National Academies of
Science, Engineering and Medicine

The Pediatric Subspecialty Workforce and its Impact on Child Health and Well-Being

November 2, 2022

Proceedings by:

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P R O C E E D I N G S (11:00 a.m.)

Agenda Item: Welcome and Goals for the Webinar #3

DR. RIVARA: Good morning. I'd like to welcome everyone to this public listening session on behalf of the National Academies of Sciences, Engineering, and Medicine. I'm Dr. Fred Rivara from the University of Washington. I'm chair of the Committee on the Pediatric Subspecialty Workforce and the Impact on Child Health and Well-Being.

The committee's task is broadly to examine clinical workforce trends related to healthcare needs of infants, children, and adolescents, and the impact of those trends on child health and wellbeing and to recommend strategies and actions to ensure an adequate pediatric workforce to support broad access to high quality care and a robust research portfolio to advance the care of all children and youth.

The committee's full statement can be found on the project website, as can the bio sketches for the committee members, and the study sponsors are also listed on the project website.

So the goal of this webinar is for the committee to receive comments from a range of perspectives about the pediatric subspecialty workforce. The first session will provide an update on relevant work by the American Board of

Pediatrics, including preliminary results from a new model for the future of pediatric subspecialty workforce. The second session will cover the pediatric physician scientists and research pipeline from the perspective of funding agencies. Both sessions will include a question and answer panel with committee members and speakers.

This is an open, on-the-record session, but I want to remind everyone, this is an information-gathering only session. That is, the committee is in the process of assembling and examining materials for consideration in its further deliberations to develop our conclusions and recommendations. Everyone should be extremely mindful of the fact that the committee has made no conclusions and that it would be a mistake for anyone to leave thinking otherwise.

Comments made by individuals, including members of the committee, should not be interpreted as positions of the committee or the Academies. The committee may ask probing questions to try to include in our information-gathering.

The committee is also inviting the public to share their experiences, thoughts, and ideas about pediatric subspecialty care. The call for perspectives can be found on the project website.

The first session will include Dr. Laurel Leslie, who is the vice president for research at the American Board of Pediatrics and then Dr. Colin Orr, who is an associate professor at the University of North Carolina, who has been the principal investigator of a workforce model to estimate the future supply of pediatric subspecialty physicians providing clinical care in the United States from 2018 to 2040.

Their bios are both available on the project website.

Session II will come after this. We'll have each of Dr. Leslie and Dr. Orr present for about 10 minutes, and then we'll have about 20 minutes for questions from the committee. So Dr. Leslie.

Agenda Item: Session I: Modeling the Future Pediatric Subspecialty Workforce

DR. LESLIE: I really very much appreciate this opportunity to present to you all on behalf of the American Board of Pediatrics. Since 1992, we've actually been publishing our workforce data, and here's an example. The first book we put out called Manpower Data, the title rapidly changed, because there were a fair number of women involved in pediatrics at that time. But we initially started with certification data, and then we also collect all data on trainees, both in residency as well as in

fellowship, and including those in other tracks like med peds. And then in about 15 years ago, we started adding in what we call our census surveys, and those are questions that are asked at seven different touchpoints across pediatricians' lives. And important for this discussion is we also ask about number of hours worked, percent time in clinical care, et cetera, and that's important information as we start talking about the model.

And then recommendations, we receive from our foundation board of directors that funds the workforce effort, was that we transition our data from pediatrics to data dashboards for more indirectivity, that we partner with the pediatric community to prioritize and synergize workforce efforts, and we contract with outside investigators for more rigorous studies.

I'm not going to go into detail today about the information we have on our website, but we have made the effort to democratize our data and have certification trends over time, residency and fellowship trends over time, geographical information down to the state and county level, as well as results on some of our surveys.

As I mentioned, we get subspecialty demographic information around fellowship trends, gender, race, ethnicity, degree type, other things like where you train, and then we have subspecialty geographic data locating

individuals within their state and county level, based on their work address, and all of this is available on our website.

We have published several papers that I just want to call your attention to. This was a paper that came out in JAMA Peds a couple of years ago looking at geographic distribution of pediatric subspecialists and proximity to specialty care for patients. Colin Orr who will be presenting in a minute just recently published a paper looking at the intersection of educational debt and race/ethnicity, pointing out that about a third of those who self-identify as Black or African American have more than $300,000 in debt and the impact of career decisions and on the importance of mentorship with respect to that.

So these are some of the types of studies we try to take on that have been aligned with the direction of the foundation board's recommendations in 2016. They also recommended that we consider taking our data, since we had multiple points of data, and data that is more inclusive than the AMA master file, and think about modeling the subspecialty workforce. So we contracted with the University of North Carolina Sheps Center, health services research center there, to work with us on developing a model.

The reasons that model was seen as important were for a couple of reasons. One is that we had data that had not been previously used in models. The second was that most national models clump all pediatric subspecialists together as if they were one group, and we were very aware from our data that each of the subs functions independently and has very different profiles with respect to the workforce.

We are also seeing shifting or increasing pediatric disorders such as mental health, autism, eating disorders, gender-affirming care, and with the pandemic changes in infectious diseases, whereas anecdotal evidence of shortages and maldistribution of pediatric subspecialties, particularly in rural and some expensive urban areas, and that we're seeing increasingly pediatric and rural hospitals closing, limiting access. We see this model as an important and synergistic effort to the work the consensus study is doing.

So when we contracted with UNC, we asked them to create a rigorous model that would involve a fair amount of stakeholder engagement. We asked them to create an interactive data visualization and then to work with us to disseminate the results through manuscripts, policy briefs, and other products.

With respect to the model, we used historical data to look at the supply for each of the subspecialties, and then we created eight what-if scenarios to try to think through what might happen in the future and how that would impact the future supply. And then we also were able to look not just at headcount, which older models have done, but also at self-reported proportion of time spent in direct consultative or inpatient/outpatient clinical care.

And we were able to take this down to three levels of geography: the national, the four census regions, and nine census divisions. So we are in the midst of launching the visualization. We are going to have a soft launch this week where we'll release the website, a methods brief, and other supporting documents. We are happy to share that with the consensus study's members if they can keep it confidential through the process of the consensus study, and we're hoping to incorporate some approach to risk adjust around demand.

One of the things the model does not do is capture demand well. We are looking for an omnibus way of addressing demand through risk adjustment that would take into account worsening health status for groups of children.

Our official launch, we hope to be in the late spring or summer of 2023, and we hope to have that parallel

the preparation of a series of manuscripts and briefs that we're putting out to amplify the messages and highlight the findings.

I want to talk about an approach that we've decided to take which is creating a supplement to pediatrics that will be disseminated. The goal is to have this be one summary of a current subspecialty specific workforce information. So drilling down into each subspecialty and seeing them as a unique subspecialty within themselves. They'll be discussing the findings of the model, but not just the model. Also bringing into context other ABP data, subspecialty-specific data, some have conducted surveys with their constituents, others have created their own economic forecasting models. We're asking them to think about what demand is currently for their subspecialty and how that may change, what impacts geography may have, and any wildcards that they see may be happening in the future.

An example of one interesting wildcard is changes in the currently available treatments for cystic fibrosis and how that may impact clinical care, education, and policy. We're asking each of the subspecialty (audio disruption) educational practice, policy, and future workforce research implications.

So we have identified writing groups of three to six for each of the 14 subspecialties included in the model, plus hospital medicine, which was not included in the original modeling as we only recently made the decision to certify individuals in that field. We're working closely with a leadership team of five and with Dr. Alex Kemper at pediatrics to ensure supplement quality, and meeting monthly with the teams and providing office hours with both the Sheps modeling team and the ABP data team.

This is our timeline. I just want to draw attention to two things on this timeline. One is our hope to submit the supplement in around March, and the second is that we're having the groups first write about the demographics and current state of supply of providers within their unique subspecialty, then talk about patient demand and access, then react to the model, and then think through implications, limitations, and conclusions.

The way the supplement is set up is to have an opening prologue, move into a methods piece, there will be a separate piece on diversity, equity, and inclusion and the impact of changing demographics, geographic locations, and prevalence of diseases, and then each of the subspecialties will have their own piece followed by an epilogue.

I'll stop there, but if you have any questions, please don't hesitate to reach out and I'll turn things over now to Dr. Orr.

DR. ORR: Good morning, everyone. I am beyond delighted to have the opportunity to present on behalf of the ABP Sheps team the outcome from the three-years-long project where we sought to project the future supply of the pediatric subspecialty workforce. I am Colin Orr. I'm assistant professor at UNC, general pediatrician.

I am also -- I would not be here without the amazing contributions of Dr. Erin Fraher, who served as PI for the project in the first three years. Mr. Andy Knapton was our modeler who, along with support from Tony Kane, modeled using very rigorous and robust data in order to produce the estimates that you see here and the visualizations that we will be displaying were produced by Mr. Evan Galloway, and of course this would not be possible without the amazing support provided by Dr. Emily McArthur(ph.) who served as the project manager for the project.

I just wanted to take a moment to say thank you to the American Board of Pediatrics Foundation for funding this project and for being an amazing collaborator and stakeholder as we work through the multiple iterations for the model project.

