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>> SANDRO GALEA: Good afternoon. My name is Sandro Galea and I have the privilege of serving as Dean of the Boston University School of Public Health. On behalf of our school, welcome to today's Public Health Conversation.

These conversations are meant as spaces where we come together to discuss the ideas that shape a healthier world. Through a process of free speech, open debate, and the generative exchange of ideas, we aim to sharpen our approach to building such a world. Guided by expert speakers, we work towards a deeper understanding of what matters most to the creation of healthy populations.

Thank you for joining us for today's conversation. In particular, thank you to the Dean's Office and the SPH Communications team, without whose efforts these events would not take place. I would also like to acknowledge Lori Chibnik, Anita DeStefano, Jacqui Hicks, Mary Murphy-Phillips, and Lisa Sullivan for their contributions to today's event and the BUSPH Summer Institute in Biostatistics and Data Science program.

Today we will discuss the future of biostatics over the

next decade. We will talk about how we can develop the field and shape a more diverse pipeline for biostatistics as it evolves. Our conversation will be guided by reflections from alumni of the Summer Institute for Training in Biostatistics program at BUSPH, which is now known as the Summer Institute in Biostatistics and Data Science program. The program is a federally funded effort to grow and diversify biostatistics. This year marks the 20th anniversary of the SIBS program at BUSPH. I am delighted to celebrate this milestone with all of you, and I look forward to learning from our guests today.

I am now pleased to turn over the conversation to our Panel 1 moderator, Dean Lisa Sullivan.

[Applause]

>> LISA SULLIVAN: Thank you, Dean Galea.

In 2004 it was funded by NHLBI as one of the first three SIBS programs with NC State and Wisconsin. It was to introduce the field to biostatistics. I'm pleased that we have retained NIH funding 20 years later. We have had many passionate faculty and staff working on the program. I was the original P.I. and I asked Anita DeStefano to work with me as co-PI. It was her idea for this event, we can thank her for her continued commitment to SIBS and for getting us all together. Unfortunately she couldn't be here in person, but she is on Zoom.

I loved working on SIBS and I know the same was true for so many faculty, staff and guest speakers who make it such a special program. I would like to thank Dr. Scarlett Bellamy for her support of SIBS in this conversation. One constant throughout the 20 years has been the quality of the SIBS students. The first year and every year since we have all been amazed by the dedication, curiosity, thoughtfulness and abilities of the students who chose to spend six weeks of their summer break learning biostatistics.

Over these 20 years we have seen changes in the students and the SIBS programs. We started with three and now there are ten which reflect the changes over the decades. Today more students know what biostatistics is. At first they didn't know what it was, didn't understand what it was, very few undergraduate courses had courses in biostatistics. Many have taken a class or two but many still lack more information in the field. More students come to SIBS with some programming experience. It was always our goal to teach both SAAS and ARB. Now more than half are likely to have statistical computing experience. This reflects changes in the field, including increased computing power, the many tutorial YouTubes available.

Over the decades, SIBS shifted focus on building of pipeline to expanding the diversity of future bio statisticians. Many of the SIBS faculty were engaged in the Harvard study.

Students got the opportunity to work on real data and visit the Framingham Clinic. The cohort was predominantly white and they may not generalize to non-white populations. Thus in 2012 we partnered with the Jackson Heart study, the longest longitudinal study. Ensuring broader representation as a way to better engage a diverse group of students and best equip all students to practice biostatistics in a diverse world.

In 2019 we incorporated infectious disease model in BU SIBS and pivoted with the rest of the world to a virtual program during the pandemic.

During pandemic years the grant was up for renewal and NIH put out a request for proposal with emphasis on data science. We were well positioned to respond. It's the summer institute for biostatistics. I think I speak for the many faculty, staff and guest speakers involved in the program we have been consistently funded for 20 years because of our ability to embrace the changes in the field and attract future statisticians. I look forward to hear from our panel and their views how biostatistics will further evolve in the next decade.

I would like to introduce our first speaker for this program. Brittney E. Bailey, an Assistant Professor of Statistics at Amherst College. Her research explores statistical methods for dealing with missing data and clustered clinical trials, and her collaborations have focused on social and behavioral interventions to improve mental health and well-being.

As a Black woman in STEM and a first-generation scholar from a low-income background, Dr. Bailey is dedicated to supporting students with similar experiences and works to create environments where all students can thrive. Within Amherst College, she co-founded the STEM Incubator Program, and on the national level, Dr. Bailey is the current Vice Chair of the American Statistical Association's Committee on Minorities in Statistics and is in her fourth year as co-chair of the planning committee for CoMiS's StatFest, an annual conference designed to encourage undergraduate students from historically underrepresented backgrounds to pursue careers in the statistical sciences.

Dr. Bailey, we welcome you.

>> BRITTNEY BAILEY: Good afternoon. I was a little overwhelmed being here. I think about how broadsided I've been over the last four and a half years with things I just did not expect to happen. I imagine many of you in the same boat, right? The COVID-19 pandemic. This sort of rising inflation we are all dealing with making it hard to afford the basics. Housing affordability crisis I feel a bit acutely here in Massachusetts.

These things I feel like I did not foresee five years ago.

And so it's hard to think about what the next ten years of biostatistics looks like, knowing these issues especially effect marginalized communities and fall hardest on low-income communities especially. That in turn affects the types of problems we see as bio statisticians with our collaborators. How we may go about addressing including A.I. and what impact that may have in the field. But who will be in the room thinking and working on those problems with us.

Which is why we are here today. To talk about what does it look like to build and grow that pipeline.

Reflecting back on 20 years ago for me, I think I was that picture in the middle at that time.

So as you shared, I was the first in my family to go to college. Before that I was a student at a small rural high school. There were fewer than 1,000 people in the town at the time. And sure that's still true today. I was one of a handful of students of color in the entire K-12 building that we were in. It wasn't the best high school by any means. We didn't have any advanced classes, we didn't have any A.P. classes. The one line, the exposure to statistics, half a semester course. Taught by a sub. One retired, the other left the previous year and we were waiting to hiring somebody new. I didn't have much exposure to statistics in high school.

Somehow though I manage to be here in front of you today as professor in statistics. Due to the adjustments in grad school. And types of programs I was involved in that helped me along the way, much like the SIBS program we are here to celebrate.

So thinking about where we stand as a field, I pulled 11 years worth of graduate degree data in statistics and biostatistics. And what we see is that Indigenous, Black and Hispanic or Latino students make up fewer than 9% of degrees awarded in our field. Which is a little disheartening given that even within the United States they make up at least 25% of the population. So we could be doing better in terms of bringing students of color, especially, into our field.

But the other part I think about with this, is the intersection there tends to be between race/ethnicity and socioeconomic status. We see among the same groups they are more likely to be from families from within poverty.

And we also know that lower family income is associated with higher likelihood of never enrolling, delaying enrollment or never even completing postsecondary education. So part of our pipeline problem begins as children effectively in this country. And so what does it look like to try to think about getting students into undergrad in the first place. And then into our field and supporting them so they can be successful all along the way.

So my belief is that there are sort of four core things we need in place in order to increase or bring people into our field and increase a sense of belonging. So the first is early exposure in the first place. Let people know what is statistics, what is biostatistics, what kinds of things do we do? You can't have people in the field if they don't even know what it is in the first place.

Second is thinking about access to opportunities. This isn't just thinking about access to academic institutions, it's also thinking about access to jobs, positions, promotions as they move along in their career. And then there's the people things. Thinking about who did they have in their network to support them, give them guidance, to help them make those connections so they have access to opportunities and advocate for them along the way.

Finally the thing a little harder to work on is thinking of psychological safety. What I mean by this, that feeling of feeling valued in your program, workplace and field. Feeling your contributions matter. Feeling you can bring your full self to the workplace.

These are the things I think we need. In terms of trying to figure out how we go about getting there, I have thought about a few things and I borrowed a few things from Jamar and Melody Goodman. In no particular order. Thinking about adopting equitable practices. Within the classroom, workplace, academic institutions. Thinking about as you are teaching, if you are an academic, what pedagogies do you use. Universal design is a common approach there.

What admissions policies and hiring and promotion practices are we using to ensure we have equitable access to opportunities? What are the cultural norms of our departments and workplaces to help foster a sense of belonging?

I think a lot about reducing barriers to entry, especially when it comes to financial barriers. But one thing again raising awareness opportunities in first place. Providing financial support. Maybe in grad school, admissions process, those are fever waivers in programs like SIBS or other summer research programs thinking about you are providing stipends, housing, whatever you can do to support students in terms of having access to the program in the first place.

Also fostering connections in the field. Maybe through mentoring or also through making connections in these research programs themselves.

Developing and supporting existing programs. What can we do to support the next 20 years of SIBS. With that as well beyond the summer research programs there's bridge type programs entering undergrad, perhaps going from undergrad to graduate

programs. What are ways we make sure people have the foundations they need to be successful as they move forward in their academic career.

