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SPECIAL ISSUE

Inside this issue:

Hogg and Craig Lectures: The 50th Festival

April 28-29, 2023

Featuring

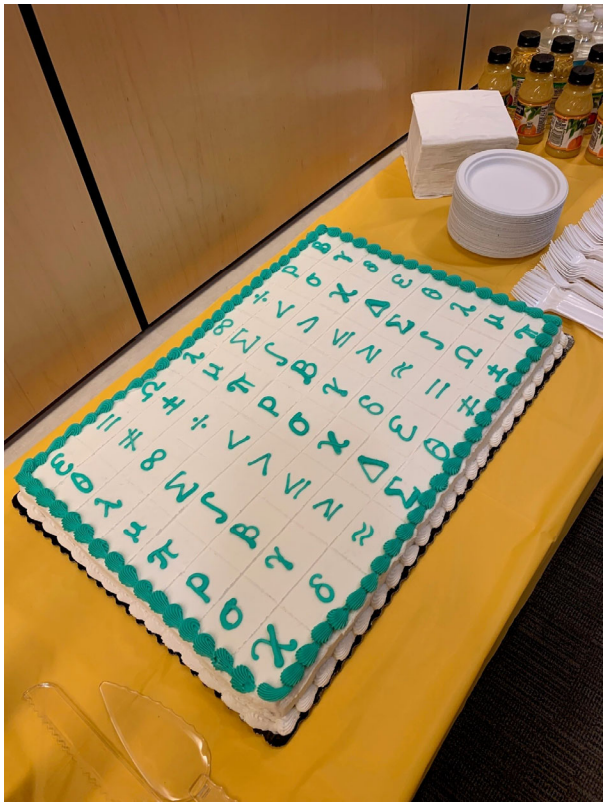
Dr. Dan Nettleton,

Iowa State University

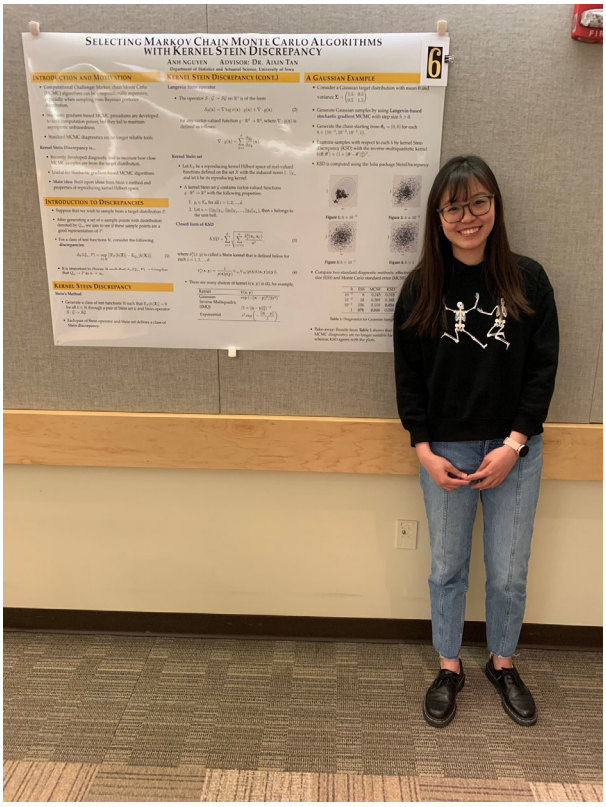
Hogg and Craig Lectures – The 50th Festival
Day One

On April 28-29, 2023, the Department of Statistics and Actuarial Science celebrated the ***50th year of the Hogg and Craig Lecture Series*** *with a festival featuring two lectures by* ***Dr. Dan Nettleton****, Laurence H. Baker Endowed Chair, Distinguished Professor, and Chair, Department of Statistics, Iowa State University (MS and PhD in Statistics, University of Iowa ('93, '96)).*

Day One (April 28) of the festival opened with a poster session featuring our current graduate students, the Annual Hogg and Craig Cake, and opening remarks by Kung-Sik Chan and Christopher Cheatum. An awards ceremony recognizing achievements by our students and faculty as well as best posters was followed by Hogg and Craig Lecture #1 by Dan Nettleton: "My Adventures in Sports Statistics, Beginning with Bob Hogg." Day One concluded with panel discussions on "Hot Topics in Actuarial Science."



