leads me to my next question. There is a tendency now to try to incorporate telemedicine as a part of our outpatient clinic, whether it's PH clinic or not. How do you guys see that as a complement to in-person visits? Is it helpful if we're implementing a mix of telehealth and in-person visits?

Dr Fagan: We, fortunately, have not been pressured to try and make telehealth—We're still being very much encouraged to have everyone in person. I will say that I had an experience with a patient in my office on the phone with a consultant. I was there. It was really a telehealth visit for this patient and a consultant in another city.

I was there to feed additional history, to feed the exam, to do those things. That worked out really well actually because it saved her a 5-hour trip to go see someone else. The patient and I together were able to see that consultant.

I think that that's something that I may want to try and look at a little bit more. I think having a health professional with the patient physically during a telehealth visit, it was really a powerful experience because we were able to really collaborate in the care of that patient. The patient was there, and we were able to have a really functional full visit.

Dr Oudiz: That's Nirvana I think. If we can have that everywhere, that would be a perfect world.

Dr Fagan: It was really nice. Maybe I'm spoiled now, and I can't think of any other way to do it.

Dr Preston: Ron, are you going to implement a mix of telemedicine and in-person clinic?

Dr Oudiz: You mean what Karen was talking about? I wish I could. We have limited resources. That's the problem.

Dr Preston: No, not necessarily to have a multidisciplinary visit, but I was thinking more to do in-person alternating with televisits for the same patient.

Dr Oudiz: I think that's going to stay. I think even in the corporate world. We heard Apple yesterday is going to have some of their workers now work from home. What before was taboo to put on your time card that you were working from home and even though you weren't in the office you get your paycheck, the same thing for patients.

We're never going to really go back to 100% in-person visits as long as the precedent has now been set and this concept is reasonable. I think that we see patients every 3 months and that's the standard for the stable patient. It's up to us and our staff and our nurses and nurse practitioners and allied health to determine whether or not there is appropriateness of that visit. If you chose wrong and you had a telehealth visit, then you bring them in soon.

Dr Preston: Do you use any devices to monitor them? Do you make them do 6-minute walk tests at home?

Dr Oudiz: A lot of them have pulse oximeters. I find it very useful if they're doing daily weights and they can measure their blood pressure and pulse with an automated machine and get me a pulse ox. That's pretty good. Then show me their feet and see what kind of swelling they have.

Dr Preston: There are also apps on the iPhone that can record an EKG strip. Have you used those?

Dr Oudiz: No. I was actually working with a developer of an idea like that long before they got FDA approval for the one device that currently exists. It's a really novel approach. It's just not ready for prime time yet. There are a bunch of issues with noise and with overcalling. Every couple of hours, we're going to get a call from our patients or even their PCPs saying, "You've got to see this patient. They're in a fib," and really all it was they were brushing their teeth.

Dr Preston: Hap, are your patients device savvy?

Dr Farber: Some are, some aren't. I think what Ron alluded to and I think what Karen alluded to, it is clear from this pandemic that telehealth is not going away. There's no question that it's now going to become an integral and

even a larger part of, just as Ron pointed out, business, medicine, everything.

If we're going to accept that fact, then the idea that we need to start working on is how to make these telehealth visits at home better. There are several apps under development to create a 6-minute walk at home, which might be helpful. We'll see if they work, but this is the whole concept now.

The idea, as Ron pointed out, that you can record EKG is not granted. All this stuff is in its infancy and probably has a lot of issues, but you got to figure it's going to get better. Like I talked about, we've taught patients, significant others, how to stick their thumb in somebody's legs so we can see if they have edema.

We can look at their infusion lines with the phone and stuff like that. I think the onus is on us and obviously, the technical people who do all this stuff, to come up with better ways to monitor people at home. It's the same thing as we pointed out. Some patients love it, and they're going to not come in all the time, so you have to have ways to effectively monitor them at home.