I actually had the opportunity to do this last thing in the second bullet point, a postdoc to tenure track position. Get my feet wet at Amherst College to tenure track at university later.

Learning collaborations. A couple examples they gave there were connections between larger, more-well resourced institutions and smaller institutions that maybe don't have as many resources. The University of Michigan School of Public Health partnered with Spellman College for nutritional sciences. NYU and Jon Jay College of Criminal Justice in the city partnered to have quantitative training and seminars available to students.

Or we can think about having study away models as students can have access to more resourced institutions.

An idea that Tian Jiang shared with me, a Columbian University. Rise of A.I., what does it look like for an institution that doesn't have all the access they have to computing needs for artificial intelligence? What does it look like to partner with industry to have those resources on hand for students?

So these are not all encompassing. And I'm sure the other speakers on the panel today have additional ideas. But this is just a start think about again what does it look like to grow our field, develop a sense of belonging? Thank you.

[Applause]

>> LISA SULLIVAN: Thank you. Next we will hear from Mark Fiecas. Mark Fiecas is an Associate Professor in the Division of Biostatistics and Health Data Science at the University of Minnesota.

He also serves as Chair of the Biostatistics Diversity, Equity, and Inclusion Committee at the University of Minnesota School of Public Health. The focus of his research is to understand the structure and function of the human brain through the use of imaging technology.

His experience with neuroimaging research spans a broad range of areas, from studying the connectivity of the human brain to investigating genetic underpinnings of brain phenotypes. His interdisciplinary research focuses on functional connectivity and imaging genetics. From a methodological perspective, his primary interest is in time series analysis. Mark Fiecas?

>> MARK FIECAS: Thank you all for having me today. I would like to thank the Dean's Office at Boston University. This is a topic I have a lot of strong opinions about. So hopefully this is, I don't just blurt some of these things out loud. I will do

my best to try to restrain myself on some of these topics. A lot of what I will talk about is Minnesota centric. When you think about biostatistics in the next decade, I think it's important to see where are we at right now. And in particular, I would like to show you where we are and we here being Minnesota.

So let's first look at the male/female break down of our graduate program at University of Minnesota biostatistics and health data sciences.

If we look at this you will see regardless of graduate program, MS or Ph.D., roughly equal proportions between males and females.

So from that perspective, it looks like we are doing quite well. This is for all of our students right now who enter as early as fall 2019.

We look good here. There's nothing that seems there's any type of disparities.

Now when we start to look at things with respect to race, this is where things get a little bit iffy.

I'm not normalizing here, standardizing with respect to proportion. But you can just look at that last row and see that looks overwhelmingly large relative to the rest of the rows.

And regardless of program, right?

So I will also say that this is one of my strong opinions. I really hate that second row that says Asian. The reason why it is so collapsing. As a Filipino man, I find it a little offensive. I will restrain now.

If you were to look at this, this could be a little bit concerning, especially in the context of University of Minnesota being a land grant institution. We should also be serving our local community. And this is not reflective of the population of Minnesota.

Especially if we look at Black African Americans, that's a problem. And I'm not offering a solution. I'm offering a start of a discussion. I think we can't talk about what the solutions are if we don't acknowledge that there are some potential problems here. So that's what I would really like to highlight here. So if we look at international students, there's really only one row to focus, the second one, nearly all of our graduate students, at least international graduate students are coming from China and then we have a couple from other countries.

So this hopefully gives you an idea of what the University of Minnesota graduate student population is like. I can't speak to other graduate programs around the country. I can't speak to B.U., but this is where we stand. When it comes to gender break down, male/female it looks good. But when we look at racial break down we start to see a little bit of a problem. What I

don't have data on is socioeconomic break down. I think that is important when we think about who is even enrolling into our program.

This is what our students look like. We do try to set some things up on recruiting students into our programs. We have, I'm highlighting three things here. The first is program called math alliance. This is a nationwide program and the idea here is to provide mentorship to undergrad students from traditionally underrepresented backgrounds in the mathematical sciences to encourage them to pursue careers in mathematical sciences and strongly encourage them to go to graduate school. So the University of Minnesota is a partner of this program. I will say that we haven't had a lot of success getting students from math alliance into statistics and biostatistics. One of the challenges here disclaimer, this is one of my strong opinions, I feel amongst the mathematical community, we are viewed as second rate applied mathematicians. That's my impression. If there are any mathematicians here offended I apologize. But that's the impression I get being from math alliance. We haven't had a lot of success. But we are still a part of it because it's a way for us to meet potential graduate students to talk about statistics and biostatistics.

We had a SIBS program, I can't say we are celebrating our 20th anniversary like B.U.

That ended in 2018 for us. Since then we have been trying to get another summer program of sorts. And then this is where the last bullet point, the R.E.U., an NSF-funded program. We actually just started last week. So I am the P.I. of that program. It's very similar to SIBS, similar in spirit. Ten students, ten weeks. It's a little bit longer but it is also half the size of a typical SIBS program. A lot of what we focus there is on the, what's called the largest NIH funded study on adolescent development. The students are looking into projects, analyzing that data with a keen eye towards disparities.

And what I mean by disparities is broadly defined whether racial, ethnic or socioeconomic, I'm leaving that up to them. But this is where we are. What we are trying to do with respect to getting students exposed to biostatistics. So I will also say that more broadly, the School of Public Health at University of Minnesota is very much aware of how important it is to get people from other backgrounds as a student of public health. Around late 2019, we began working on the strategic plan for anti-racism. And the need for this became very timely in Minnesota, when I'm sure you know what happened in Minneapolis specifically in May 2020. This is a massive document that we are very proud of. And I certainly encourage you all to take a look. I think there's roughly 75 pages of what to do to set us up to

be an anti-racist institution.

I'm highlighting here one of the many goals which is about the recruitment of students.

Pretty much this topic, the reason why we are all here today. And some of the actions listed there is exactly what we are talking about. Building pipelines and pathways to go from, am I someone who could be a part of this? Am I someone who sees statistics, biostatistics as a career, as a profession? That's one out of many things we are hoping to do.

And with respect to that pathway, one of my beliefs is exposing kids earlier to what is biostatistics? We have a committee in our division that is committed to exposing high school students to the data sciences. On that note I would like to end with these three hypothetical questions.

When it comes to building a diverse pipeline, so, to me, this first bullet point here is, well where are the gaps right now? I showed where our gaps are at for Minnesota. But just broadly speaking, as a field, where are our gaps? I will tell you for Minnesota specifically, we have problems recruiting people from the south and also California. And the feedback I get a lot is Minnesota winters. But you know, that's a different conversation. The second bullet point is something I strongly feel, I have strong opinions about as well. I mentioned earlier I'm Filipino, I can challenge you now, can you think of five Filipino statisticians? Just five, one hand, if you can, that's great.

Before I took my position at Minnesota I was at the University of Newark. The question I asked my supervisor, also Filipino, how many Filipino statisticians are there in Europe? That could be important when tragedy strikes. That's what happened when a major typhoon hit the Philippines and I had no one to talk to. The third bullet point is what I was talking about earlier about early exposure. A lot of this was motivated when I was attending the Minnesota State Fair and I see all these kids playing with robots. Why can't they play with data. Is there a way we can make this cool and fun? Maybe not even about statistics but just data literacy? That is, in my opinion, where we start. Being literate in the data sciences means being able to take what looks like a spreadsheet and play around with that, and is that something we can then do. I will end there, so thank you.

[Applause]

>> LISA SULLIVAN: Thank you, Mark Fiecas, we welcome your strong opinions, that's why you are here.

We will then turn things over to Jacqui Hicks. Dr. Hicks is a Clinical Associate Professor of Biostatistics at the BU School of Public Health and Lecturer in the Department of Computer

Science at Metropolitan College. She is Co-Director of the Epidemiology and Biostatistics Certificate in the School of Public Health and the co-Principal Investigator of BUSPH's Summer Institute for Research and Education in Biostatistics program. Dr. Hicks runs the Public Health and Biostatistics Lab series for the Upward Bound Math/Science Summer Program, a program whose purpose is to prepare low-income and first-generation college bound students for success in higher education. She runs a program within the Department of Biostatistics to better prepare graduate students for teaching students courses in the field of public health. She also does research on using new pedagogical methods in teaching introductory biostatistics courses to graduate students. Jacqui?

>> JACQUI HICKS: Thank you. It's great to have a mini reunion of SIBS. I want to thank Lori, Anita and Lisa for starting the program and Howard Cabral who has been there from the beginning as well. And great to see instructors and alumni. Nice to have you here today.

Thinking about where biostatistics is headed over the next decade. We are in a really exciting time for the field. There's a huge need for more data statisticians. We have big data coming up with more data in electronic health records. Many of are wearing apple watches where we have multiple devices, more data is being generated by the minute than ever. There's more of a need of statisticians than ever. And with that comes with more challenges but more opportunities for our field.

With that we have more opportunities for personalized medicine. We are just not plying medicine as a blanket for everybody, but tailoring medicine to the unique needs of each individual. Using machine learning and A.I.