The Annual Hogg and Craig Cake



Graduate student Anh Nguyen with her poster

ON THE COVER: Hogg and Craig 50th Festival attendees. Row 1: Dan Nettleton, Erin Post, Olivia Frazier, Sreya Sarkar, Yilin Wang, Qian Tang, Barbara Hogg, Sanvesh Srivastava, Serena Tiong, Elias Shiu. **Row 2:** Lyle Paukner, Ling Zhang, Yeh-Fong Chen, Yiran Zeng, Kun Chen, Kung-Sik Chan, Hai Liu, Tianrun Wang, Tammy Siegel, Aaron Christ. **Row 3:** Zhen Wang, Kai Wang, Alex Zajichek, Russ Lenth, Mike Jones, Dale Zimmerman, Luke Tierney, Dai Feng, Levent Bayman. **Row 4:** Bo Wang, Rui Jin, Aixin Tan, Congrui Yi, Shamriddha De, Boxiang Wang, Zhiwei Josh Tong, Javier Porras, Laura Clymore Ellman, Yikai Zhang, Collin Nill, unknown. **Row 5:** Shiao Liu, N.D. Shyamalkumar, Beth Hanson, Lan Luo, Xinyu Zhang, Matt Bognar, Ting-Hung Yu, Subhashish Chakravarty, Fei Wu, Zhijiang Van Liu.

Best poster awardees Collin Nill, Sam Dannels, and Yilin Wang

Poster session presenters and attendees

Erin Post, recipient of the Allen T. Craig Award for Outstanding Teaching Assistant

Award recipients Boxiang Wang and Aixin Tan

Day One cont'd.

Poster session attendees Aaron Christ, Serena Tiong, and Subhashish Chakravarty

Dr. Dan Nettleton presenting his lecture, "My Adventures in Sports Statistics, Beginning with Bob Hogg"

Kung-Sik Chan presenting a gift from the department to speaker Dan Nettleton

Transcript: Panel Discussions on "Hot Topics in Actuarial Science"

On April 28, 2023, the panel discussions on "Hot Topics in Actuarial Science" featured (from left to right): panelists Andy Ferris (Deloitte Consulting), Larry Lickteig (Transamerica), and David Dillon (Lewis & Ellis), and moderator Barbara Hogg (Aon). The transcript of the discussions is below.

Barb Hogg: Welcome to this panel on hot topics in actuarial science. I'm Barb Hogg and the moderator for this session. I was a 1982 graduate of the Actuarial Science Program in the Department of Statistics and am now a consulting actuary in Chicago. I'm a retirement actuary by background. I have three panelists with me today and I'm very excited to have them all because they represent three different areas of actuarial science.

Dave Dillon, next to me, is a health insurance actuary that consults for Lewis and Ellis, and lives in Dallas, so we're glad he came up here for this session. As a health actuary, he's involved in a lot of things from a medical perspective. So, one of the things I find fascinating about Dave's background is that when the Affordable Care Act, which you may know as Obamacare, was adopted, he spent time interpreting what that meant and working with various states to implement it. That's a real-world example of what we're doing from an actuarial science perspective. He's also very active professionally. He's been on the Society of Actuaries' Board of Directors and he's been involved in the American Academy of Actuaries. More recently, he's been an instructor for Georgia State University in their Risk and Insurance Department.

Next to Dave is Larry Lickteig, and Larry is an annuity actuary. He works with pricing and managing annuities at Transamerica in Cedar Rapids. Larry gets involved in many things: product pricing, product development, risk management, valuations, and derivatives.

He's also been a liaison to fund managers that are behind the annuities that Transamerica offers.