So to provide an overview of where we hope to go in the next 15 minutes or so, we sought to provide a model that projected the supply for 14 subspecialties at multiple levels of geography, including subnational levels, and this builds upon prior work by having better data, stronger methods, and really important collaborations with key stakeholders, included among that was the American Board of Pediatrics and also having interactive data visualization that will allow individuals to customize the findings that are most applicable to their subspecialty and region in the country.

And we'll dive a little bit deeper into this in subsequent slides, but without this model, the story of the pediatric subspecialty workforce would be one of growth if looked at in aggregate. However, our data suggests that this is not necessarily the case, recognizing that there are multiple societal and global events occurring that can impact society and medicine.

The model, in addition to having the baseline model, which we will spend the majority of our time discussing today, there are also scenarios built in where we can see how different changes in the fellow pipeline into subspecialties or other events will subsequently impact the supply of subspecialists in the future.

And also we will talking a little bit more about the dissemination of the model with respect to different target audiences. We know that all the subspecialties are different and have different obstacles and opportunities, and it's important that the model is placed in the context of the individual subspecialty.

So here are the 14 subspecialties that are included in the model that have certification through the American Board of Pediatrics. As Dr. Leslie mentioned earlier, unfortunately pediatric hospital medicine was not included in the model due to the lack of robust data necessary to produce stable estimates in the model. However, we do recognize the importance of the pediatric hospital medicine fellowship on the future pediatric workforce. So we are working closely with individuals to have an article in the supplement which will discuss the current state and potential future directions of the pediatric hospital medicine workforce.

We are going to be talking a little -- we're going to be diving a little bit deeper into the different components of the model. I know Dr. Leslie mentioned this in her slides. Just wanted to reorient, because this will be really important for the future visualizations that we review together.

So we will be having the headcount, also known as the number of individuals and also we'll have the PCT, the self-reported portion of time spent in clinical care. These are going to be two very important model outputs that we will be discussing, and importantly, we'll be talking at three levels of geography. We'll be looking at these different model outputs at the national level and then also at the census regions and census division levels.

As a way to orient the audience to the different levels of geography that we will be discussing, we have our four census regions. The west, midwest, northeast, and the south, and then within each one of those regions, we have our divisions. I would like to draw particular attention to the west south central region, because we will be sharing some data that has direct implications for this region, and this is overall in the census region of the map.

On this slide, we have the conceptual model for the variables that were considered as the model was being developed. So things start with the current workforce, and then we also think about what does the trainee pipeline look like, how do trainees and practicing physicians and out-of-country physicians diffuse within the United States across the different census regions and divisions? How does workforce exit impact the future supply? And

importantly, it's really important to consider not just the number of individuals within a given subspecialty, but also the amount of time spent in clinical activities is each individual presenting, and that's why we have this really important metric or the idea of the proportion of time spent in clinical care. All these different variables are added together in order to produce the projected supply of the future of the pediatric subspecialty workforce.

So our model is accounting for a few different factors that affect physician behavior. So we're looking and considering the individual subspecialty. We're also considering the location or the geography. We're considering the age of the individuals. We are also considering an individual's gender. Although there are a lot of discussions around race/ethnicity, due to data availability this was not included in this version of the model. However, we're hopeful that as data becomes more complete, we'll be able to add this variable to the model output.

So how does this model build upon past versions of workforce modeling? One is it has separate forecasts for the 14 subspecialties. It has output at multiple levels of geography, and also accounts for physician movement after training and during one's career. It also utilizes multiple sources of robust data, including data

provided by the American Board of Pediatrics. Being able to have a very interactive display of the model output is another strength of the model, and this was developed with significant stakeholder input to make sure that the output at different phases of the model development seemed plausible and also there's a lot of stakeholder engagement as we thought about what scenarios would be most applicable for the individual subspecialties?

We're really excited, because as we mentioned earlier, this not only captures the number of individuals within an individual subspecialty, but also captures the unique contribution of clinical time. So what did we find? The three big messages that we're very excited to discuss are that there are differences by subspecialties. There are also geographic differences, and we will also highlight the importance of diffusion.

So without the model and if we were to take all the subspecialties in aggregate, the story that we would have would be one of growth, and here is an example of the visualization produced by Mr. Evan Galloway. So we have the years on the x-axis, and we have the headcount on the y-axis, and we see that there is a significant increase in the total headcount of individuals across all subspecialties.

However, when we divide into the individual subspecialties, 14 in total, the axes are the same as in the prior graph, we see that the story of growth becomes a little bit more nuanced, where there are certain subspecialties that continue to -- there are certain subspecialties where the projection is one of continued growth, and there are others where the supply projection has growth; however, may not be at the same rate as other subspecialties.

And then building on the other strengths of the model, we are able to look at an individual subspecialty within an individual region of the country. So to orient everyone to the graph at the bottom of the slide, we again have our year at the bottom, but the axis on the y has changed slightly. So we have the number of physicians who are spending time in clinical activities with the denominator being children, 100,000 children less than 18 years of age and less.

And here you can see that there's slightly more nuanced data results here. In the green, we have the New England region, where the projection for the number of adolescent providers per 100,000 children 18 years of age and older, we see a continual increase. However, when we look at another region, for example the mid-Atlantic, we see that the number of adolescent providers per 100,000

children is actually one of decline. So having the ability to look at individual subspecialties at different geographic regions, we're able to see the actual complexity of the pediatric subspecialty workforce.

In this figure, we have a map of the United States, and we have the areas where there are current adolescent medicine programs and fellows per 1 million children. As we see and to orient everyone to the scale, the different shades of blue highlight the number of adolescent medicine programs and fellows per 1 million children, and we see the New York, Pennsylvania, New Jersey, the New England part of the map, where there is a deeper density of blue, suggesting that there's a higher concentration of training programs and fellows, and if you remember back to our prior figure, that is also the region of the country where the supply projection is one of increased ratio of number of individuals relative to children.

Of course, this map is any associations that we see are ones of association, not causation, but as we think about maldistribution of the pediatric subspecialty workforce, it becomes increasingly important to think about where the training programs are and if the training programs are located in areas where there's projected growth of children.

So, again focusing on the adolescent medicine subspecialty, we know that in terms of the supply of the adolescent medicine workforce, the west/south-central is projected to have a 1 percent increase in the total number of adolescent providers, where the mountain region is projected to have a slight decrease in the number of adolescent providers. However, when we think about the denominator and the areas of the country where growth is projected to occur, we see that the west/south-central division is projected to have an almost 30 percent increase in the number of children, and the mountain region is projected to have a 20 percent.

So we can see that the areas of projected growth in terms of number of adolescent providers may be misaligned with the projected growth of children in the country.

Coming back to our conceptual model, we wanted to take this as an opportunity to reorient everyone on the importance of diffusion. As we were going through the iterative process of reviewing the model output, we stumbled across a very important or interesting finding as it relates to the diffusion both of the fellow workforce, but also the practicing physician workforce as it relates to the pediatric subspecialty workforce.

So our model accounts for three different types of diffusion. One is where are fellows moving after they complete their training? We also then look at the probability that a subspecialist who is in practice moves between census regions and census divisions. And importantly, we also look at another source of diffusion, and this is the probability of an individual who has left the United States and then returns to practice in the United States.

Here we have a visualization, which highlights or demonstrates the impact that diffusion can have on the supply of the pediatric subspecialty workforce. On our x-axis we again have the year, and on our y-axis we have the headcount, and this is looking specifically at the mountain census division, total headcount for all subspecialties.

So as a disclaimer, on the visualization, the only line that will be seen by the end user will be the top green line, but for illustrative purposes, we are showing the other lines, and so the blue line assumes the baseline projection of the supply, with no diffusion. The second -- or with the baseline assumptions of the diffusion after training. The orange line looks at or takes into consideration the diffusion of the practicing workforce, and then the green line looks at the impact of all types of diffusion and currently included in the model. So the

fellow, the practicing physician, and the out-of-state return diffusion, and we can see that for the mountain census division, considering all different types of diffusion into the area, can have a significant impact or can have a notable impact on the supply of the subspecialists in that division.

Thinking about not just the number of individuals within a given subspecialty but also thinking about the amount of time spent in clinical activities, in order to provide access and care to the different children across the country, is another important output that the model can produce.

So calculating and finding amount of time in clinical care is a very important question and a lot of care needs to be taken into considering how this is operationalized. So we were able to operationalize this by taking the responses of two questions. Question one, on average over the past six months, approximately how many hours did you work each week? And then the second question is what proportion of your total professional time is spent in each of the following tasks? We took the responses to these two questions, specifically 1 and 2-a, and were able to calculate our variable that we have named the PCT, or the proportion of time spent in clinical care.

Here we have the impact of -- we can see why it's important to consider not just the total number of individuals, but also the PCT. The x-axis, again, has the years, and for the y-axis we have with the blue line demonstrating the headcount, and then the orange line below that shows the amount of time spent in clinical care, and I know after our presentation there will be a discussion on the research conducted by subspecialists that the discussion of research can explain the delta between the blue line, which is total number of individuals, and then the orange line, which focuses exclusively on the amount of time spent in clinical time or activities.