Developing clinical trials and drug development where we are tailoring techniques for certain groups of individuals. Infectious disease modeling and environmental health.

But with that comes different problems. So as we saw with the COVID-19 epidemic, we have more people looking at what we call health equity. What we saw with COVID-19 is that these infectious disease and these public health problems and problems we are seeing in medicine are affecting different groups of people more than others.

And what we are seeing is that people, different race and ethnicities, certain genders are being affected more than others. And what we would like to do is to recruit biostatisticians to help us tackle those health inequity problems we are seeing.

However, with these challenges and some of my previous colleagues speakers highlighted this, don't represent what we are seeing throughout the country in terms of our racial and

ethnic background. What we are seeing is biostatisticians in the field are more likely to be white, and again Asian is more of a blanket term as pointed out by my colleague.

We are seeing people who are more likely to be affected by these health disparities are more likely to be Black and African American, Hispanic, Native American, and less likely to go into the STEM field. Less likely to be biostatisticians. We need to recruit more individuals in these racial and ethnic backgrounds who will be more likely to be affected by these health disparities.

The question is how do we recruit more of these individuals in these fields more likely to be affected by these health disparities?

Now biostatistics has always had a problem of diversity. What we have done to help these problems, we try to introduce diversity into, try to introduce a diverse student body in grad schools by trying to recruit more into the biostatistics field. We have done this by going to conferences like Sacnes and Avercams. We have been successful. We had programs like the summer institute in biostatistics, we recruited undergrads and introduced them to the fields of biostatistics and data science. SIBS has been a pretty successful program. Anywhere from 90-95% of our students have gone onto graduate school. No pressure for our class of 2024 students who are here.

[Chuckles]

I would like to argue in order to increase diversity in our field we need to look beyond just undergraduates. We need to go further down the pipeline. We need to start look at recruiting at the high school level and even middle school and elementary school.

So one of the things I have done is started pairing with the Upper Bound -- this doesn't only exist at B.U.,

There are several across the country. This is a six week residential program. One of the ones we run here is the public health series. Students involved in biostatistics, global health, we introduce students to the field of public health where we collect their own data. On noise pollution and air pollution. We have them take that data, bring it into Excel and they learn how to analyze that data. They learn how to develop their own research questions. And they learn things like descriptive statistics. These can be done at the high school level. I would venture we could even go further than that. We could start outreach programs at the middle school and elementary school level.

I started reaching out at middle school level. You can teach them things like descriptive, I have gone on and brought M&M's and skittles in the classroom. We do things like mean and

standard deviation. How teachers feel after I leave and they are sugared up from the candy, I don't know. But it can be done and I think we can move beyond middle school and think about going into elementary schools. I tell you, students start to get disinterested in math and statistics much earlier on, even I think it occurs early as elementary school. So sf we want to start intervening and create more diverse pop line of statisticians and people in the STEM field we need to start intervening at a much earlier time point, I think the minute time point. I have gone on and does it at the high school level, middle school and I think we need to start thinking about doing this at elementary school. Make sure we can create a more diverse pipeline but also to get students to start thinking math is not just plugging in numbers but see a more applied approach to mathematics and statistics and think math is fun when they see it in a more applied setting.

I think if we do this, we can start creating a more diverse pipeline and start getting more people who had these health inequities involved in public health and biostatistics research. Getting the numbers up that we are seeing for Ph.D. and masters students statistics graduate schools to help address this problem. Thank.

[Applause]

>> LISA SULLIVAN: Thank, Dr. Hicks. And to all our speakers I would like to ask if our speakers can join me on stage. We will have a discussion, take questions from the audience. And for our audience joining virtually, we will ask you submit your questions using the Q&A function and we have people here in the room who will read your questions to the panelists.

Thank you, all. Let me start things off with a few questions. Dr. Bailey, you shared some of your personal story of how you got into the field and maybe you want to elaborate on this, but I wonder if Dr. Hicks, Mark Fiecas, if you can share your own journey in the field of biostatistics obstacles you faced, or supportive specifically related to Diversity and Inclusion.

>> JACQUI HICKS: I was talking to my SIBS students about this earlier today.

My parents brought me up with math and science at an early age. They didn't know anything about biostatistics but they knew being educated in math and science were important. When I did my undergraduate degree at University of Michigan I thought I wanted to -- fortunately, I won't say poor advising, I just never reached out to my advisor, I was in my summer of my junior year, I started shadowing a dentist and realizing I hate this.

I'm a senior, no idea what I wanted to do with my career. Finally reached out and talked to my advisor. You have the math

major and science major. Why don't you find a way to combine them. So blindly apply to some graduate schools in biostatistics. Found a passion for it. Went onto graduate school at George Washington University. In D.C.

And this was my first time in the big city. I had gone to undergrad in Ann Arbor, smaller, not as expensive. When I was in D.C., it was very expensive. So I needed some spending money. There was an opportunity to be a teaching assistant. Never taught before, but I thought I can do this, so I applied. A lot of poor decisions on my part not really thinking things through. I applied and teaching, and I loved it, I absolutely fell in love with teaching. I decided to go on and get my Ph.D. to be able to teach at the graduate level. That's how I wound up at B.U., and the rest is history.

>> LISA SULLIVAN: Any regrets about the dental career?

>> JACQUI HICKS: No, not at all.

[Laughter]

>> MARK FIECAS: So for a long time, I thought I was going to be a mathematician. I went to undergrad university in Houston. I really like algebraic number theory. That was my jam. What I liked about it, it was a collection of puzzles and I like puzzles. I like theorems. That was my thing. I thought this is going to be my thing. After Houston, I went to University of Illinois. I was pursuing a masters in mathematics there. And I remember filling out my schedule for my second semester there. Two courses offered but at the same time I have to pick one. So I flipped a coin.

>> LISA SULLIVAN: Scientific?

>> MARK FIECAS: Very scientific. In a different universe the coin landed in another way. But in this universe that coin landed in a way the class I ended up taking was linear models and the person teaching it would eventually become my Ph.D. supervisor.

So we talked a little about mentoring. His name is Dr. Hernando N'bao, he is Filipino. That's how we clicked in the very beginning. He went to grade school with my mom's cousin, so there are some weird things like that.

I never heard of biostatistics, until really probably that moment. I didn't know what it was. And you know, when I started, my parents were even asking me, you know nothing about biology, what are you doing? There was a man, I could see myself being similar to a couple years down the line and lo and behold here we are.

>> Seems I might also need this. So yeah, I also had no idea what statistics was. Coming out of my high school, despite my math experience, I did like math, I found myself trying, as I learned the material, wasn't really learning it from the sub.

Trying to teach it to other students in the class and I really liked that. I was not sure what people did if they liked math but I had high school math teachers. Oh I will go to college and be a high school math teacher.

Thankfully I talked to my high school teachers and they said don't, don't teach high school. I continued with math as a major. But I didn't know what I was going to do with it. I needed money in the summers, so starting not with my first summer. The first summer I made cement and laid bricks for a summer.

But my second summer I was able to do an internship with a government, I was in Maryland, with the Department of Defense. It was a bit miserable, in a cubicle by myself and every once in a while my mentor would pop his head and see how the coding was going. It was like an applied math thing. Okay, I don't know about all this. But going into my senior year, I was able to do a summer R.E.U. at University of Wisconsin, which I appreciated in the summers but they said they go on the lake in the winters, which I assume is also a Minnesota thing, okay we will stick with summer. That's where I learned about biostatistics, right. Computational program as part of larger STEM, R.E.U., but we got to meet with a bunch of biostatistics faculty and current grad students and they shared their own stories about how they ended up in the field.

Also through the project we did that summer, it was fascinating that my math skills could be used to directly impact healthcare. I was working with a pharmacologist doing end-of-life care. How to do the bolus, when you click the button, you don't get it every time you click the button, it's timed out. How do you space them out so there weren't toxic levels in the blood. I was young. I don't know if it influenced his clinical care but the idea it could was just mind blowing. That's how I ended up figuring out maybe I should go with grad school. I went with statistics. I still didn't know what biostatistics meant but in grad school I pivoted to a biostatistics program.

>> LISA SULLIVAN: Thanks for that. Sounds like you took it upon yourself to do things, you flipped a coin, you did the internship which turned you in a different direction. Based on the data you shared we have to do much more and more intentionally.

We can't just hope that these good people find us, you know? And somebody sparks an interest in them. So what can we do to find the students that we want in our programs? Because a lot of us are, we are all sharing the same interest and goal but we need some strategies that we can apply and be more intentional.

>> Since I have the mic, I mean I think about what I can do mostly in my workplace in part because it takes up most of my

energy, that's some days where I think I live. For me I try to
be intentional through advising. My first year advising,
encouraging students to explore, I tell them about myself and
the field.

Even though I hear A.P. stats for example is much more
common, I still have a lot of students who didn't take any
statistics in high school. They don't know what statistics is,
a lot come into Amherst College and want to be medical doctors.
I tell them do you know there's this thing called statistics.