Farthest down is Andy Ferris. Andy is a life insurance actuary. He is a managing director at the consulting firm Deloitte and serves as the organization's chief actuary. Andy, like me, is from Chicago and like Dave, he's also had several professional roles at the Society of Actuaries, the Academy, as well as The Actuarial Foundation.

One of the things I love about my three panelists here is that when you hear what they are doing, it really shows the power of the Iowa Actuarial Program.

Actuarial science is an important part of the program. I think Kung-Sik mentioned that when the department was first created, it was just "statistics," but it is now "statistics and actuarial science." I think that is important because it recognizes the value actuarial science adds.

What we want to do today is talk about actuaries in the real world and give you a sense of the types of things we do. We are not going to be technical at all.

University of Iowa Actuarial "Fun Facts"

Before we start, let me give you a few University of Iowa actuarial fun facts that Elias gave to me. (He's going to give me the thumbs down if I get these wrong.) Iowa is the second oldest actuarial science program in the U.S. starting shortly after the turn of the last century. It has continuously taught actuarial classes for 110 years. It's a very old program, which is one of the reasons we're so proud of it.

We have had a major impact on the field. You've heard me mention the Society of Actuaries a few times. Five of the presidents of the Society of Actuaries have been from Iowa or Iowa grads. Two of the presidents of the Casualty Actuarial Society were also from the University of Iowa.

We have several legendary actuaries that came out of Iowa. We're here to honor Hogg. (And, yes, he is a

relation to me, my father.) Hogg and Craig are obviously very well known in the actuarial field. We also have other legends like Henry Reitz, the early chairman of the department around that turn of the last century. Lloyd Knowler is another one. Today, you heard several awards named after Lloyd Knowler. (My brother Rob, who's in the back, said the Lloyd Knowler awards should come with a "little red cap" because Lloyd Knowler was known to walk around wearing a red or orange hunting cap.) Jim Hickman, who many of you may have heard of. Bob Myers was from Iowa. If you think of our social security system in the U.S., Bob Myers basically helped create the social security system and was its chief actuary for 23 years. He even came back and helped when social security was reformed in the '80s. Obviously a huge influence on our lives, or for some of you, your future lives. Then we have people like Jim Broffitt, Stuart Klugman, and Elias Shiu, right here, who are legends in the field as well. We're very proud of what we have here in Iowa.

In 2009, Iowa was one of the first universities awarded the Center of Actuarial Excellence designation from the Society of Actuaries. We are very proud of that. More recently, the Society of Actuaries has changed its education program and now has a process where they credit universities so that if you teach a specific course, and the students work hard and make it through the coursework, they automatically get exam credit for those courses. Iowa was one of the first 13 universities to achieve that accreditation. Only nine of those universities are in the U.S., so we're one out of nine. On top of that, we have four different exams that you can get university credit for by taking the classes. Elias, correct me if I'm wrong, I don't think many of those universities have four. Some might just have one or two. You can see that the program here is really powerful in how it prepares students and gives them a lot of opportunities. So, the students here, be thankful you ended up at Iowa because you're getting a great head start on your actuarial career.

What we're going to do today is ask some questions of our panelists, talk a little, and hopefully, at the end, have time for Q&A. So, if you have some questions of what you want to ask an actuary, ask away, and we'll do our best to answer. But if it's technical, we're just going to ignore you. Okay? I just wanted to give you that heads-up. Don't ask us about your most recent actuarial class problem.

On Actuarial Careers

Let's start with a "get to know the panelists." When we think about actuarial science, we think "technical," starting with a fairly technical education here. But we also know that actuaries can branch out into a lot of different areas and leverage those skills.

Question: When you think about your career, what are some of the unique things you've done that might have surprised your younger self?