If we've learned nothing else over the last couple of years, things are rapidly changing and there will be events that cannot be predicted. So building flexibility into the model is really important. So we have the baseline model, which is used for historical data to forecast future supply. Things change. There are changes in the workforce, changes in society, changes on a global scale, such as a pandemic. So there are opportunities for us to see how different changes might impact the future supply of the subspecialty workforce, and this is accounted or addressed by the development of scenarios.

What scenarios are included in the model? There are scenarios which focus on fellows, and this is the

pathway into the subspecialty workforce. There are two scenarios that focus on this, both an increase and decrease in the number of fellows. There are two scenarios which focus on changes in the proportion of time spent in clinical activities, and this is also an increase and decreasing scenario, and then there are scenarios which think about how would different types of earlier exit than assumed in the baseline model impact the supply of the subspecialty workforce.

And finally, we have a set of scenarios which are the best in terms of growth and also represent the worst case in terms of early decrease, decreased fellow entry, and decreased time spent in clinical care or activities.

As an example, this is how the early exit scenario where we have individuals have an increased probability of exiting the workforce prior to the assumed retirement age. Here we have the x-axis and then again we have on the y-axis the headcount. The blue line overlaps quite nicely with the green line, which makes it difficult to discern, and so the blue line is the baseline. The orange line, we have an increased level of exit at all ages above the really low baseline probability of exit at all ages, and then the green line looks at the increased level of burnout specifically among those who are in their midcareer phase of their professional lives, secondary to

burnout, increased childcare needs, et cetera, and looking at these different scenarios and the impact of the future supply of the workforce, we can begin to make conjectures about how different types of exit will impact the supply.

Really thankful for having the opportunity to present some of our findings, and we're beyond excited to have the opportunity to work with pediatrics to put the findings of the model into context for each of the individual subspecialties, and we welcome any questions that you may have. Thank you for your attention.

DR. RIVARA: Thanks very much. That's really terrific work, very important work. We'll now take questions from the committee. Please just raise your hand and I will moderate the questions.

DR. GARFIELD: Thanks. I appreciate both of you taking the time to explain the model to us. It seems really interesting. I am curious to what extent, either on the supply or the demand side, you're incorporating financial considerations or even in the scenarios that you're considering, if you've thought about that as one input that you could grapple with. Thank you.

DR. LESLIE: Maybe I'll start, Colin, and then you can add anything. What we didn't show was that for each of the scenarios, we have a series of factors that may influence those, and we certainly see economics driving

that. So I am sure you all have read Eva Catenaccio's papers on the salary differentials between pediatric, different pediatric subspecialties as well as comparing adult to ped subspecialties. So that economic impact of people possibly deciding not to go into a subspecialty because of a reduction in their net lifetime earnings would be one of the factors that might influence a decrease in fellows.

So for each of the scenarios, we have a background table that lists some examples of possible factors that would lead to that decrease. Colin, I don't know if you want to add anything.

DR. ORR: No, that was perfect.

DR. FOREST: Hey, Colin, great work. Thanks for presenting that. In that interval that you were focusing on, 2020 to 2040, the child population in the United States is projected to increase about 3.3 percent, 3.5 percent, if I remember, and somewhere around the middle of your talk you were showing that the percentage increase in the subspecialty workforce was about 70 percent, 69 percent, with variation by subspecialty. So I wonder if you could summarize the supply findings that you had per population, because it seems like the pediatric subspecialist supply is increasing at a much greater rate than the child population. Thanks.

DR. ORR: That's a really great question, and I think it highlights the power of the model to begin to address some of these more subtle findings. In terms of overall growth of the subspecialty workforce, there is a pretty robust growth, but I think the question becomes is it the right subspecialty, is the growth equitable or the same across all the subspecialties, and then is it equitable in terms of where the projected growth of children are in the country.

So I think to really begin to address your really important question, I think looking at individual subspecialties, particularly ones that may not have the same level of projection and growth, looking at those per 100,000 children in census regions where there may not be as large of a concentration of training programs. I am in the south, and I'm slightly biased, so I'm really interested in thinking about growth in our region of the country, because I think some of the more recent data from the census bureau suggests that the south is projected to increase in terms of its child population.

However, the northeast may not have as robust growth, but as we saw with the adolescent medicine example, their concentration of the programs and the subsequent headcount for providers, adolescent providers specifically, is in that region. So I think that there are a lot of

opportunities to do a deep dive of not just the numbers but where the numbers are and how that relates to where the projected growth of children will be.

DR. RIVARA: While waiting for other questions, I'll give a question here. Did you model at all where these subspecialists will be practicing? Are they going to be practicing in children's hospitals, academic centers, community hospitals?

DR. LESLIE: I'll say, we did not model that per se. We modeled it in terms of geography at the census and sub-census level. But not with respect to that. The other thing we didn't take into account is telemedicine. So the capabilities of people to serve in an area where they're not actually physically located, those are all areas that we can speculate on, but we weren't able to model down at a lower level than the census division and still might maintain the statistical strength of the modeling process.

But those are important trends we can watch in other ways. So we do collect data reporting on what location people are working in at the ABP, and we can track that data over time to look and see if there are changes. Right now, we have much fewer subspecialists that are in outpatient settings not affiliated with academic medical centers compared to adult medicine where that's highly

common. So for the most part, subspecialists tend to be in academic medical centers compared with the adult world.

DR. GIGLI: Thanks for this presentation. I think my question is for Dr. Leslie, and you mentioned that as part of the supplement you're looking at access in the different specialties. Do you have any innovation or unique ways you're thinking about defining access to the different specialty providers?

DR. LESLIE: Yeah, and Kristin, I'll just also bring up that this does tie in with your work with the nurse practitioner data and the physician's assistants data, because a number of these subspecialties are trying to move towards more team-based care, but we also know there are limitations in the growth of the advanced practice providers that are interested in pediatrics, particularly not neonatal or ICU-based services.

So one of the things the model is not taking into account is increased use of other advanced practice providers. It's also not taking into account, as I mentioned, telehealth as an option for increasing access. Our thought with the risk adjustment is if there's some way we can modify the slope of the line to capture increasing disease burden, either for a variety of reasons, decreasing insurance, decreasing access, decreasing -- increasing poverty, decreasing health status, climate change, et

cetera, that we can also demonstrate how the need might change based on policy decisions that we make. We're in the midst of working with a couple of people to think through how we might do that. And if any of you have ideas, please reach out to us.

DR. DEL REY: I am calling from Spain, by the way. Question: Colin, thank you very much and Dr. Leslie, also, thank you for presenting. I know you presented to us when we were writing the initial phases of the paper, but there was a question I still have. Does the model -- I know it separates geographically, but does it say academic centers versus community in that geographic distribution? We were trying to look for that when we talking, for example, for pediatric emergency medicine, because most of the people seek care; where do they seek care and how do they seek care in academic -- you know, children's hospital for example, versus community hospitals. Does that -- isn't the count of that geographic is just where the provider is located geographically in the U.S.A.?

DR. LESLIE: Colin, do you want to start with that one?

DR. ORR: Yes, Javi, I hope you are enjoying your time in Spain. Slightly jealous.

So in terms of the model outputs, we felt comfortable with the current subnational regions due to a

concern for having stable estimates in terms of number of people and also for privacy. So in terms of the model outputs, it does not take into account the location of a freestanding children's hospital or other ED that might provide care to children.

We do think that that is a really important element that we hope that the writers of the supplement will discuss. But the method we showed during the presentation is our approach to kind of think about where are -- we used adolescent medicine as an example -- where are the training programs and is there any association of the location of the training programs and then the location of the practicing workforce. So I think those are our initial approaches to try to begin to answer that question.

DR. LESLIE: The other thing I will just add, Javi, is we do have our surveys that we do with every pediatrician when they're reenrolling in maintenance and certification, and we have between a 50 to 66 percent response rate, depending on the year, but we do ask what is the setting you're working in and you can go in and drill down in the dashboards. So you could say hospital medicine or ED medicine and see what they say in terms of the location that they're working in, and we've tried to align our questions around practice with the American Academy of Pediatrics so that the two types of research that are

conducted by both can be easily comparable. So that is there, and it's not necessarily incorporated in the model, but it is there for additional information that can inform each of the subspecialties' individual papers.

DR. DEL REY: That is great to know. That's very useful for us, at least for our subspecialty part.

DR. FOREST: Second question, so much in this presentation, it's really exciting to see, but I do wonder about the diffusion component of the model. So, quick question, the first is -- I have two questions -- is the model available in terms of opening up the black box? Can we look at how the assumptions that are being made, what they are?

And then second, this might be more a feel kind of thing, like I'm asking you to give us your opinion here, but to what degree is the maldistribution of subspecialists related to the maldistribution of training programs, because of the high probability of people staying where they train? You might answer that in part by telling us what's the probability that you use that people who train in location A stay in location A. So both the black box as well as the degree to which the maldistribution is explained by the location of the programs.

DR. ORR: These are really excellent questions, and I think in terms of beginning to answer the black box

question, one, in order to provide as much transparency and background information and as much information on the assumptions that the model contains, Dr. Fraher and her team are working on a standalone separate methods paper, which really goes into all the assumptions of the variables that are included in the models, because no model is perfect and every model has limitations, and it's really important to understand the assumptions in order to really place the model's findings in the context. So that's one approach that we are having in order to provide -- to ensure that there is confidence with the robustness of the models, which are really robust.