I also run, we just started yesterday, the STEM incubator
program which is more of a STEM exploration program. I'm
partnered with colleagues in chemistry and biology to give
hands-on basic research experience to students across multiple
fields. This year we also have an astronomer on board. Again
it's a way to get students involved earlier, thinking about what
it could look like to do research in these fields and build a
cohort of support along the way.

>> The three us talked about early exposure. And I think
this is an extremely important thing. I didn't know about
biostats until after I graduated from undergrad. Even before
then I took A.P. stats, hated it. I took a one year sequence of
probability and statistics in undergrad, hated it. That doesn't
mean that's what stats was. This is old school, stat is NOVA and
looking into effect of treatment on crops, right?

You think about bio stats specifically it's not just
clinical trials any more. This is where I'm really liking the
term health data science. Because biostats specifically is just
so much more. I think getting people exposed to that early on,
the application of you know, certain techniques and looking at
data in different ways, that's data science.

Yes, there's a bunch of math, yes, there's a bunch of
coding, but this goes back to what I shared about robots, what
is our analog of robotics for the data sciences? I don't know
what that looks like. But I think there are ways in which we can
really inspire the young mind to really think about the data
sciences.

>> You know, I think one of the things we need to do is
having students see the more applied part of statistics, I think
people who said I took a stats class and hated it, all you think
about when you took your probability in stats classes you think
of how many ways you can pull socks out of a drawer. Of course
you hated your stats class then.

Making sure students are exposed. It comes down to
instructors making sure they see the different applications and
get that type of exposure early on, I think that will help
things. But I think exposure earlier will help in high school

setting. Like I said. Like I mentioned, getting them excited about math earlier on, also.

>> You gave the example about middle school. I was thinking high school, but middle school is a really good idea. And I guess it's just thinking about what are the applications that would grab the interest of those students? I'm certainly too far removed from them to be able to make that connection. But some of you could do it. And you know, how do we find out what those applications are that would grab those students?

>> Yeah, so one of the things I had to do, I reached out to certain middle schools and talked to the teachers to see what units were you teaching and how could I tie in concepts and statistics to what they were teaching.

When I found out they were talking about percentages and rates I knew I could tie in descriptive epidemiology and tie that into statistics. But it's really difficult because you have to, one, with the public school system it is today, teachers are over worked so it's kind of hard to find the teacher to ask them do you mind if we work in a statistics unit on top of everything else you have to do, unpaid.

So that's kind of difficult. And then there's a lot of areas I wanted to work in, there's a lot of high turnover, so some of the teachers I worked with you find out a year later they left the school system. That could be difficult too. But when it works out really well, it works out really, really well.

>> I bet it does.

>> BRITTNEY BAILEY: These were not my ideas but I was in a seminar on a similar topic on Friday. How to get in high schools. I don't know they went to middle school but some was generating their own data or playing with fun things.

Jacqui, you were talking about the M&M thing, we did that for Ohio state and I enjoyed M&M day too. They made these catapult to launch things and what kid doesn't like to launch things across the room. And Dr. Stan at Memorial Sloan Kettering. I think they tried to squeeze in an hour and a half doing things related to data. I think they present different pictures, images and tell people to try to guess the age. In realtime they are populating the kids guesses and talk about data and variability. Some may not be about knowing what the kids think is cool. But rather, playing. Literally just playing, having fun with it.

>> My advisor's daughter was a fifth grade teacher. He encouraged me to go into her classroom, which I did, this was many years ago. I had the kids, I brought the CDC growth charts and tape measures doing head circumference and height, and looking where they fell in the percentiles they were for their heights and head circumference, and kids thought it was fun.

They were measuring. No matter what percentile they turned out they thought it was the best one to be. It was good for everybody.

Can we shift to a comment that you made, Dr. Bailey about belonging. How do we create environments and your comments went to that too. If we get the students we want in the programs how can we best support them and make sure that we retain them throughout their programs? Because I think the worst thing that could happen is we get a diverse body of students and we lose them. That would set us in the wrong direction. What can we do specifically to create the environments that support all students?

>> MARK FIECAS: The most obvious thing is the mentorship. I think, however, that even though it's obvious, it's also not sustainable. There needs to be more. There needs to be broader infrastructure in place. I don't know what that infrastructure looks like.

But regardless of who you are, or look like, or your identity, you should be able to find someone, whether amongst the faculty or whatever. Someone in the program who you could just feel safe around. That's touching on the mentorship.

But what if there's a system in place for that. Again, I don't know what that looks like. I benefited a lot from research advisor, and after graduate school, while he and I maintained contact, and even to this day maintain contact, having some support still comes a long way. Now I have a lot of mentors. I have a lot of you, you know, people who are cheering me on as I progress in my career.

But when it comes to very specific things about myself and who I am, should I have to explain to you when it's Manny Paquio is fighting why the night stops for me. When the big volcano erupted a couple weeks ago in the Philippines, if I'm a little bit disturbed, you know, someone will be able to understand that. Again, I'm talking a whole lot right now about mentorship. I think something that we could really think about as a field is, what is beyond that. Whatever that may be, I think we need it.

>> I agree. I think it's harder to think about broader systems in place. I will give an example, at least from the program that we run, again the STEM incubator, one of our goals is thinking about the cohort building, in part to think about how can we ensure these students at least have each other and maybe whatever we are doing in this space will expand beyond that and into the broader Amhurst Community and they carry the schools beyond Amhurst itself.

At Amherst we start by listening to the students, what is it they need from us? Yesterday about an hour, hour and a half,

we started our summer program with what we call community circle. We develop a sense of community values. Every student. We have a list of potential values they can add to the list if they want. We have everybody share. What is it you value in terms of thinking about having a supportive team and community and embarking on this together this summer.

Everybody gives a value and their reason and we break into smaller groups and try to build a community value statement we hope to live by for the rest of the summer. Through that it's not just what do you value as a teammate but what can we do to support you and your learning in this program? Those things don't just apply in that small space. I hear those things and I'm like oh crap what do I need to do in the classroom to make sure I'm meeting the needs of the students as well. It starts by listening. That's easier to do in a smaller setting. We only have 18 students in this program. What does it look like for the 2,000 in Amherst College or across the nation generally, it's harder.

>> I know it could sometimes feel like an insurmountable task. I don't know what the systems look like or how to tackle it. I want to think every little bit helps, one of the biggest issues, I don't know if you agree is accountability. I think we all have a responsibility and we have to be accountable. We can't say you are really good at this, you do it and I will sit in the background. That's not going to work, right? I guess even among faculty and staff, we need to hear and share our values. Make sure instead of just assuming we are all on the same page. Because this takes work. And we aren't going to change those numbers you showed us unless we all commit to it.

[No Audio]

People invested in me, so I don't know how to not do the work. I tried to opt out and I find myself back in, very quickly. I'm doing it despite and make sure my research stays strong on the side and still a priority.

>> To build off that, you know, it does remind me of the impression I have. That the faculty of color are feeling compelled to do so. I do challenge those who don't belong in such groups to also feel compelled to do so.

>> I agree, because it's an awful lot, disproportionate lift and that's not right.

Others? Questions? Please use the mic so our online audience can hear you.

>> LINDA SULLIVAN: Hi, thank you, panelists for the wonderful discussion. As an early career person and person of color and international, I feel like a lot of concerns or questions around other educational and professional development

opportunities such as going to conferences or taking part in
boot camps which I haven't at least seen a lot for bio stats.

So I'm just wondering if that is part of any of these
programs that you mentioned or it is going to be in the future?
I don't know if this is an idea or a question at this point, but
I see a lot of like funds going into science, medical science
but not a lot in bio stats. It's either Computer Science or
medical, the bio stats is kind of hanging in the middle. I'm
just wondering what are such opportunities that people can look
into? Or if you have any suggestions.

>> Are you looking for opportunities for undergraduates?

>> All levels I feel. Coming into grad school I had no idea
where I was going, I just knew I liked biology and math. I
blindly applied for bio stat and it worked out for me. Students
have reached out to me and I have no answers because I myself
don't know. At any level as data people is there a repository we
can build or look if that exists already?

>> Do you want to talk about SIBS and many initiatives you
are involved? Please go ahead and start.

>> Sure, at least for undergrads, I can't speak about our
SIBS programs but we did have a SIBS program. That was one way
to get people involved. SIBS is NIH funded and in my case it's
REU. The target is undergrads and getting them exposed to
research in the statistical sciences. For faculty, I don't know.
Maybe the other two here may have an answer. But at least for
undergraduate students, they have SIBS and REU's. I will say
regarding your comment about Computer Sciences, I feel like we
are now in competition in some sense with the Computer Sciences
especially this idea of data science. It has a very broad
definition and everyone wants a piece of the pie. If we as a
field of biostatistics really want to make ourselves distinct
and will encourage people, we should make a lot of effort on
creating distinction this is bio stats, this is Computer
Science, this is whatever other data centric field.