Dave Dillon: Well, I think the first thing that surprised me is that I've made it. You guys can go ask Dr. Shiu after this. I think he would have wagered I would have never been up here. I always say this with pride. If I had gotten one lower grade while I was here under Dr. Shiu, I would not have graduated. One lower grade. I also probably had the lowest amount of exams passed when I came out. I think when I was here, I learned determination. I was not very successful here, or technical, compared to everyone else. I always used the old joke, "What do you call the last person to graduate from medical school? Doctor." That's how I viewed myself. I'm still an actuary. Didn't matter. I think what I learned from that was being non-traditional. When I came out, I did not have the opportunities for jobs and internships like some of the others because they had the great grades and had three or four exams, and I had one. I had to be determined. I had to go a different route. I had to take a job in a rural area in Arkansas where there aren't a whole lot of actuaries, things like that. But, I think you can be non-traditional, and I think that's what I would recommend to you guys. Don't get down. I failed a lot of exams, but I still got my FSA, and I still have had a very successful career.

Larry Lickteig: I guess one of the interesting things you said, "being persistent and determined," I think that's always important when I talk to people. If you work hard and you're persistent, don't give up; those are some of the key things to becoming an actuary. On my side, I've certainly done some of the more traditional stuff such as pricing and valuations. I've worked in a couple of non-traditional things as well.

As Barb was saying, I work a lot with annuities and, starting with the track I chose when I was doing my FSA, I decided to do the investment track, which is the quantitative track now. Part of that was it's more technical which I like. Most people in my division would not have taken that. They probably would have taken the life and annuity track or something like that. But, it opened up some different opportunities to me. I was often the liaison with the derivatives desk, and so I got to work with that a lot. That was interesting. For a while, I was working kind of as a liaison role, working with some of the mutual fund information that feed into our variable annuities. That was a really interesting opportunity to see what the different strategies are of the mutual fund managers. Those are kind of on the fringes of things, but are some interesting opportunities to work with and, in my case, I could influence product development and see how things work in a different area.

Andy Ferris: Interesting question. What would have surprised your younger self? I go to some of the things Dave said, but as I think about the roles that I have today, these would have surprised my younger self. I'll talk about roles in two dimensions: first, my commercial responsibilities, and second, some of the volunteer roles that I've had for the profession. At Deloitte, I lead our new business and underwriting practice for life insurance and annuities nationally. The role does not have to be filled by an actuary. Secondly, I lead our enterprise risk management practice nationally. We call it Risk Capital and Regulatory (RCR), but it's a risk management practice. Again, the leader of that practice does not have to be an actuary. Finally, Barb mentioned I also serve as our chief actuary for our life insurance and

annuities business. I'd say those first two roles, for which a leader does not necessarily have to be an actuary, would have surprised my younger self. It shows that actuaries can do things other than just be an actuary. I think that just really demonstrates a lot of value from the profession, from this program.

On the volunteer side, I would have never guessed that at this point in my career I would have served on the board of directors of the Society of Actuaries, the American Academy of Actuaries, and The Actuarial Foundation. In just three weeks, I'm going to be chair of the board of The Actuarial Foundation. Those things would have really surprised my younger self.

Barb Hogg: Thank you. You can see a lot of opportunities when you're looking at what you want to do. Get started, then recognize it can go many different ways; be open to that.

Next, I want to talk a little bit about changes in expectations and opportunities for actuaries. I've been out of the program the longest. So, change to me may not be change to everyone else. The Society of Actuaries now has an exam on predictive analytics and it's one of the required courses to become an associate of the Society of Actuaries. So, that's newer. We also know the department here at Iowa has recently started a master's in data science. I want to get the panelists' perspective on this next question.

Question: How do you see these two newer topics — predictive analytics and data science — showing up in what you're doing in your work, and how do you think it may influence actuaries in the future? Andy, I think I'm going to give this question to you.

Andy Ferris: Sure, I'm happy to start on this one. This has been fascinating to watch. For me, I mentioned I lead our underwriting practice for life insurance annuities at Deloitte. This interest started about a decade ago, because that was a time where we started helping life insurance companies realize that in the underwriting process, the use of predictive analytics is really, really helpful. We're changing the way companies do underwriting by using predictive analytics as a tool to improve a core business operation. That's exactly the innovation that actuaries should be leading. Now, a decade has passed and I've watched this evolution happen. Having a robust data science team at a large life insurance annuity company is table stakes these days. That was not the case a decade ago, but it is the case today. I think we're a little bit behind property and casualty. They were probably a little bit ahead of us in that regard, but I've watched it happen.