And in addition to the methods paper on the actual interactive visualization, there will be dedicated sections information related to the methods and how the outputs were produced.

In terms of the question about the probabilities of diffusion and the importance of the location of the training programs, I think some of that is outside the scope of the model, because the model can't necessarily produce an estimate saying if we placed a training program in the south, for example, for adolescent medicine, that will increase the supply of adolescent medicine specialists in the south. We can't say that. But we can say that

there is an association between location of these training programs and the supply of a workforce in a given region.

DR. LESLIE: If I could just add to that really quickly, it's not just training location, but it's also the fact that most pediatricians are in dual career couples, many of them with other physicians. So you're not just looking at that individual's ability to diffuse, but the capability of the partnership to diffuse, and then we're also seeing with some of the antiabortion stuff that's going on the American Board of Obstetrics and Gynecology is very concerned about people not applying to programs that are in certain regions of the country, and we are concerned, frankly, about the same thing with respect to transgender care and abortion.

So there are also political factors that may impact where people decide to live and practice. So we need to attend to all of those.

DR. ZIMA: This is excellent work, and I just had a question. With your database, is it feasible to link it to some of the other publicly available datafiles on social determinants of health? I'm thinking about the American Community Survey or the U.S. Household Pulse Survey.

DR. LESLIE: We talked about that. The problem is the model doesn't go down to the geographic communities that those utilize, but it's a fantastic idea. We may not

be able to do that with the model. We may be able to do it with our own data where we're not incorporating so many variables.

DR. ZIMA: Yeah, because when I saw Colin stratifying by the census divisions, the census regions, it might be a little more exploratory, but Laurel, to your point about thinking about the burden and the complexity of the disparities of care. I just throw that out. Because sometimes we can go down to the census tract level as well. Thank you.

DR. RIVARA: Thank you. Let me just ask a question, because the next part of this webinar today is going to be on physician scientists, and you modeled basically the clinical FTE versus overall FTE, the proportion, and you said the delta was mostly research. How does -- what is that delta? Is it like 20 percent, 30 percent FTE, and how does it differ by specialty?

DR. LESLIE: We published a paper on that, and I can send that to you all using data -- it was probably about five years ago. So the proportions do vary. Each of the subspecialties has its own flavor with respect to research and how much it attracts people into research. So I can share that with the group. It's not incorporated into the model, because it focused just on clinical care.

DR. RIVARA: But you did that percent FTE. So what was that clinical percent FTE? Is it 70 percent or what did you use in the model?

DR. LESLIE: It takes into account -- we basically use Monte Carlo processes. So it's taking into account all the different individuals' data we've got about hours worked and where their percent time was. So it varies based on the individual and then within the sub. So there's not one single ratio we're using.

DR. DEL REY: For my own understanding, following what Dr. Rivara is saying, so if you take one hour, peds emergency medicine, into in the model, does it assume that that person is going to be working 70 percent clinically? Does it assume it's 40 percent clinically? Because it makes a big difference, right? Numbers versus amount of clinical time that is devoted to those geographic areas that are covering. Are you using for each subspecialty the average of a brand-new faculty in an academic center gets hired at this percentage, or how do you calculate that? Or does the model take into consideration that calculation?

DR. LESLIE: Colin, do you want to answer that, or do you want me to answer that?

DR. ORR: I can take a first attempt at it. So that's another great question thinking about really kind of like the arc of an academic career or the career of a

physician, and with the model, we're limited to the responses on the surveys, but we do have age that's also included in the model, because we know that as one's professional arc and as one gains more experience, also age, that the amount of clinical time can vary over that life course, and so by taking into account age and then also the responses to those two questions, the model does take into account an individual's contribution and adjust that also for their age. So it's not necessarily -- it's the PCT that we see for the model is really an aggregate of all the responses that we have also taking into account the age and gender.

DR. RIVARA: Well, thank you. I wish that your report was about six months ahead of schedule here, because we clearly would like this information to inform our own report here. But it sounds like maybe we'll get some of this information in early spring. Thanks very much. Really appreciate it.

We'll move onto the next part of this webinar. It will be moderated by a member of our committee, Shafali Jeste, who is the chief of neurology at Children's Hospital Los Angeles, and professor of pediatric neurology at University of Southern California Keck School of Medicine. Shafali?

Agenda Item: Session II: The Pediatric Physician Scientist & Research Pipeline

DR. JESTE: Great, thank you, and, yes, that last discussion was very timely and a nice segue into our next section. So the objective of this session is actually to hear from leaders from funding agencies about their perspectives on pediatric research and specifically the physician scientist pipeline and workforce, which is an area that we have really been thinking quite a bit about, and it's a theme that's been raised in various webinars, but we haven't had a real focused discussion on it, and we're very lucky to have some incredibly thoughtful speakers on this panel to help us with this, and you'll see our list of speakers here. We have Dr. Ericka Boone from NIH, Dr. Rohan Hazra from NIH and specifically NICHD, and then Dr. Louis Muglia from the Burroughs Wellcome Fund.

Before we launch into the presentations, just to give you a quick overview of what the session will look like, we're going to have each of the speakers present consecutively, and then after the last presentation, we'll open it up for questions and a panel discussion. You each have bios for the speakers available on the webinar website. I'll introduce each speaker before they each speak.

So I'm going to start by turning it over to Dr. Ericka Boone. Dr. Boone is the director of Division of Biomedical Research Workforce within the NIH Office of Extramural Research, OER. In this role, Dr. Boone provides leadership on the development and implementation of programs to really sustain and enhance the diversity of the future of our biomedical research workforce. Also, very relevant to this webinar, she also was the director of the NIH Division of Loan Repayment.

With that, I'll turn it over to Dr. Boone. Thank you for joining us today.

DR. BOONE: Good afternoon. I have been asked to come today to talk about an NIH-wide initiative that is focusing on enhancing diversity, equity, inclusion, and accessibility, not only within NIH, but across the NIH supported workforce. So I think that my presentation might be a little bit different than my colleagues this afternoon.

I'd like to start off by saying good afternoon and, like I said before, I want to take a few moments to speak with you about the NIH UNITE initiative, and in 2020, UNITE was established to identify and address structural racism and promote equitable presentation and inclusion within the NIH and greater NIH supported scientific community. So with representation from across the NIH

institutes and centers, UNITE aims to establish an equitable and civil culture within the biomedical research enterprise and reduce barriers to racial equity within the biomedical research workforce.

So the UNITE initiative is being informed by five different committees that you see here, U-N-I-T-E, and like I said, there are experts that are representative of the 27 different NIH institutions and centers, and these committees are developing specific plans and making recommendations to catalyze new action to address racial diversity, equity, and inclusion within the biomedical research workforce. UNITE has a rather robust website. You can see that on the lower lefthand side of the screen.

If you have a moment, feel free to review the site and I believe that we have a progress report that's now listed on the site as well. So for a brief explanation of the five committees, the role of the U committee is to utilize quantitative and qualitative data to gain -- that has been gained from listening sessions that were conducted not only with NIH staff, but with members of the extramural research community to better understand their experiences related to structural racism and to use this information to develop actionable solutions. So this committee has released RFIs and has hosted several listening sessions targeting many different segments of the research community

as well as NIH to gain additional perspective. So I'm hoping that when those calls for RFIs went out and those listening sessions, that I'm hoping that some of you were able to participate in those efforts, and I'm sure that we will have more coming up. So if you're able to participate in those, we really do want to receive your feedback.

Next is the N committee, and this is focused on the assessment of current programs and developing recommendations for sparking new research programs, funding, and career development opportunities that are related to health disparities, minority health, and health equity. As a part of this committee's efforts, NIH released several funding opportunity announcements that are focusing on funding transformative research approaches that address health disparities as well as health equity.

Moving on to the I committee, the I committee is focused on helping NIH to take more of an introspective look within our own processes and policies that impact staff, including our intramural researchers, to help promote equity within our internal NIH workforce. So I love the fact that we're also including I within this, because sometimes I feel like NIH can be a bit paternalistic -- and I have to remember that we're being recorded. But I feel that sometimes we're a bit paternalistic. So we're very readily aware that we

definitely have a large impact on how the extramural community functions, but I think that if we are sweeping around other people's front doors, then we probably need to sweep around our own as well.

So an example, some of our intramural or our I committee work, this committee has helped to promote equity -- I'm sorry, we've developed several initiatives including here within NIH, including the antiracism steering committee. This is comprised of more than 500 individuals, and this group aims to help NIH address racial and ethnic equity within the internal workforce.

Next is T. The T committee is helping to foster greater transparency of NIH available data and communication between internal and external stakeholders and, finally, is E. The E committee is focused on promoting change within the extramural research community, and I serve as a co-chair for the E committee for UNITE. So I'll take a bit more time to talk about that one.

Okay, so the charge of the E committee is to identify policies and practices that contribute to a persistent lack of inclusion and funding inequities within the extramural research ecosystem, and then to develop strategies to address them. So the goal of this committee is to aid NIH in achieving meaningful diversity and

inclusion of personnel and funding equity as a value as well as a conscious practice.