>> If you have people interested in the intersection
between math and biology in their undergrads, I would highly
encourage them to apply to SIBS. There are ten sites now. These
are 24 students now for B.U.

Right now we have five-week in-resident program and five-
week remote program where they learn about biostatistics and
application to epidemiology, clinical trials, infectious
disease. They work on a research project with a stipend. We can
talk more about it. There are different sites. And then there's
different REU's throughout the country. There isn't a repository
which is unfortunate. But there are some other sites I can point
you to and we can talk more about this later. But yeah.
Definitely talk to me.

>> One of my favorite things to talk about is opportunities available through the American Statistical Association. I will call it since 2017. As a grad student I was on a panel at StatFest talking about our experience as grad students. But the point is there are two major initiatives, one is stat fest geared toward undergrads, it's every fall, September 21st at Columbia University this year.

For StatFest it's about exposure. We have career panels across academia, industry, government, to try to let students know about what the variety of opportunities are like in statistics. We have a keynote speaker a little more seasoned who can talk about their own winding pathway through the field.

We have a StatFest Expo, we have grad program representatives there, we have industry representatives there to tell students about opportunities and have that personal connection with them. And then the highlight of the day is usually a closed session with grad students and students only where again they get to hear more about what it is like to go to grad school.

What the application process is like. What the lived experience is like for students in the field. Since grad StatFest is geared toward grad students, last year we had elementary and high school students there. So we could address that sort of early exposure and learning about what are the many different opportunities in the field. And then for those who have already identified statistics as something they want to get into, we have the diversity mentor program. Which also has some aspect of exposure.

There are still people from different career fields who might talk about their experiences if you are still trying to figure out as a student, grad student or as a post-doc or early career transitions what is it I want to do going forward with this degree. A big part of the diversity mentoring program attached to the joint statistical meetings this year, I'm not going this year you so I can't plug the dates but you can look it up. But the mentoring component is key there.

We have mid career and late career statisticians partnered one-on-one with students, post-doc and career statisticians. They meet every morning during J.S.M.. They talk about what it is to be in a mentoring relationship and how do you make that mentoring relationship successful and lasting. They have that one-on-one, I guess I would call it bonding time. But the intention is these are long-term mentorship relationships.

They are having small group and larger group discussion to also build community among the people there. We tend to see return applicants within DMP and stat fest as well. As soon as you come into the program we say, well come to the family. We

are here for you, even if I don't get a chance to talk to you, you know my email and how to* find me, I want to be there for you, and having that community to serve potentially as mentors but also as peers going through the stages of life together, going through the stages of your career together. We want to make sure you have a community and network to fall back on.

>> Great. Other questions?

>> Hi, thanks for that. I have a question going down this idea of thinking more creatively about the diversity pipeline. You know, so, and people who know me well know this is a hill I will die on. You know, I think there are structural things we can rethink. I think evidence for that might be perhaps everybody graduate admissions thought we could never do admissions without a GRE score. COVID gave us an actual experiment that said we can and a lot of places survived, a lot of places aren't going back to GRE scores.

I'm wondering if you have thoughts about other structural things that getting to this idea of inclusion and belonging that sort of, you know, I think the way we do graduate school and sort of our programs are defined around, you know, like we expect students to come in, fit in with our model and we provide them with support that basically assumes they are going to assimilate to our structure. And I'm wondering if there are ways we can sort of think about expanding being more flexible around what that structure might be. The qualifying Zambian (?) being one of them. Thanks.

>> MARK FIECAS: We are thinking.

>> BRITTNEY BAILEY: I think the a good question, I don't have an answer either but as soon as you said qualifying exams. They are such high stakes. Speaking from someone who failed the first qualifying exam. We had two at Ohio state. By the time I went to retake it, I almost hoped I failed again so a decision could be made. When I passed I was like darn it, the second one is coming up do I really want to stick this out. The exams are discouraging and high stakes. For me it wasn't assessing my ability to do research in this field. On the other hand I understand why they are there, in the sense you need to know this stuff. And you're not necessarily showing you know it. I don't know, I would like to believe you are showing it in the classroom. But is that always the case? I don't know. The a complicated question. But I also just generally don't like them. Are there other ways that aren't timed exams even, if we feel we have to have some sort of assessment, is there a more creative way to go about it to show what it is we are trying to show, especially for doctoral level.

>> Yeah, this is a really tough question.

I mean, I will throw something out there, you said creative.

When it comes to evaluating a potential applicant in your grad program, you mentioned G.R.E., but what about G.P.A.

Especially since, know, these things are not exactly comparable across institutions. And what makes it tough, right, is that I mean, I'm certainly not saying we should get rid of GPA all together but is there a way we can look at, you know, "Performance" I will use that very loosely. Be able to evaluate and assess students' past performance in order to forecast their future performance. I mean, I don't know how we could be creative around that. But a G.P.A. is one those, where, to be honest, when I look at some institutions, okay 360 that is actually great, but a 4.0 there, that's all right. Why am I doing that? That's a question then that we, perhaps I should also reevaluate, you know. Because it should be objective. And this is what a G.R.E. was supposed to provide us, some standardized way, I will put a G.P.A. evaluation as one of those things.

>> JACQUI HICKS: I understand what you are saying about qualifying exams. Because some students simply don't test well. You put them in a stressful environment, anxiety-inducing situation. I have seen students even not just in my intro-level quant core class break down. It's an awful situation to put them in. And have your entire Ph.D., academic career set on one exam, not the situation to be in.

>> I think it's time to open the conversation about what are other ways we could evaluate students. Just because we move away from something, like the G.R.E., we moved away from and as far as I can tell we are not bringing it back. And nothing bad happened. Nothing bad happened. We still have excellent students. They are doing just as well as they always did. No issues. I guess we have to stop thinking if we take something like qualifying exams away that means our program doesn't have integrity or something. That's not the case. What was the purpose of them? Were saying maybe there's a role for students in a different setting, that's okay, if that's important. What are the other ways we can assess these things because they don't work for everybody. So I think, the time is to open the conversations. Why not? Other questions?

You have a question Erica, from online. Great.

>> ERICA AUGUSTINE: Arthur asks what are your thoughts on other end of the biostatistics pipeline, and lack of representation? By that I mean the actual research and research funding landscape. It can be demoralizing and alienating to see how little attention certain populations or disease areas get.

>> MARK FIECAS: That's an excellent question, there's a couple ways I could interpret that question. One of which is the people we are studying. Another interpretation is who are getting the grants? So let me talk about the first one. I mean, this is tough. Because at the end of the day we want to be able to talk about science and how this, the results that we get are applicable to more than just the white educated.

That's what we want to do. Yet, when we think about who are the people going into the studies, guess who has the time and resources to be a participant in said study? So that's just the people. I can't speak about the diseases itself. But at least with respect to the people participating, you know, I think that outreach into really encouraging people to be part of the process. And this could be tough when there is history between say, certain groups of people and the federal government. And something that I think we should be mindful of when you are recruiting study participants. I already forgot what the second interpretation was, so I will just leave it at that.

>> LISA SULLIVAN: Anything else to add?

Okay. Other questions?

Go right ahead.

>> This question is from Patricia a SIBS 2004 alum. What can we do to support the next generation of bio statisticians entering the workforce, how can we support the future of the SIBS program in the next decade?

>> LISA SULLIVAN: Jacqui, this one is for you.

>> So we are always looking for alum from SIBS to participate in the SIBS program. One of the things talked about previously was mentorship. I'm always telling our SIBS participants, the SIBS 2024 program is not just 2024. We will be mentoring these students for many years to come. Whether that be course selection, letters of recommendation, trying to help you determine what graduate school program to go to. What that entails is, we might be reaching out to our SIBS alum to be like have any of you attended North Carolina bio stat program? We have a student interested, could you help us out. We have a student interested, could we put you in contact with this particular individual. Things like that. Or we have a student interested in clinical trials. Could we reach out to you to put you in contact with this individual. Help with things like that. A quick Zoom call with past or current SIBS participant would be really helpful.

>> LISA SULLIVAN: Excellent. Any others from online?

>> ERICA: This comes from Carisa, I notice some decisions are driven by the need for income, I also had that challenge. What could be a more intentional way to inform the reality of

supporting yourself as a student or moving from other jobs to academic jobs.

>> LISA SULLIVAN: Could you say that one again? I'm not sure I grabbed that.

>> ERICA AUGUSTINE: I think she is talking about some decisions of potentially the career paths are driven by a need for income. And I also had that challenge. What could be a more intentional way of informing the reality of supporting yourself as a student. I guess just thinking of potentially economic factors driving decisions in terms of education paths is my interpretation, at least, of the question.

>> JACQUI HICKS: I was broke as a student. Especially one living in Boston. I had two roommates the entire time and lived outside of Boston and commuted in on a regular basis. So, and I get it. You know, you don't want to make these decisions based on the economy. So I found a way to make it work. And I think that universities are getting better at recognizing, particularly at B.U., at recognizing the economic factors driving these students decisions. They have raised the research assistant stipend, which is great. So I think universities are coming around to that. So that's been really helpful.