I think one perfect example of the importance of this, the strategic nature of this, is I have a group of life insurance company executives coming into the Deloitte Chicago office in July for an executive roundtable that I host. One of the topics on our table is "How do we facilitate better collaboration among three groups: the actuaries, the underwriters, and the data scientists?" because that is the heart of it — getting those teams to collaborate and work together. We've got a lot of ideas early on, but we haven't yet solved this. Data science is here to stay in the world of life insurance and annuities.

Dave Dillon: My exposure to it is completely different than Andy's because I'm in the health insurance world, and health insurance is really one year to one year to one year of, primarily, major medical. We're not forecasting out a whole lot, right? We don't have to be super robust in general. But where we do find the need for forecasting is the Affordable Care Act (ACA). One of the interesting dynamics coming out of the ACA is that how you price and how much money you receive is based on how well you predict what everyone else is doing. In life insurance, traditionally, you project out what your population's going to be, how often they're going to die, that kind of thing. In the health insurance world now, we have to model what we think other people's decisions are going to be. So, our payments at the end of each year are not based on how many claims I have at my insurer. It's also based on how many claims the other guys have at their insurer. In the health insurance world, we're doing a lot more predictive analytics around behavioral choice and things like that because what we get paid depends on how well we really estimate someone else's systems. So, it's not just about us anymore. We have to model others as well.

Barb Hogg: It sounds like predictive analytics and data science will be critical moving forward. That creates a lot of opportunities for us.

I want to now ask a question for the actuarial students in the room. So, be on high alert listening to this.

Question: When you think about the training and skills that are needed for actuaries, what do you look for in a candidate and what attributes seem to drive success? Both to get a job soon and in the future, what's going to be really important? Larry, I'm giving this to you.

Larry Lickteig: I think certainly the technical skills are always going to be high on the list, but by the time you are actually doing an interview, you've already been screened for that. When you're doing an interview, I'm looking for communication skills: can you communicate what you've done and what you're doing? That's very important. Some of your classes, like accounting and computer science, can also be important.

As far as long-term, I would say the ability to work on a team and leadership skills are good. Project management is important, which is kind of hard for an actuary because we always like to work by ourselves, on a team of one. But being able to work with others and demonstrating project management skills, or just planning things out, is important. Planning can be a challenge because you don't always know how soon you're going to be able to figure things out. Some of the other things that I would look for maybe aren't always obvious, but long-term those are important.

Dave Dillon: I work for a consulting firm and maybe what we look for is a little bit different than the actuaries in the insurance industry. I'll give you a dirty little secret: if you have an ASA or FSA, I don't even look at your resume. I'm good! I know you know the technical side. We have what I would call, for lack of a better word, a personality skills test. Every applicant we get, even before I

look at the resume, you've got to take this test. It has rapid problem solving, you have to be flexible, you have to be quick on your feet, that kind of stuff. That is what we look for. If you have the credentials, we know you can do the technical stuff. Now, granted, I'm going to look at where you work and your experience to make sure it fits with the role we're looking for. I know you have the technical skills. We're looking for the other stuff.

Barb Hogg: That's really helpful. It's thinking to the future about what's going to be important to make you successful as an actuary. I agree with what we just heard. It's a lot of the communication skills, it's the problem solving. Even during interviews, you are looking for this. A lot of organizations now interview with the idea of we're interviewing for certain competencies, including problem solving. Think of your experiences and prep for questions like, "What are some great examples that show how you dealt with some problem? Or, decision making? Or, getting to consensus?" Those are all really, really important skills.