Dr Preston: Great, thank you. I do have another question that we could piggyback to the vasculopathy in the beginning. We recognized that our severe COVID patients ending up in the ICU with acute respiratory distress syndrome have different phenotypes. There's one type that has very high oxygen requirements, but their lungs are not very stiff, right? Their compliance is almost normal, versus those who are more typical ARDS patients in whom compliance is very low. My question is, do you think that the first phenotype is maybe more associated with vasculopathy, and are those patients the ones who will develop long-term symptoms after they recover from COVID, should they recover, or is it not clear?

Dr Oudiz: I think it's not clear.

Dr Preston: Has anyone looked at what were the acute phenotypes during the acute infection in those long-haulers?

Dr Farber: It's interesting, Ioana, we've seen a significant number of these long-haulers, which are now called PACS, post-acute COVID sequelae, who weren't even sick enough to be in a hospital. They never got admitted. They were never intubated. They never had "ARDS", they just were sick at home and never got better and in fact got worse.

Dr Preston: I see.

Dr Farber: I would agree with Ron. I don't know that the data are good enough to tell us what phenotype precedes long-term sequelae from COVID.

Dr Preston: Or if you had severe disease, you're at higher risk of becoming a long-hauler or PACS?

Dr Farber: It doesn't seem that severity matters, at least in the people that we've seen so far with PACS, at least anecdotally off the top of my head. I can't make a correlation between the severity of their initial disease presentation and what happens down the road.

Dr Oudiz: It's not obvious.

Dr Farber: It isn't obvious, which is fascinating. You would think that the people who would be more likely to develop ongoing symptoms would be the people who had the most severe disease, but it doesn't appear to be that way.

Dr Preston: Yes. More research needs to be done.

Dr Farber: Ron and Ioana, do you think that the morbidity and mortality among the PH patients has gone up during this year and a half?

Dr Preston: I think the opposite. The way my experience has been in the ICU in the second part of the pandemic, it looks like the population has changed into younger COVID-infected population and maybe just because of the age, but I've had better success at keeping them alive.

Dr Farber: No, what I meant was just PH patients in general over the last year and a half with all that we've talked about, the pandemic plus not being able to see them as frequently or at all. Do we think that if we went back and did morbidity and mortality statistics that the numbers would be different than they've had been, say, the year or two years before this?

Dr Oudiz: We have data, and I'm sure the PHA's registry will be able to actually answer that question leading up to the pandemic and during the pandemic and then now post. I think that they'll be able to get some meaningful numbers because they have so many in their registry.

Dr Farber: Ron, just out of curiosity, do you think among your patients, do you think it's changed at all?

Dr Oudiz: No, I haven't seen it. You know, the problem is that we don't have a ton, we have a couple 100 patients. The problem with a couple 100 patients is sometimes you have a cluster of 3 or 4 who, all of a sudden get hospitalized, and one of them dies and your staff is looking at you like, "What's wrong with us?" Then months go by and nothing happens. That's why I think the registry with more numbers and more diverse centers that are putting into that registry is more realistic to give us an answer.

Dr Preston: Panagis, how were you connected with your patient community, and what was your experience with remote visits during the pandemic?

Dr Galiatsatos: It was tough. I think it works for the right patients, and I think it doesn't work for others. When I say the right patients, there's a lot. There could be a social conversation where some patients may not have the equipment to do a virtual visit, they have to rely on a phone, or their digital literacy just doesn't allow them to really access it well. I think of my 74-year-old mother, she has no idea how to run a computer. She can make a good baklava, but she has no idea how to run a computer.

Dr Farber: That's more important.

Dr Preston: Exactly. We should talk, right?

Dr Galiatsatos: There are some patients that I think a telemedicine visit is perfect. We'll talk about a few medications. Others have a hard time expressing their problems: "I'm having this symptom." In those, I really wish I could examine them.