>> Yeah.

>> LISA SULLIVAN: Anything else? We are just about time. I want to thank again Drs. Bailey, Fiecas and Hicks for joining us this afternoon.

We will take a break and resume with Session 2 discussion with our alumni moderated by Lori Chibnik, Associate Professor of Neurology at Harvard Medical School and Harvard TH Chan School of Public Health and Adjunct Assistant Professor here at the BU School of Public Health. Thank you very much.

[Applause]

[Recording stopped]

[Break]

[No audio]

>> She will lead the discussion. Lori, thank you.

>> LORI CHIBNIK: Thank you. Lisa was not just my thesis advisor, she managed to survive that somehow. She is a very strong woman.

I will start by giving a little bit of a background on the SIBS program to set the scene.

In 2004, NHLBI put out programs to introduce undergraduates to biostatistics. Three were funded, B.U., North Carolina State/Duke Clinical Research Institute and University of Wisconsin. Every three years this faculty got together and was able to keep funding up now for 20 years.

The original schedule we had stuck with some enhancements over the years. We started with about two weeks of biostats led

by Lisa and SAS with Howard. We had guest speakers from the outside, Dr. Apovian from BMC, Director of the weight management clinic and discussed risk factors and treatment for obesity.

Dr. Kim Dukes from DM-STAT, now BUSPH, invited the SIBS students to DM-STAT to meet her team and discussed the importance of data quality and data management. Many other faculty, Michael Pencina in math and stats, Alexa Beiser in Biostat, Adrienne Cupples from Biostat came and shared their pathways and personal stories how they got into biostatistics.

We then went to epidemiology with Wayne, and we had Pat Kludt with the Department of Public Health talk about an outbreak of food poisoning at a wedding. Professor Glantz talked about evidence in ethics and how to think critically.

Professor Bill Bicknell another favorite and former commissioner for Public Health for Massachusetts talked about some issues he faced throughout his career.

Next clinical trials with Joe Masaro, the consummate a fan favorite. Ralph D'Agostino discussed his illustrious career in clinical trials working with the FDA, and then a field trip to HCRI. Joe loved to take everybody around and show all the places they worked.

Finally switched to statistical genetics with Anita, here today online. And what really started a very, let's say friendly rivalry between clinical trials and statistical genetics, it was the Joe versus Anita. This has continued for 20 years and even bled into the Yankee swap in the biostat department. We had Diana Bianchi come and speak, she was medical geneticist at Tufts, now she directs National Institute of Child Health and Human Development.

However one of the best aspects of the SIBS from my perspective, was its focus not just on the science, but on building community. Throughout the program the students lived together in a Bay State Brownstone which had no AC, so they were very dedicated. They were joined by the faculty and participated in many social and community-building events and activities organized by Mary.

They got to know Boston, first a trip to Faneuil Hall, with Lisa insisting on getting cookies from the Boston Chipyard, then a Duck Tour and Freedom trail and although we always had costumed guides, Mary, Lisa and I usually managed to throw in a few sort of accurate historical facts along the way.

We toured the Framingham Heart Study and heard from Dr. Bill Kannell, one of the original investigators. We took a trip to George's Island, we saw Wayne on his boat. And of course took in a Red Sox game, though know Yankees fans were allowed per Mary's orders.

We always ended the six weeks with a dinner that includes faculty at Lucia's in the North End. With all we were able to squeeze into six weeks and the community SIBS built over the years, I think we earned the moniker of "Statistics Camp".

Our faculty and staff were so impressed with our students they kept applying to continue the camp, 20 years on. Our goal was to run an interactive program to introduce undergrads 2010 and later competitive solicitations resulted in 7 additional SIBS programs: Emory, Iowa, Pittsburgh, South Florida, Washington U in St. Louis, Columbia, & Minnesota.

Our primary goal was always to run an interactive program to introduce undergraduates and recent graduates to biostatistics as a vibrant, vitally important discipline that offers many exciting career options. Some former students once told me that they considered SIBS "a 6-week advertisement for biostatistics and public health" so I think it worked – many of our SIBS graduates went on to further study in biostatistics or epidemiology, focusing on clinical trials and statistical genetics. Some now hold faculty positions themselves, and many others work in industry.

Before we hear from our panelists about their experiences with SIBS – I want to offer a personal reflection. I was in my first year of the BU PhD program in Biostats when SIBS got funded. I will always remember the first time Lisa told me about it, my response was "Oh that sounds like camp" – I'm pretty sure that is not the response Lisa was expecting – and yet she still asked me to be involved, which is how I ended up managing the program throughout my PhD and even after. That conversation was a turning point in my career, so many of my choices and priorities have been driven by my time in SIBS and what I learned from the faculty and students in the program.

On that note, I would like to turn to our SIBS alumni to share their experiences. I want to start things off with one of my favorite quotes from a SIBS student:

"I want to thank you and everyone else at SIBS for really changing my life. When I got there I knew that I liked stats (I've liked math my whole life) but I wasn't sure what to do with it. Being part of the applications, having the ability to work with real data, really influenced my views. I get so excited when I think about being able to apply to a PhD program and then doing research and working with people - which is what I really want to do. In particular, I am very interested in clinical trials and the medical aspect of biostats/epi.."

Today, we are pleased to be joined by four alumni of the BUSPH SIBS program:

Before we hear from our panelists about their experience in SIBS I want to offer one personal reflection. I was a first year, they were waiting to hear if they got funded. My response that sounds like camp. I don't think that's the response but that's how I got involved. How I managed throughout my Ph.D. and stayed as active as I can with the program thereafter.
That conversation for me was a turning point in my career.

So many of my choices, my priorities have been driven by my time in SIBS.
What I learned from the faculty and students in the program I have carried forward. And everything I have built since in terms of training programs and mentorship, I really owe a lot of credit to the SIBS program. On that note I would like to turn it over to our SIBS alumni.
I will start by introducing them. In the order they are sitting. So first we have Taylor Mahoney, is a Senior Biostatistician at Avania - a CRO focused on clinical trials for medical devices and she participated in the SIBS program in 2013. She received her BS in biostatistics from Simmons University and her PhD in biostatistics from BU. Her research interests include stat methods for adaptive design clinical trials and the analysis of correlated data.

Then we have Alison Pedley, currently Chief of Staff for Merck's Biostatistics and Research Decision Sciences organization. In this capacity she leads the organization's leadership team in advancing organizational, operational, and strategic initiatives.

Alison earned a Ph.D. in Biostatistics from BUSPH in 2010 and joined the Late Development Statistics group within BARDS at Merck in the fall of that same year. Alison was a participant in the inaugural 2004 SIBS program here at SPH.

Next Jamie Collins, is Associate Professor of Orthopedic Surgery at Harvard Medical School and Associate Director of the Orthopedic and Arthritis Center for Outcomes Research at Brigham and Women's Hospital. She is the Director of the Biometry Consultancy Unit in the Department of Orthopedic Surgery at Brigham and Women's Hospital and Director of the Brigham Coordinating Center's Data Management & Analysis Core for the Arthritis Foundation's Osteoarthritis Clinical Trials Network. She received her PhD in Biostatistics from the Boston University School of Public Health and was a participant in the inaugural Summer Institute in Biostatistics at Boston University in 2004.

So thank you all for being here and some coming from out of town to join us.

I would like to start by asking our SIBS alumni.

Taylor?

>> TAYLOR MAHONEY: Hi, so ooh, that's loud. I'm Taylor Mahoney, Senior Statistician at Avania and I did the SIBS program in December 2013 after my sophomore year at Simmons.

I think for me, if it hadn't been for SIBS I wouldn't be sitting here today. I was fortunate to go to college with a biostats major, I picked it so I could not major in biology. I knew I liked math but absolutely hated zoology, so that was my turning point. At SIBS, the support of the faculty.

>> ALISON PEDLEY: My name is Alison Pedley, biostatistician at Merck which say pharmaceutical company. I was, as Lori mentioned one of the first participants of SIBS back in 2004, which is embarrassing for me to say was 20 years ago because it doesn't seem that long. You remember clearly being in your exact same seats and I'm so happy for all of you are here and get the opportunity to learn about biostatistics this summer. For me, this was a pivotal program in my professional career. And something that's been very important to me ever since I left the SIBS program. For me I was at a small liberal arts college studying mathematics and not really sure like other people up here had mentioned what I was going to do with that.

I considered being a math teacher and I loved teaching. But I knew that wasn't quite the right fit for me. I also loved medicine. I spent the summer, I came to Boston here, also doing a summer program at Penn State Hershey Medical Center, I wasn't sure if I wanted to go into medical school or not. For me biostatistics was the marriage of two fields I felt really passionate about, math as well as medicine. And the opportunity to come here and learn about what biostatistics even was, was a lot of doors for me in terms of where I could see my career going.

It was really cool to learn from all of the professors in the program about what it was. And then for me, to also see that pharmaceutical career was something that was possible. I didn't even know what biostatistics was before I came to the program. And finding out it was something I could go to school for after leave undergraduate was something I found out about here and sent me on the pathway to where I am today.