On Hot Topics in the World and Actuarial Science

I'm now going to shift to what I will call "hot topics in the world," and give you a little bit on how actuaries are influenced by or influencing those issues. One hot topic that has impacted us all is the COVID-19 pandemic. Obviously, this had a major impact on our business. If you think of the roles we all have, we're all in actuarial fields and look at things like mortality and morbidity. What could be closer to COVID-19 than some of those concerns, right? During COVID, especially for that first year, we had weekly trainings, and every training seemed to have an update on mortality and what it means to our work. We were trying to figure out what's happening today, what are the causes, and how much of this do we reflect in the long term? I'll say, it gave me a lot of insights so when I saw a simple number in the news I'd think, "Oh yeah, but they don't know all the numbers underneath and what's really driving that outcome."

Question: When dealing with COVID-19 in the real world, how has it affected the work you were doing? Andy, maybe I'll start with you on this one, the life insurance side.

Andy Ferris: One of the things we do in our actuarial practice, as you would expect, is we help life insurance companies determine actuarial assumptions they should use, whether that's for pricing, or for valuation, or for projection purposes. What I've seen over the course of my career is just a real increased scrutiny on those assumptions. Increased scrutiny internally — from within the walls of the organization. The CFO wants to understand it, others want to understand it. Scrutiny from outside — whether that's regulators, your auditor, or other stakeholders. There has just been more scrutiny on actuarial assumptions. Before COVID, you would think this stuff is relatively straightforward actuarial practices. You do your experience studies which lead to revised assumptions; it's a long-standing actuarial practice to do that. Then COVID comes along, and all of a sudden, you're at the end of 2020, you're in the middle of COVID, a bunch of people have died, and you've got to set your mortality assumption for next year. Everybody's looking at you, and you don't know what to do. Nobody knew the answer. That was difficult. I'd say at the end of the day, the most helpful information was not the raw numbers, but rather the thought process behind the numbers. "Here is what I've done, I have an opinion. Here's what I think is going to happen. I realize my opinion might be just as valid as the next one, but I've got an opinion." That's really what got us through it.

Larry Lickteig: Certainly the life insurance side was affected. My experience was that annuities were affected too. There's still a question today, "Do you even include that data or don't you?" And that's always the big question, what's going to happen in the future, how does it affect our results? With COVID, we saw things happen with lapses and different behaviors than we otherwise expected.

If I think about what we did before the pandemic and what we did after, one of the things I found interesting was on the asset side. We had always done various sensitivity tests. In the pandemic tests, everybody knew about the Spanish flu and a lot of that other stuff. There are always pandemic shocks. Then on the investment side, there was always, "Okay, let's do a shock with equities. Let's do a shock with interest rates and all these other shocks and see how things look." The interesting thing that we probably didn't do enough of was that interaction because when the pandemic actually came, you not only had shocks on the mortality side, but you also had shocks on the asset side. Variable annuities are a good example. You had both a big drop in the equity markets and had rates dropping. That interaction was missed in advance; people hadn't thought about it as much before. But afterwards it was very obvious what was going on there.

Dave Dillon: In the health world, one of the Actuarial 101 calculations is what we call "incurred but not reported" claims (IBNR). Here's how it works: Let's say at the end of December, the financial statements are cut off, but we know people went to the doctor and the hospital in December, but we haven't received the bill. We have to estimate how many claims there actually were in December. How do we do that? Well, we look at past history. We look at the last 36 months or so. But as I mentioned earlier, health insurance is really a 12-month deal. We really only have 12 data points. There's not a whole lot of info beyond that. So, we get to March of 2020 and literally in April and May, not a single claim occurred. No one went to the hospitals, no one went to the doctors, and how are you supposed to predict what's going to happen in April when two of your 12 data points are now zero and you know it's not normal? How do you predict the next one? Then, June and July start coming back a little bit. You have to estimate how much is going to come back. So that was very tricky, such a disruption. Any health actuary could do the IBNR in their sleep and it's very simple. It wasn't simple anymore.