In order for us to be able to do so, the E committee has developed a framework around four main contributing or causal factors of inequity that we believe are serving as the cornerstone for E committee's efforts. As you see, we have limited resources and capacity-building at HBCUs, TCUs and other minority-serving institutions, or MSIs. So this particular subcommittee of E committee is focusing on identifying and providing recommendations to strengthen workforce, institutional and infrastructure capacity at HBCUs, tribal colleges, and other minority-serving institutions that don't have a history of receiving high levels of federal funding from the NIH.

Next is inequities in NIH processes and policies that can contribute to funding inequities. So this particular subcommittee is focusing on areas including peer review, interactions of NIH staff with applicants, especially those from underrepresented groups in science and more.

Then is promoting equity at extramural institutions with a focus on environment and culture. So this particular subcommittee is focusing on identifying evidence-based interventions to address a culture of inequity across extramural institutions.

And then lastly is the subcommittee that is focusing on enhancing career pathways for underrepresented groups in science. So this group is reviewing and evaluating our existing NIH programs in an effort to identify gaps and successful metrics that can be scaled up as well as considering additional resources and strategies to help address ongoing barriers that are faced particularly by underrepresented groups in science.

So committee E has initiated more than 13 different implementation teams to catalyze some of the recommendations that we have developed into action. I won't talk about all of these different implementation teams. This is not the totality of the implementation that will be happening as well.

Our efforts are ongoing, but I did want to make sure that I showed to you some of the implementation teams that we have, as I said, trying to catalyze some of our actions.

I do want to alert you that a more extensive overview of UNITE activities and progress will be provided at the December 9 NIH advisory council to the NIH director meeting. So if you all are going to be attending, you will hear much more about UNITE activities.

Much of our activities for UNITE E can be consolidated into these three buckets. So funding

opportunity announcements, policy changes that need to be -- or that we are thinking about implementing and moving forward, as well as other areas that are related to outreach and engagement.

I'll take a moment to take about a few of the recommendations and the implementation team actions that were listed on the last page. So, I want to talk a little bit more about some of these planned initiatives. The first one is focusing on promoting equity across extramural institutions with a focus on environment and culture.

As you all are well aware, institutional culture is defined as the perceptions as well as meanings that are attached to the policies, the programs, the practices, that individuals experience within their own institutions. It's kind of akin to the personality of an institution. So it's the bedrock upon which everything exists and has a profound impact on the work environment and the ability of every person to be able to succeed or not succeed.

So while many say that inclusion, diversity, equity, and accessibility are critical for harnessing the full range of human creativity and talent to drive innovation, I've heard this over and over again, people of color and other individuals from minoritized groups continue to be underrepresented and face barriers to

academic advancement that individuals from other majority groups just don't encounter.

To help address this, UNITE E is developing a framework for funding opportunity that's enabling institutions to make use of validated instruments like the audit to conduct organizational climate assessments and self-studies to better understand their own institution-specific DEIA challenges and then to develop action plans to address those. Not shown here, however, and as a counter to the institutional assessment, UNITE is also establishing an institutional excellence in DEIA prize award, which will provide recognition and acknowledgment to institutions that are implementing innovative programs and interventions that are leading to culture change within their institutions, have resulted in increased success, retention, as well as advancement of students and faculty from underrepresented groups.

Also, because the work of advancing DEIA efforts typically falls on researchers from underrepresented groups, UNITE E is working to establish a five-year excellence in DEIA investigators grant, which will provide simultaneous recognition and support for outstanding research being conducted by these investigators and to help them with their ongoing DEIA efforts. Many times, these DEIA efforts are voluntary and are unrecognized, and we

want to acknowledge that this work is important for expanding and extending innovation within the biomedical research workforce, so we feel that the implementation of this program will go a long way to helping to do so.

Lastly, UNITE E is partnered with professional societies, for example, AAMC, FACP, and AAU, to find ways to encourage and incentivize, and maybe even apply a little bit of pressure to academics institutions to update their promotion and tenure expectations and policies, to meaningfully factor in faculty efforts advancing diversity, equity, inclusion, and accessibility endeavors at their institutions.

Next, planned activities that are focusing on policies and procedures. With regard to PO and SRO, program officer and scientific review officer, training opportunities. Program officers or POs here at NIH represent the front door and first point of contact for NIH investigators. So UNITE E is developing targeted program officer or PO and scientific review officer, SRO, training modules, to address recognition and mitigation of implicit and explicit racial and ethnic bias, institutional reputational bias, favoritism, fair and equitable access, when considering interaction with all applicants, and all of these factors were identified as key areas of

improvement during those listening sessions that I told you about earlier.

New reporting mechanisms. Harassment in any form represents a real clear and present danger to scientific progress, and in support of this and to assure that we make this explicitly evident to the extramural community, UNITE E worked with NIH to update the NIH harassment portal as well as the web form, to explicitly include discrimination along with sexual harassment. We've also updated our antiharassment notice as well. What we've found is that many of our harassment policy was really focused on sexual harassment, but we need to really be focusing on other things that are impacting or other types of harassment and discrimination that are impacting individuals within their extramural communities.

Further, on May 10 of this year, NIH implemented a congressional provision to address harassment at NIH-funded institutions, so this provision mandates that NIH-funded institutions report to NIH when principal investigators or other key personnel are removed from an NIH-funded grant due to concerns about harassment, bullying, retaliation, et cetera.

Career pathways. We have really talked a lot about our efforts to enhance early exposure to science education opportunities. Everyone here on the call

understands that the later that you introduce certain topics to individuals, especially those from underrepresented backgrounds, the harder we tend to think that they are and the less likely we are to pursue them as an academic career. I am not a physicist for a reason. I am not a mathematician for a reason. But we have actually expanded NIH participation in the science education partnership award, or the SEPA award, that we fund here at NIH, and now more than 20 NIH institutes and centers are participating and funding SEPA awards, and this is a sharp increase as compared to previous years.

UNITE E DEIA and mentoring FOA -- FOA language implementation team is also developing a framework for further revising and enhancing DEIA and mentoring language, as well as expectations within the T32 FOAs. And we're going to be potentially expanding this to be included within fellowship applications as well. And this is a means for us to try to better support and strengthen research training environments for those individuals who are early in their research careers.

Another one of our implementation teams is creating a diversity supplement matchmaking platform, as a means to increase participation of individuals from underrepresented groups in the SBIR and SCTR product development entrepreneurship and research training

opportunities. This platform, in essence, enables companies to identify students or faculty from underrepresented groups as well as from minority institutions that are looking to explore opportunities with small businesses, and vice versa.

Lastly, I wanted to share a little bit about UNITE E's effort with regards to capacity-building. UNITE E is developing several funding opportunity announcements to support needs assessments and action plan activities to support institutional and infrastructural needs, as well as instrumentation needs at minority-serving institutions. This not only helps them to expand their research capabilities, but also their teaching and education opportunities with the students that are there on campus.

And what we found with some of our listening sessions is that some of these institutions acknowledge that they didn't have the funding to support some of their instrumentation needs. As well, they didn't have some of the funding to support the contracts that were needed in order to provide upkeep with this instrumentation, so we're developing FOAs to help to address that.

We also have a keen focus on further expanding support for growing capacities of offices of sponsored programs and strategically enhancing our communications and outreach with minority-serving institutions. While we

understand that minority-serving institutions and particularly HBCUs and tribal colleges provide the foundational education for many investigators that are from underrepresented groups, we're not really creating space for these institutions to participate in the biomedical research workforce, so the efforts of this subcommittee are really focusing on engaging with these communities to determine what are the needs of these institutions and then providing a platform or providing a process by which we can assist.

As I close, I'd like to thank my E committee members. I'd also like to thank you for the time and attention that you have given to me over the last few minutes, and I will cede my time. Hopefully I haven't run over.

DR. JESTE: That was fantastic, thank you. And we'll have, we'll make sure you have time for questions and discussion at the end.

Thank you very much, and now we're going to move it over to Dr. Rohan Hazra. Dr. Hazra is the director of the Division of Extramural Research at the Eunice Kennedy Shriver National Institute of Child Health and Development, or NICHD, which funds of course quite a bit of pediatric research, and importantly, he also co-chairs the NIH pediatric research consortium, which is a trans-NIH

initiative started in 2018 that leverages pediatric research expertise and resources across the 27 NIH institutes. So I'm going to turn it over to Dr. Hazra. Thank you for joining us.

DR. HAZRA: Great, thank you very much for having me and including me. I do not have slides, and really part of the reason is my presentation is really coming from a very nice conversation I had with Shafali in September, and then some follow-up questions that she provided me. We've started doing some of these analyses, but unfortunately almost all of them are still unofficial estimates, and so not ready for public reporting, but I can at least share with you sort of semi-quantitative and some qualitative information as well.

Some of what gets really complicated very quickly when we're doing these analyses around the research pipeline in pediatrics at NIH and NICHD is, number one, NICHD, while we're the largest supporter of pediatric research at NIH, we only fund about 16 percent of it. So the vast majority is actually funded by the other 26 institutes and centers. So any question you have about pediatric research, we can potentially quite confidently are in charge of NICHD data, I can share that with you, but then it takes a lot of wrangling to get all of our other

colleagues to participate and help us do those larger analyses.