I'm a lung doctor, and so oxygen level checks are important. Let me put it this way, I think that telemedicine visits were better than nothing, even if they were just used as a checkpoint. I do think there's value in them moving forward, where I think certain clinic visits can be accomplished nicely through that. I'm going to now just take this to a different level.

This is where I would scream that we need advocacy at the government level to allow a universal medical license. Many patients that I see aren't based in Maryland, and for a lot of them, our checkpoints are fantastic. They say: "I love that I could just do this visit with you, from where I live in Maine."

Just an FYI, there's a way to advocate for a universal license because the doctors who specialize in very rare diseases, a telemedicine visit can be really easy for patients. Nonetheless, Ioana, you asked me a great question, and to some extent, and added one more thing to that.

Dr Preston: I think it's a very important thing, and maybe we should gather forces to be heard to advance the care of rare diseases like PH on a global scale, not only country, but in remote areas of the of the world, because there are countries and areas where there are no PH specialists.

Maybe we can offer our expertise on a global scale. Now, talking about disparities, and those patients who do not have access to remote connections, internet, computers, smartphones, and whatnot, have you seen worsening of the disease, more ER visits, hospitalizations from PH, Panagis?

Dr Galiatsatos: The group that I specifically work with are patients with HHT that sometimes renders them with PH. I feel like my comment is going to come across a little biased at the moment because of the patient I'm thinking of is right now admitted to the hospital, we couldn't get her to a telemedicine visit. She's of minority race and coming from a very socioeconomically disadvantaged neighborhood.

I would say the majority of the patients that I've seen are more affluent and more likely nonminority races. Potentially, I think there is some impact from a health equity standpoint. I will say the other challenge is sometimes that patients may have the devices, but maybe not have the digital literacy to use them. That's a big portion of this conversation too.

This isn't an easy step-up approach for a lot of patients to use the software on the EMR to navigate this properly. I think it's a combination between lack of access to technology and how to access it. That probably contributes a lot to health equities. I know that I'm coming across from my own bias of what I've seen.

It seems to be still a bit of the norm for other providers that I've talked to. I think this can be a big advocacy. If we really want to make telemedicine part of the staple of medicine, I think, in the right way, it can be used very well. We just need to make sure that we're not contributing to health inequities, and any that would exist, we have to be prepared to combat them.

Dr Preston: What's your experience, Ron, in different socioeconomic layers in your patient community?

Dr Galiatsatos: I have a mix about half of which are referred patients in a private clinic and the other half are part of the safety net hospital. There are definitely differences. As far as telehealth and access to that kind of stuff, though, I'd say most of them have at least a cell phone, and most of them have a smartphone, but it's glaringly different for those that don't.

There are still some that really are just not technically enabled. Getting around in LA, especially if you're impaired, isn't so easy. Our public transportation system is really bad. Three hours for one-way bus ride for some of our patients, and I've been on those buses myself just to see what it was like to get from my home to my clinic. It took me two and a half hours, and it's 11 miles.

Dr Preston: Maybe we can all team up with the PHA association and try to find solutions to combat these differences in care for our PH patients.

Dr Farber: A lot of it is somewhat generational, and I think it's been alluded to. Even those people who have a cell phone or a smartphone, or even have an iPad or computer access to it, there are a lot of them, especially older patients, who still have no idea how to use it or what to do with it.

For the Doximity thing, you send them a text, then all they have to do is hit on the text and say, "Yes," to access their phone and their camera, and you can see them, but we have a lot of patients who cannot figure out how to do that, unless their grandkid's in the room.

Dr Preston: I can tell you, my parents do not know how to text.

Dr Farber: They don't feel comfortable with it. They've not grown up with it, they don't know how to use it, and they don't plan to learn how to use it.

Dr Preston: Yes. Any other questions from you guys to the group before we wrap up? I think we've touched upon very interesting aspects of COVID-19 and its impact on pulmonary hypertension and vice versa. We've all went through a painful experience in the past year and a half. We hope we will be better at providing care for our PH patients during the pandemic and outside. Thank you all.