>> JAMIE COLLINS: I'm Jamie Collins, biostatistician at Brigham Women's Hospital just across town. I always loved math and was always really good at math. I was one of the fortunate few lucky enough to take as an undergrad. I sort of knew that was what I wanted to do.   The problem is where do I go from here and learn more about this. Dr. Bailey mentioned in her remarks this access to opportunity and how important programs are like this to open the door for people to get opportunities to learn more and begin to network and start a career in this field. And my kind of funny story was, I was a junior, an

undergrad. I knew you were supposed to sort of do an internship or do something so you could get a job when you graduated from college.

I didn't really know, how do you find an internship. The unfortunate reality is a lot of people find internships because a mom or dad or family friend or somebody else knows somebody who knows somebody who can get them an internship somewhere. If you don't have those connections what do you do? How do you get a foot in the door.

I went to undergraduate services at my undergraduate institution, which I shall not name. I asked, I'm interested in this field of biostatistics, 20 years ago, so it was sort of less known than it is now. What should I do? How do I get an internship. And the answer I got was try calling hospitals and see if they have internship programs. I said you mean take out the phone book, look up the number for Brigham and Women's Hospital and call it and ask the person who answers the main line at the hospital do you have biostatistics internships?

That was the advice I got from career services. So I was trying to find a way to, you know, not have to go back to my home town of Buffalo and work at a grocery store over the summer which is what I usually did. I didn't really know what else to do. I got pretty terrible advice from career services and got pretty lucky at the last minute and heard about this opportunity for SIBS.

From there I got my first job. Instead of coming to the campus during the fall and worked at a coffee shop, I think a slight step up from the grocery store, I actually got a job with Dr. Kim Dukes, one of the people we met over the summer, got my job as a statistical programmer, as are these women, so a sort of reunion. Through there I got my next job in academia, decided to go back for a Ph.D.. I sort of tried on my own to see how do I start this career in biostatistics and kind of ran into this brick wall of the phone book of calling hospitals. And got really, really lucky at SIBS that opened all these doors for me, I feel so fortunate to be part of the program and passionate about programs like this this can do that for other people.

>> GREG SANDOVAL: I didn't consult the phone book but I went to Dr. Google and looked up the program at the time. I went to a large university but they didn't have a statistics department at the time. I was undergraduate mathematics major.

Always interested in medicine, similar to what Alison's story is. I wanted to find a discipline. I also took A.P. statistics in high school. I had some exposure to statistics from that experience. But I always wanted to mix the two. And biostatistics, Dr. Google, SIBS came up, surprisingly. And I saw there were three programs and I applied to all three.

Also at the time I was a rising senior at my previous university. I also applied to an R.E.U., speaking of R.E.U.'s from the previous panel. I got accepted to that and the B.U. SIBS program. People that I had consulted with and looked up to in the sciences were like go to R.E.U.

Because it was more prestigious at the time, to be honest, it was only the third year the B.U. SIBS program was going on.

I always remembered my decision, I was always interested in the interdisciplinary aspect of medicine, public health, mathematics, statistics.

I took a shot and decided to go to the B.U. SIBS program. I'm really glad I did. It set the foundation for where I'm at now. They are at the foundation what they are to teach kids and student what's was applicable and relevant today.

At my time it was statistical programming. That skill, I used to use every day. And it's very essential to your education and through when you apply for jobs. It also allowed me to tab into a network as Lori was mentioning. As you leave the program you can always reach out to them and they will help you with job prospects or even other university graduate programs. So that's how I found out about the SIBS program and how I got to where I am.

>> LORI CHIBNIK: Is this on? There's been a couple themes in the conversations we had today. One of them of course is getting people into the pipeline and another is keeping people in the pipeline. I want to pose a question. So SIBS as we heard, has opened many doors for you. What were some of the things that were available to you post-SIBS that allowed you to continue in the field. Things that were important, if they didn't exist you might not have been able to continue?

>> For me, after I did SIBS I did another summer program, the following summer at Harvard School of Public Health and their Department of Biostatistics, similar to SIBS, just another way for me to meet, sorry, Lisa.

It was another way to meet more people and more people doing biostatistics. But another piece that doesn't have to do with another school, I did an internship with Lori in statistical genetics, because after SIBS I was all about statistical genetics, and I don't do that now, because I went into clinical trials.

But without SIBS opening these doors of how do I find these other opportunities, what is graduate school? Because for me, similar to Dr. Bailey, I came from a low-income, single parent household the first in my family to go to college. I had no idea what I was doing at SIBS, I felt so out of place. But the faculty helped me realize what a master's degree and Ph.D. was. And they were just always there to support. So without doing

SIBS I wouldn't have known about these other programs and
internship opportunities.

>> Yeah, I think for me, the mentorship that everyone
talked about today has been really critical for my pathway.
Coming here in the summer and seeing the people who came to
speak with us, the professors, they were real people with great
careers that were friendly, they weren't off a page and on a
website telling me about something. They were real people I
could relate to, that I felt I could do the same things they
were doing and gave me inspiration to go on that same path.

And then post those SIBS program, connecting and having
help even from Lori with my graduate school applications and
from the staff to get into the program. And then once I got
here, the job at DM-STAT that Jamie mentioned, lots of
connections along the way, the connections in SIBS really helped
me set up for myself. Lots of mentorship, lots of help, lots of
support and lots of feeling like belonging.

>> All of those things that Alison just said. You know, I
said in my story, you try to do all of the things you are
supposed to do to get a career or get on the path to graduate
school. I think, unless you are lucky enough to have somebody in
your life that knows those ropes it could be really challenging.

You could really try your best and still really run into
roadblocks. So again, just this community of knowing people, of
having people to ask questions to. How many people, Lori, have
emailed you and saying I'm thinking of going to a graduate
school, do I want an MPH or MD in bio stat, there's not a lot of
people who could give you good advice on that question.

Should I take a little time off first? What are my next
steps. Having this whole community of support to ask that
question to. If Lori doesn't know the answer or if Jacqui
doesn't know the answer they will know somebody you can talk to
help figure those things out. It's been so helpful to feel
there's this whole community and mentors you could lean on.

I think all of us want to be the next generation. So you
know, any of you that have these kind of questions or these
dilemmas we want to be here to support you all to. I think
that's been a really big, I guess SIBS is not just kind of
raising the next generation of bio statisticians but raising the
next generation of mentors that also want to give back and give
the next generation the same support that we got.

>> GREG SANDOVAL: I will echo. I will tailor it to my
story. I think, one aspect of the SIBS program I liked, I try to
impart this to everybody that always ask me, how do I get to --
learn by doing. A lot of the activities we did during SIBS, you
learn by the lectures and you apply it through the activities
and the programming. And it really reinforces what they are

teaching you. So one of the resources I took advantage of when I was a master's student at B.U. was the scholarship research, the grasp, graduate research assistant scholarship program.

At the time I was really interested in clinical trials. I still am. And Joan Basaro networked me, linked me with small CRO in Cambridge called Prometric, that was my internship in grad school. And lo and behold when I finished my master's degree I ended up staying there the next seven years. It was a very fulfilling career. I was always learning and I took classes, I went back to B.U., wasn't sure if I wanted to do a Ph.D., I wept back-to-school and took classes. Still have the aspect of going to work. But that's one of the valuable things about the SIBS program when you leave is that network that's open. Really tap into that, take advantage of that. I guess I will end one point, it was interesting because the SIBS program when I was a participant was primarily funded by NHLBI, now that investment NIH has came through, now I'm a P.I. of the NHLBI study. That's a really great investment. You guys, 20 years, that's a great achievement. You guys, please continue.

[Laughter]

>> LORI CHIBNIK: That's great. I second that last statement. You mentioned the GRASP program, at that time a funding program for master's students. I wonder if people could comment on how they made the choice and the funding going to different schools.

>> I went into a Ph.D. simply because I couldn't afford to do a master's program. It wasn't the only reason I liked biostatistics and was passionate about it. But I wouldn't have been able to go to school any more if it wasn't for going into a Ph.D., which is unfortunate. It's a field I enjoy. I like to think I do well with it. So, yeah. It's a big decision when it's a financial burden to you. Because even for me for SIBS, I found out about it in my freshman year, 2012. My school really highly recommended the SIBS program but I couldn't do it, I had to work over the summer to support myself and my family. I wasn't able to do it until I lost my job the second summer. Yeah.

>> ALISON PEDLEY: I think for me the financial part was really critical. I was considering going to medical school but I wasn't sure how that was going to work out. And before I came to this program, I didn't know there was any other options for me. My parents definitely were cutting me off from helping pay for higher education. I knew I had to find something that was sustainable. And the graduate assistance Ship through Boston university was pivotal for me to come. I wouldn't have made it here without that for sure.