I think another complicating factor is, again, while we are the largest supporter of pediatric research, pediatric research is not all that we do at Child Health Institute. So we have to be really careful within NICHD when we're looking specifically at a pediatric analysis, that we're really making sure that we're really separating out the OBGYN, the reproductive health, and the rehab medicine. Fred and others who have served on our council know well that we have a lot of activity going on in these non-pediatric areas, and how do you parse those in and out also make for some complicating factors.

But that being said, I want to share first of all just sort of the overall where we are in pediatric research at NIH. What we did is we looked at from 2008 to 2021, and if you look at the total NIH budget in 2008, it was $29.6 billion, or almost $30 billion. And by 2021 it had grown by 40 percent, so it was up to $41.5 billion. So it increased by 40 percent.

During that same time, between 2008 and 2021, pediatric research actually grew by 95 percent, so more than double the rate of the comparable -- the rest of the NIH budget. Which is just tremendous news. I don't think it's what most of us kind of feel like we've experienced,

but that's what the numbers do show. Most of that increase has actually come since 2016. But it basically means that in 2008, the pediatrics represented about 9.3 percent of the total NIH budget, and it now represents about 13 percent. So that is really quite substantial growth overall.

I know one of the questions you'll probably ask is just sort of a sense of what kind of demand is there for the different pediatric opportunities. And that really speaks to a fair amount of demand, because as you all know, some of the demand is based upon what we put out as set-aside initiatives, but most of what we fund at NIH is investigator initiated, unsolicited applications. So it basically means that the pediatric research universe at NIH over the last 10 years has really grown more than double what the rest of NIH has done.

I think that sets the stage that for some of the questions that Shafali had. One of them was what is the rate of the K to R transition in pediatrics, and if possible, by subspecialty. This is one of these that, boom, it very quickly gets very complicated. We are working on this, but I will say that one of the sentiments that's coming out, at least when we look at NICHD, is that in pediatrics most people come to their first R not from a K, but actually from a T32 or from some other mechanism.

So what we're in the process of doing now is to try to do an analysis really of looking at that whole career trajectory by mechanism, as opposed to just specifically looking at the K to R. And then really trying to compare it, what is it for pediatrics, versus the rest of the NICHD universe? Again, of course, the important thing is what about all the other subspecialties that are covered by the other institutes? So that's going to be an aspiration that we'll be able to try to get to.

Teasing out subspecialty gets difficult because that's not a prespecified data field; that does require going in and pulling that and so that's going to be complicated as well, but we are going to try. We're basically working on this sort of career trajectory analysis.

The next is of the pediatric funding, what is the distribution by PhD versus MD versus MD/PhD? So again, these are unofficial estimates, not ready for full detailed public reporting, but I will say that it's about two-thirds -- this is for pediatrics just at NICHD -- about two-thirds are PhDs, about a fifth of PIs are MDs, and about 8 percent are MD/PhDs. Then the remainder are other degree categories.

The next question on pediatric funding, what is the distribution of clinical versus bench research? Now,

one of the things about any sort of categorization is that they're potentially overlapping. But the best that we can tell, and this is now looking at all of NIH from 2011 to 2021, so over 10 or 11 years, for pediatric research about one-third is basic, 60 percent is clinical, and 6 percent is translational.

Finally, there was a question on what are the top 20 disease categories within the pediatric research portfolio? Again, this is something that, once we have the official estimates, I can provide. We do have these data, we can generate them, but again, they 're overlapping. So once you start counting up the dollars by category, you're going to very quickly get way beyond what we say is the total of pediatric research spending. So they're probably helpful, but in a limited way.

I think those were, Shafali, most of the questions that you had posed back in September. I know there are some other ones maybe that we'll get to in the discussion, but I can go ahead and stop there and look forward to Lou's presentation and then the Q&A.

DR. JESTE: Thank you, that was extremely helpful. I was furiously typing while you were talking. But, yes, we'll have a few more questions at the end, but I appreciate your really addressing the very specific questions that we had.

Now we're going to actually, our final speaker is Dr. Lou Muglia. Dr. Muglia is the president and CEO of the Burroughs Wellcome Fund, which is a private foundation located in the Research Triangle Park in North Carolina, and they fund quite a bit of biomedical research, with really a lot of focus on supporting initiatives in early career investigators, and also MD-only researchers, which I'm sure we'll hear about. He's also an adjunct professor at the University of Cincinnati College of Medicine, and Cincinnati Children's, which is where he's spent much of his career.

I am going to turn it over to Dr. Muglia now. Thank you again for joining us.

DR. MUGLIA: Thank you for the invitation to participate. It's a real passion of mine talking about physician scientist development, and for many years prior to coming to Burroughs Wellcome Fund I was a practicing pediatric endocrinologist and physician-scientist, and see many friends on the panel here today, so I'm especially appreciative to be able to give this talk.

Once again, what I wanted to start out by doing is talking about what is the relative magnitude of different funding, different organizations in supporting healthcare research and healthcare expenditures. And this

is a slide I took when I attended the Milken Institute Global Conference earlier this year.

But you can see foundations and private funds only support about 2 percent of total healthcare research expenditures, which surprised me. NIH is about 18 percent. Biopharmaceuticals, medical industries, and healthcare services really support the majority, and I would argue biopharmaceuticals and medical industry devices are disproportionately skewed away from pediatrics in terms of what they support and probably participate less in developing the physician-scientist pipeline that they really should be helping to support to populate their studies in their rings. So I see that as a real opportunity for growth of getting support for physician-scientists across the board, but as we see in pediatrics, I think specific biopharmaceuticals, especially around rare diseases, will offer unique opportunities to support pediatric scientists.

Just to give you an idea about the Burroughs Wellcome Fund, this is our mission statement. The Burroughs Wellcome Fund serves and strengthens society by nurturing a group of diverse leaders in biomedical sciences to improve human health, through education, empowering discoveries in frontiers of greatest need.

This just shows our grant expenditures in fiscal year 2021 and fiscal year 2022. This is -- $41 million is about typical for us, $40 million to $50 million. Our total endowment size is about $800 million, which puts us in, I would say, the area of a modest-sized science philanthropy, to give you relative comparison. The Wellcome Trust is about $35 billion, Gordon and Betty Moore Foundation is around $6 billion. So we're a little bit smaller than that, but large enough to, I think, use our funds very strategically to promote areas that are of greatest need.

You can see that our biomedical sciences portfolio, it's in general about a third of what we spend our money on, but that even does not capture it entirely, because our infectious disease work and our interfaces work also captures biomedical research as well. So we're very excited about the opportunity to really invest in early careers, particularly in the biomedical research pipeline.

I would be remiss, and I was very happy to see Dr. Boone's presentation about promoting diversity; we are very committed to promoting diversity at Burroughs Wellcome Fund. Initially, this focused on our enrichment programs, our postdoctoral enrichment program or graduate diversity enrichment program, which provided resources to underrepresented minority students, but now it really

permeates everything we think about at Burroughs Wellcome Fund, how we function as an organization, how we make our grants externally, how we interact with the world. And by diversity, we mean primarily race, ethnicity, and underrepresented minority populations in the United States, particularly those that have been the targets of structural racism for generations; age, gender, sexual orientation, socioeconomic status; and then geographical location. We realize it's an unfair playing field across North Carolina where we're located, for example, for our K through 12 efforts, but also across the United States.

In terms of investment in our underrepresented minority programs, we've invested about $8 million in our postdoctoral diversity enrichment program and graduate diversity enrichment program, and on the order of $20 million to underrepresented minorities in total.

Our diversity in science programming includes postdoctoral diversity enrichment program, graduate diversity, but also specific enrichment works where we convene and network our physician scientists, our graduate students, and others. We make a lot of ad hoc awards and grants in this domain, and really look forward to supporting diversity initiatives, and one thing I'd just like to highlight to you is right now 49 percent of our grants have gone to underrepresented minority candidates.

That's African, Hispanic, Native American, and Islanders. So we feel that we're I think living what we're hoping to preach in terms of diversity support.

And then our six-year total, we just got these numbers back recently, about $26 million in support to underrepresented scholars, and that number's going to keep growing. A lot of the awards, again, are fostering pipeline development, which are smaller awards, which is why about 50 percent of our awards are to diversity scholar candidates, however the total funding amount, because some of our larger awards are not restricted to those individuals, take precedence.

We've recognized the declining number of physician scientists, particularly pediatric physician scientists, has received I think fairly longstanding recognition, and little evidence of significant resurgence despite various expert conferences and intervention strategies. The most common current pathways center on integration of a research experience during medical school as part of an MD/PhD program or Year Out. These strategies we feel, while providing a useful experience, retain significant limitation. They lengthen the duration of training, they don't align to clinical experience that sparks the scientific interest with the ability to tackle them, which we feel is a really major deal.

A couple examples of people that really found their passion for doing research later in their careers that I think are role models. One is Marilyn Gaston, a physician who was working in Philadelphia when she came to her passion around caring for children with sickle cell, and she was the first to lead a sickle cell nationwide screening program to test newborns for immediate treatment and the first African American woman to direct a public health service bureau. So really a remarkable individual, but that wasn't until her internship that she really came to that, which makes it hard to get into a research pathway.

And then I would argue one of the most successful physician scientists, now a pediatric neurologist, Huda Zoghbi at Texas Children's and Baylor College of Medicine, was a medical student at Meharry, where she got her initial training, but then, based on seeing patients that later got diagnosed with Rhett syndrome, she became a leader in neurodevelopmental brain disorders and was the first to reveal the molecular mechanism that led to this disease, now with therapies in active intervention.

So how do we support these people that really find their passion around a clinical question at the clinical stage of training in their career? Just to review for you a little bit about what Burroughs Wellcome Fund has

done over the years. Our initial and current major funding mechanism is our career award for physician scientists. It was based on the Lucille Markey Charitable Trust program, and it started really in 1995, when he first awards were made, and I was actually one of the first recipients of these, so I feel very fortunate that Burroughs Wellcome has funded individuals in this category.

Since its inception, Burroughs Wellcome has invested $250 million in the career awards program. That's not the only program. We had the clinical scientist award in translational research. We had the career awards in medical sciences, which the career awards for biomedical sciences transition to, and then most recently, we have our physician scientist institution awards, that was created in 2017, to specifically address the small number of physicians entering the workforce as physician scientists. And we were trying to limit that to MD-only, that again we felt were at a competitive disadvantage in terms of securing grants.

I just wanted to highlight some of the other ad hoc funding that we do around pediatric physician scientist development. We support the pediatric scientist development program that is led by Sallie Permar at Cornell. We have fostered a convening of institutions for developing the next generation of pediatric researchers

that was partnered with the coalition of pediatric medical research, and then you can see a number of these. I'll just highlight the Indiana University program for Medical Physician Engineers, Scientists and Clinicians Preparatory for high school and college students. That's led by Wade Clapp, the department chair of pediatrics at Indiana University, who is specifically channeling individuals into thinking about physician scientist programs overall. So really excited about these investments that we're making.

Our physician scientist institutional awards have identified some barriers, as you might guess. We got 136 proposals from 83 medical schools. We made 10 awards, and when we look at what the big barriers were, mentoring was the single most effective intervention to getting people into careers in research. However, mentoring is often not very well supported for middle-stage and senior investigators.

And then finances and funding. Fifty percent of students conveyed that the ability of paying back loans was the deciding factor in the decision to pursue a career or not as a physician scientist. And then the other barriers you see listed here, including lack of research experience, institutional barriers, and then career and work-life balance, as many people appreciate is a challenge for balancing family and career.

We report the findings of these in a paper published last year in the JCI, innovations in MD-only physician scientist training, which I can refer you to, that was written in collaboration with all of the physician scientist institutional award programs.

We have done some other things that we think you might be interested in. We realized that many organizations, nonprofits, are funding physician scientists. We've tried to gather them to develop a shared strategy for really developing a pathway, a highway of on and off ramps that individuals starting in research can consider to understand the next step of where their support might come from. So we convened a meeting of the Lasker Foundation, Doris Duke Foundation, Health Research Alliance, Simons -- you'll see the list here. And really mapped out where people were funding investment, and many organizations are sort of funding at the fellowship level program, but to be competitive for these programs you often need a little bit of a runway before that. Institutional K awards, such as the K12s, the CHRCDA awards, help to support those, have been slightly reduced in number, but we view this as trying to build a pipeline from undergraduate into faculty where support can be garnered.

So numerous investment ideas emerged from this. Some were collaborations awards for basic scientists and

clinicians to work together, institutional postbac programs. Some were multistage investments that people would be eligible for one after the other in terms of competing for these. And then our large collaborative idea was an institutional continuum award to create a multilevel program supporting postbac, Year Out students, research track residents, that once we gather more information and develop a further refined strategy, we will release an RFP for institutions to compete for this.

Those are the highlights of what we're thinking about at Burroughs Wellcome Fund. I look forward to your questions, and again, greatly appreciate the opportunity to present.

DR. JESTE: Thank you. That was fantastic. A lot to think about here.

I'm going to open it up for questions. I have plenty, but I can see if anyone on the panel has any burning question to start, otherwise I can start.

I'll start with actually kind of a really big, overarching question, which is that one of the themes that's sort of come up as we've been talking about this area as we've been writing up our report, is that we all agree, and Lou, you talked about this quite a bit, is that there is an issue in the physician-scientist workforce, especially in pediatrics, that we don't have enough

physician investigators, and that we anecdotally definitely see that there's challenges, particularly as you described, with mentoring and with funding, that leads to this kind of leaky pipeline that we talk about, where we're losing potential physician scientists across the course of their career. And I guess my question, maybe to the whole group is, is that definitely the case? How do we quantify that? And if that is the case that we have this leaky pipeline, and we're losing a workforce that we need to be really supporting and preserving and enhancing, are there specific key points along that pipeline that are most threatened?

DR. BOONE: I'll start off as saying all of the areas that were identified by Dr. Muglia were absolutely on point. The only way we can have a clear understanding of what these barriers are is if we ask the individuals that are engaging in these research careers, especially those individuals who have exited out of the research career. What were those things? What were those barriers that just said, I can't do this anymore?

And because at one point I was an early stage investigator, I still identify with many of the barriers that we at NIH have identified through listening sessions, through RFIs, through different surveys that have been conducted. It is a lack of mentoring, it is a lack of representation. It is uncivil working environments. It is

encountering isolationism. It is encountering microaggression, micro insults, microinvalidations, and I think we should probably stop calling them micro because when you're the target of those, it doesn't feel small.

So I think that individuals who are underrepresented in science, including women, we understand what those barriers are. Now is the time for us to really galvanize and to reach out to our other partners to really impact these barriers that are continuing to cause people to exit out of the biomedical research workforce in droves.

So one, I think that my participation, and I'm not going to take up all the time, I attended a great group meeting, the AAMC meeting, a few weeks ago, and I think that institutions are at the point in time where they're interested in talking about these issues, and not just saying we don't have these things going on here. That's someplace else. But I think people are really galvanizing around, why are we losing postdocs? Why are we losing early career investigators? Why are they exiting out of these careers? And then doing something to keep them in.

So for us, many of our programs are really trying to galvanize around the idea that we need better mentoring, and we need to prepare mentors to be better mentors, but then also people who are being mentored, they need to be prepared as well. So we are incorporating mentoring

requirements around mentoring and mentoring training within a lot of our FOAs so that it is, I don't want to say that it's taken seriously, but that it's taken seriously.

You know, NIH is really paying attention to this and if all of the funders are saying the same thing, that mentorship is a problem, it really does need to be addressed. If harassment or discrimination is a problem, these things really need to be addressed, and we really need to hold people accountable for this.

But we also need to reward institutions, reward individuals who are really making strong headways in these directions.

DR. HAZRA: What I would say to that, Shafali, out of your question to me back in September, what do we experience at NIH? Well, what we're experiencing is applications keep going up and success rates are flat to declining.

So that does not imply that the pipeline is not there. It's that we're not able to mobilize funds to fund enough people. I think how do I manage in my mind the fact that I said pediatric funding has gone up by 95 percent versus 40 percent for overall NIH, and yet we're still having these conversations?

Well, I think the other aspect that's happened is greater and greater concentration of funding in a smaller

and smaller group of investigators, and so while that's great to say that it's 95 percent, when we do these analyses, what we're seeing, and this is not just in pediatrics, this is across NIH, that it's a larger and larger percentage of the funds are going to a smaller and smaller group of individuals. So how do we break that up so that we actually can free up funds to fund more people with all of these additional dollars that we have?

DR. BOONE: Rohan, you make a very good point. I think that theoretically everyone can agree with that point, that okay, they're a very small group of institution investigators where much of this funding is concentrated and it's a great idea for us to diversify that until it comes to diversifying it.

But one of the efforts that NIH is focusing on is providing a greater focus on early stage investigators and ensuring that we set targets for funding early stage investigators, prioritizing policies and programs that will help to not only keep them into a research career, but also help to transition them into their next phase of their independent research careers.

DR. JESTE: Lou, did you want to say anything else?

DR. MUGLIA: Well, I think your original question, Shafali, what is the data that the numbers are decreasing?

For MD only, it is pretty clear that numbers are going down. There have been a number of studies that have looked at that that are across the board. They are just less likely to compete successfully. I know within our own programs, we're lucky if 10 percent of our awardees in our career development programs are MD only just because they don't have the sort of portfolio, honestly, to compete with MD/PhDs that are going for the same set of funds.

So what we're doing now is actually just ranking MD-only candidates separately. We're going to fund different numbers of MD and MD/PhD candidates, specifically to try to address that issue because we know that it's comparing apples and oranges to some extent.

DR. JESTE: Absolutely. Great point. I see we have a couple of hands up. I think Chris had his hand up first. Go ahead, and then Fred.

DR. FOREST: Thanks, Shafali. This is a question for the panel. In prior public sessions this committee has held, we've heard that there is insufficient funding for pediatric subspecialty researchers. Rohan, the marked increase in funding you just mentioned is news to me and it's really interesting. I did hear your point about the maldistribution of funding, but I am also wondering how the panel would recommend we should think about whether the amount of funding is too much or not enough.