As I didn't know anyone in my family or otherwise besides of people in this program that had advanced degrees. So that

wasn't something I knew how to even get to. And that's something that I definitely learned through this program there were ways to, know, get funding for higher education levels. And I wouldn't, I definitely wouldn't have pursued that without this program.

>> Are we taking questions?

>> LORI CHIBNIK: Oh, go ahead.

>> Audience Member: [Off Mic]

>> Do you want to just repeat the question.

>> LORI CHIBNIK: I will repeat the question because we didn't have a mic.

The question that was asked was the program we were talking about, which was called GRASP at the time, whether or not it funded the master's program. It did at the time. You were able to fund just a master's or terminal master's without having to do an M.A. Ph.D.. I know, Taylor, when you said you started you chose particularly M.A. Ph.D. because it was more likely to come with funding. I don't know if there's those opportunities now. I would comment that not just our alumni here but many students and many SIBS alumni that is a deciding factor what program they will apply to, what is funded and what is not. It's definitely a barrier to entry that is often discussed. I answered that correctly for B.U.

Okay, so.

I was going to talk, there's another theme that has been going around from both our speakers and some of our panel here and I also can relate. Which is, many people didn't know what biostatistics was. Sometimes until they were already in a biostatistics program. That was true for me as well. I think it's true of many of the SIBS faculty, based on my knowledge.

Can you speak to your introduction to the field? And maybe offer some thoughts on how we can make biostats more known that this even exists?

Greg, are you okay start?

>> GREG SANDOVAL: I think part of it, it was touched on a little bit in the first panel. Basically just making it more sexy. You know, make it fun. I mean part is just the messaging of what we are doing. I mean, we are increasing the portfolio, diversity and increasing, we want to increase that pipeline.

But it's also about the packaging of the message and how you are presenting, when you present your results in statistics, you have to be engaging. So partly, I think, with biostats, I think it's probably the same messaging.

For me, I think it was bridging two disciplines I was always interested in. Like medicine and mathematics. So for me, luckily went to SIBS because of that interest of that interdisciplinary aspect. And the way they packaged it, and the

way they made it important and the way they correlated, not correlated but saw how it's reflected in the news and how you read the papers and how you interpret things. That's what is missing these days. People aren't really presenting it in a way people can understand in a general way. And I think that's the gist, I think, is just the messaging.

>> I think applied by a statistician, when I tell people that, The New York Times like 15 years ago said statistics was sexy. And I'm here to say if you are at a party and introduce yourself as a biostatistician, usually people's eyes glaze over a little bit. I don't know if they were right about that. If I say I'm interested in clinical trials, most people say I don't know what that means. If I can describe my work, with the problems I'm trying to solve, I work in orthopedic surgery, about 20% who have a joint replaced are pretty unhappy and don't do well. We come up with some statistical models who is doing well after joint replacement and why and come up with an intervention. When I talk about it from that perspective, people always have a story. Oh, my uncle had his knee replaced and had a terrible experience and why do you think that was? They start listing off why I think my uncle had a bad experience, what do you think. You open up the conversation, I don't sit at my desk and write out equations all day. I'm actually really trying to use mathematics to help improve public health.

When you can describe it from this and give concrete examples when people recognize themselves or recognize someone they know in the example are giving they do get really excited and want to hear more. I found starting from that side, these are the problems we are trying to solve can get people really excited about what we are doing.

>> I think, you know, from the corporate side of things, we are always looking for our ability to get back in and give back. And for me, it's all personally tied to this program and what I got out of it, and feeling like I need to Pay it Forward.

Going back to the high schools in my area and encouraging programs of new statisticians coming into my organization and going back to their programs and continuing to build the community within the whole world. Each of us has our own responsibility for giving a little bit of it. I think like Lisa mentioned, it's on all of us to give back and encourage, spread the word.

Especially as people who have benefited from this program but also just the knowledge about what biostatistics is and what a great career it can be. I feel personally responsible for trying to tell other people about it. And give them the opportunity to know what they can do. Because I wouldn't have known without this program. I can't personally create this

program for other people. But I can tell them about the ones that are out there and do my part in trying to spread the word.

    >> Yeah for me, similar to what Alison was saying, I feel I owe my entire career to this program and the people sitting on this side of the room. So when I did my Ph.D. here at B.U., my way to give back was to T.A. the program. And eventually you know, help teach the SaaS and get students excited about statistics and what they could do with it and could they see themselves doing it, it's been super rewarding because many have gone onto graduate schools, internships and reach out, it's been rewarding to help them the way all of these people have helped me.

    >> LORI CHIBNIK: That's wonderful. I want to make sure we don't have any questions online?

    Okay. So I would be remiss if I didn't ask this question. We have four alumni here who are looking on the bright and shiny eyeballs of 24 new SIBSTERS, I don't know if that stuck but that's what we used to call you guys. Alison looked over to say are you sizing up who is talking to who.

    Apparently that does not turn off. Sorry. So I am going to ask you, as you look out on the SIBS crowd, do you have any advice for them. Not just in the next six weeks but as they move forward. I will let whoever would like to speak first, please do.

    >> I just think we have sort of hammered this home quite a bit, but the mentoring and networking. I think, I don't know about how you all feel but as an undergraduate I felt sort of intimidated about talking to professors, about asking for help.

    That's probably why I didn't know about the SIBS program, I went to career services instead of my professor, which I should have done. But you don't want to bother anybody. That could be limiting in a way.

    We are all here, by we, I mean not just the people leading SIBS now but all of the alumni, this whole network is here because we want to help the next generation of bio statisticians and we want to be here to mentor and to support you. So to not be shy. If you hear from somebody this summer and think what they are doing is really interesting, reach out to them.

    If you, one of the sessions you do this summer, if you find it really interesting, talk to the person teaching it, you aren't being annoying or bothering people. We are really here, the universal we, to help it and so to support you and that's what you should be getting out of this program.

    I just hope you would take advantage of it, and not feel like you shouldn't be doing that. Because I think, when I was in your shoes I definitely felt that way. I think I sort of casually mentioned to Lisa, oh I'm going back to my job at the

coffee shop this fall. Do you know anything? Was really hesitant, I didn't want to ask or bother her. Lisa is so wonderful, through her I was able to meet Dr. Dukes. There is a network here for and we want to be here to support you. So take advantage of it while you are here and when you go home.

>> GREG SANDOVAL: I will just echo what you were saying. Likely you are all math nerds. If you are shy just grow out of it. Don't be shy to ask questions. This is your opportunity to ask questions. This is really a pivotal point in your undergraduate careers that you are forging your way to go to grad school or work. You will meet a lot of people throughout the summer that have a checkered career. Whether they worked in industry or stayed in academia. You can ask those questions about where they are at, how they got there. And when you are done with the program, again, I keep bringing this up, but the network you are tapping into is really large and it's going to be a great resource for you to use.

>> I would say try things you are not sure you will like. I said earlier that I really wanted to do statistical genetics because I love genetics but then I loved clinical trials. It wasn't something I saw myself doing, but that's now what I do 40 hours a week. Don't be afraid to try something new. Like the other panelists were saying, be proactive, sit next to the speakers and get a conversation going. Don't be discouraged if things like, if you try something and you don't like it, or you try something and it's not the right path because the path to your career is definitely not linear. It's definitely a roller coaster ride. It's a lot of hills, a lot of alleys but a lot of high points too, try new things and don't be discouraged.

>> I don't think if I have anything quite new after everybody else spoke but definitely squeeze everything out of every opportunity you get along your pathway. Ask questions. Evaluate things. You don't get to go back in time to ask questions so ask them when you have them. Tap into your networks. Someone once told me, no one says no to interns. Which I think kind of applies in this situation too.

Get opportunities just by asking the right people. And networking. That's great advice for your whole career, I think.

>> LORI CHIBNIK: I'm still looking to see if there are other questions. If not, I think that's a lovely sentiment to end on. So I want to thank our panelists for coming and sharing their thoughts. I know we will be having -- no, I will turn it back to Lisa.

>> LISA SULLIVAN: Thank you, Lori. I want to thank the speakers, thank Anita, Jacqui and Helen for leading the program and Howard, always there, Mary was always there. We have so many faculty who are so important and we lost three in the last few

years who are very important to our program. So I just want to mention them, their names have come up, and they were very important to all of us, Joe Macero and Ralph D'Agostino and -- we weren't here having this celebration if they weren't part of it too. Want to acknowledge them.

Thank you all for your comments. It's been our privilege to work with all of you and we are proud of you and everything you are doing. It's great to sit here and listen to all of the things you have done.

There's a lot of work we all have to do to make biostatistics the field we want to see it be. So let's keep doing it. Because it sometimes feels like it's overwhelming but every little bit counts. So let's keep spreading the word. Let's try to get other people excited to be in our field. Let's share our stories and keep up the good work. Thank you, everybody for being here. For those of you online joining us. Thank you so much for being here today. Anita, thank you. Sorry we missed you. We would have loved to have you in person. For those in the room, we will have a reception, we will be here, so start the networking now.

[Laughter]

Thanks, everybody.

[End time 4:30 p.m. ET]