It gets to the whole issue about how you as funders assess progress in child health. Patrick Collison has talked about the lack of social progress in the sciences. A number of breakthroughs, for example, in pediatrics, things like mechanical ventilation, reduction in childhood mortality due to cancer, those kinds of breakthroughs actually happened many years ago, decades ago. Despite increasing numbers of papers, increasing numbers of journal, increasing funding, we're not seeing the same rate of pediatric breakthrough.

So I'm wondering how you might suggest we frame the assessment of impact of funding so we can get a handle on this issue as to whether or not the funding is just right, too much, or too little. Thanks.

DR. HAZRA: I'm not sure I have a very coherent answer for that, Chris. In fact, I bet you could answer that much more eloquently than I can. But I do think trying to look at impact is increasingly something at least we have discussions about. It gets complicated. I think basic scientists will very appropriately say you can't judge us on impact because our impact may be 50 years from now, so is there a natural preference, then, for non-basic science? And then are you then sacrificing future gains? I also just think it's the whole timeline standpoint, as

well. I mean, two to five year grants, but we're really looking at longer-term areas.

But I am a pediatric HIV clinician and researcher by training. So in my career, literally I had as an inpatient intern and resident, half my ward was children dying of HIV. Now we go to that same hospital and there are probably no inpatients with HIV in the hospital.

Yesterday we were talking about those that were infected at birth, there's a cohort of them that are in their late 30s and reaching 40 years of age. That's what motivates me and so I do think trying to have that lens around particular high morbidity/high mortality areas I think is really important, but how one then places that into a very individual, driven two-to-five year grant cycle I think is tough. But certainly as an institute we have the conversations that you're talking about, but I don't know that we operationalize it very well.

DR. MUGLIA: I would add that I think we underestimate the impact of things that have happened recently in the pediatric space because they're not just limited to the pediatric space. They really truly do affect pediatrics. You think about all treatment for rare diseases, the gene therapy models, the things that have emerged that each of the diseases in itself is not an overwhelming disease, but when you aggregate all rare

diseases and you come up with the strategies for both gene therapy-based and drug-based interventions, it's remarkable.

Think about cystic fibrosis. We've changed the lives of kids with cystic fibrosis. Vaccines are constantly emerging that are of high impact. So I believe there is plenty to invest in. In my own area, I wish I had seen more progress in adverse pregnancy outcomes like preterm birth and our ability to prevent it, but I am confident in the next three to five years the investments in that area are going to have impact as well.

DR. FOREST: Thanks to both of you.

DR. RIVARA: This is a question for Lou and potentially Rohan as well about the pediatric physician scientist training. Right now, as you all know, the American Board of Pediatrics pretty much requires for all pediatric subspecialists a three-year fellowship. Twelve months of that is supposed to be on research. Some people like the American Board of Internal Medicine only require two years of fellowship training.

The question, I think, that comes up is what does it take to train the pediatric physician scientist in a subspecialty? We're not going to have everybody get PhDs, I don't think, as that adds another four to six years onto their training. Should we, for example, or should the

board, change the requirement to be a two-year fellowship for clinicians, and for those who want to go into research, they can do a four-, five-, or six-year fellowship? And what is it going to take for us to have the MDs be competitive with the MD PhDs and the PhDs in research?

DR. MUGLIA: You know, I think it's a combination of three things. I think it's mentorship to help navigate them there. I think it's funding to help support them because they're not going to have, again, the resume, the CV, that allows them to be competitive for grants if they're just finding their research question as they're entering either their residency or their fellowship.

Then last, the protected time. The institutions have to be willing to provide support and allow the time for investment in research as well. In terms of the amount of clinical training, I think everybody's training is long. I was fortunate. I did the special alternative pathway of the American Board of Pediatrics when it existed before it got disbanded. If people remember, that was two years of residency followed by a year of integrated clinical residency, and then two years of research. So it was a five-year residency and fellowship program.

I know many people that did it and I think they were -- I practiced general pediatrics on the ward, I practiced pediatric endocrinology clinically, and I ran a

laboratory. So I don't think I was too impaired in terms of my clinical training. I was deeply invested.

Two years is not enough research time even if you have an MD/PhD. So I think people can be put into clinical scenarios as instructors or assistant professors, still have the protected time, but functionally service a postdoctoral fellow in the laboratory in a mentored role at the same time. So that's why I think the mentored component is particularly important.

DR. HAZRA: Nothing much to add. I think what resonates with me is what Lou said about the spark in the clinical time. I think to allow for that really is, more than what he's talking about -- I've heard you all talk a lot about how do we increase that pipeline, we've heard medical students choose their specialty, many of them in the first year of medical school.

I know there has been a lot of discussion in the prior months about where we work upstream, but I'm really influenced by what Lou talked about, really just the careers of people that are inspired because of their clinical work. That's going to be later in their training. I think we have to work at both ends.

DR. RIVARA: One of the rationales I think has been, for the board, is that that third year, people, even if they don't go into research, do gain some knowledge of

that research that's important, and that may also be the impetus that leads people to choose a research career. Do you think that's reasonable? Or is there any basis for that?

DR. HAZRA: I do think, and Shafali and I actually talked about this in September as well, a lot of what we are talking about is success is having R01 or other independent funding, and yet we know a lot of MDs involved in clinical research that may not have their own R01 and yet are contributing substantially to oftentimes larger clinical research or clinical trial or clinical epi projects as well.

So I think we also need to allow for that to be considered success, and how one does that through promotion and tenure committees, through other ways of protected time also, but recognizing that, as you said, Fred, just having some of that research background, people can still contribute without necessarily being the PI of an R01.

DR. BOONE: I think one thing that Louis really touched upon was the earlier exposure. Even if it's not something that is official, if you're waiting until later stages within medical school to introduce this concept of the research career, it's less and less likely that it's going to happen.

So again, even with the SEPA programs that we are funding here at NIH, earlier and earlier exposure to this idea as a career option is one thing that really should be taken into consideration, and the longer you wait, the less likely it's going to occur because as he said, they're not going to have that resume.

DR. JESTE: We're almost out of time but I'm going to less Candice finish us off with the final question and then I'll turn it back.

DR. CHEN: Thank you so much. Because we focus so much on the pediatric subspecialty workforce, the earlier presenters talked about how the pediatric subspecialty workforce is much more linked to academic medical centers and that kind of linking to academic medical centers, I think our suspicion is that research funding becomes very important, and so obviously you hear a lot of our questions about how much research funding.

I think there's a question of how much and I know that you're looking at this across the different diseases states and whether you're in pediatrics or whether you're in adult medicine, there's always a you get what you paid for and we're likely to be incentivizing, we'll say, certain pediatric subspecialties, and I think that's one of the things that we're working to parse apart, as well as

the relative funding in pediatrics versus the relative funding in adult areas.

But actually, what I wanted to go to was to Ericka because that challenge of that sense that over and over pediatrics gets lost and particularly the pediatric subspecialties gets lost in the larger funding space, and so I'm wondering a little bit in the things that you're doing to expand diversity, and we also know that diversity in the pediatric subspecialty workforce is particularly bad. If you're tracking how your funding and the efforts to improve diversity trickle into the different areas of medicine, because I think that's really where our challenge is, it's not just overall funding but it's where does that funding go?

Then I just have hopefully a quick question, which is the focus on sexual harassment and expanding that I think is really important, but I was wondering if you could tell us a little bit about how much, because it's not just the policies and the reporting, but it is the accountability that's related to it, and I was wondering how often do you actually, or have you historically, removed funding because of sexual harassment complaints? And how do you do that?

DR. BOONE: Unfortunately, I have a 1 p.m. that I'm going to have to get to. So I think that these are

very good questions. So for your first question around tracking, especially among subspecialties, we do a poor job and we need to do a better job of that so that not only are we tracking investment, we're tracking where we should be putting our focus moving into the future. So thank you for that question because I definitely wrote that one down so I can take that back to my own leadership as something that we should be following up on as a part of our follow-up for the physician scientist workforce working group recommendations.

Then the next question with regards to how often we remove funding because of allegations of sexual harassment or discrimination, I don't have those numbers at this point in time. I think that there can be removal of funding or there can be removal of people from projects. More typically what happens is removal of a person from a project, but that also requires that institutions let us know when that person has done that.

So that's why that congressional policy that has recently been implemented in May of this year is important, because if we don't get the numbers from the institution, we can't report back to you and let you know, well, this is the certain percentage of individuals and institutions that have had a person removed or has had funding removed, X, Y, and Z.

But more so what happens is that a person is shuffled around quietly without letting NIH know. Now they have to alert NIH that this is what's happening.

DR. JESTE: Okay, I think we could talk about various topics for hours, but I really do want to thank our speakers for taking time out of their very busy schedules today to join us. You may be getting some follow-up emails with some more questions from us. I'm going to turn it over to Fred now for his closing remarks and again, thank you, everyone.

Agenda Item: Closing Remarks

DR. RIVARA: Thanks very much. It's been a really terrific and informative discussion that our committee will definitely use and think about. We have another webinar coming up next Wednesday about access and healthcare financing, and information about that is on our website. Again, we appreciate all of your input and your thoughts on this. It's clearly important topics that we will continue to try to figure out what are the best recommendations we can make in this report. Thank you again. You all have a good day.

(Whereupon, at 1:00 p.m., the meeting was adjourned.)