Now, we're kind of out of that, but we are seeing a couple of interesting outcomes. One, a lot of those claims that didn't occur turned out that they probably shouldn't have happened in the first place. Take emergency room care. When you have emergency room care, you would

expect it to be a true emergency, so people would have to go to the hospital, right? They may not have loved it, but they would have wanted to go to get taken care of. Guess what? Emergency room care just dropped. So that was informative to us in terms of what was really underlying emergency room care beforehand. It gave us some insight about how much emergency care might have been discretionary versus a true emergency. Health insurance companies have modified programs to help steer people away from using emergency rooms for non-emergency care now.

The other thing we saw is what we call “long COVID.” How is COVID impacting claims moving forward? Is it making your diabetes even more intense than it was before? So, there's a lot of modeling now around the long COVID. We still don't really know, right? We're still in the early stages of modeling what COVID would do on these “month to months” moving forward.

Barb Hogg: So, you can see when COVID-19 hit, it influenced us all. It impacted us as people and how we worked, but we also had the extra challenge in terms of “How do we really incorporate this into the work we are doing?”

I want to jump to the issue of “how we worked.” We're not going to spend a lot of time on this because I think every organization dealt with “how we work.” I do a lot of HR consulting, and one organization I talked to said COVID changed how they work because they've gone so virtual. They used to be the big employer in town. Then, COVID has opened up other doors. People can live in their nice, quiet, midwestern town, but they can work for the big New York firm because everything is virtual now. They said, “It's actually creating a talent problem for us,” which is something they've never had before.

Question: How has COVID-19 changed how you and your teams work? Larry, maybe you can comment on this one.

Larry Lickteig: Definitely a lot different. Transamerica is, for the most part, remote. I mean, we still have an office and there's a handful of people that go in, but for the most part, we're remote. Twenty years ago, it's hard to imagine that it would be like this, but the technology is a lot better. COVID ironically kind of forced us to go down this route. You have things like Microsoft Teams where you can see what people are looking at, and they can share their screens and things like that. It's really helped out a lot.

As far as the students, we used to always line up the supervisors with those that they were supervising. The student would typically be in the same town as you. Now, I have one person in Detroit, one in Maryland, and one in Florida. It's completely different, and it just has changed a lot. There may be some disadvantages. The culture is a little bit different. It is not quite the same when you're not working with people. For instance, I now have a cat as a co-worker. That's kind of the way things work now.

Dave Dillon: It impacted me quite a bit from a couple of different ways. So again, I'm a consultant. Before the pandemic, at my firm, I probably traveled more than anybody in my firm to go to clients. I got used to that client communication. That's how you would work on projects, things like that. I mean, I traveled so much. I always used to joke, I traveled just enough where my wife didn't complain. Since the pandemic, I have not had one client trip, not one. I was gone every week before. I've had to learn completely different project management skills, client management skills. As a consultant too, I had to ask myself, “How do I market? How do I generate new clients?” It was completely different. All of my meetings, pre-pandemic, were either phone calls or in-person. Both of those are video calls now. Everything's gone video call. That is completely different. Then I would also touch on what Larry mentioned. Now, from the recruiting standpoint, hiring, no one wants to move to Dallas anymore, right? They're like, “They're going to hire me wherever I am” and we've had to deal with that. I have hired many people now that I've never met in person. That is different. You used to fly them in to meet them. I have had people that work with me for three years and I've never met them. That's different. I've had to change how I manage them and talking to them and that kind of stuff.

Barb Hogg: Actually, as you were talking, I thought of a colleague I work with who I was talking to the other day. He does a very specific product that we have that requires him to go out and deliver an analysis. He said, “Pre-pandemic, I did 25 during busy season.” Because when you travel to a client, you deliver the results, and you come back. He goes on, “Well, when we were virtual, I did 35, because everything was online.” He goes, “Now I have to travel again, and they still want me to do 35.” So, be a little careful there too.

The next hot topic is climate change. Aon, the organization I work for, recently published a report on weather, climate, and catastrophic insight. Here are a few data points I want to share with you: In 2022, the global economic loss associated with notable disaster events was about $313 billion, of which only 40 percent was insured. And a lot of that insurance was actually in the U.S. Hurricane Ian, mostly in Florida, was the second costliest natural disaster on record and made up $50-55 billion of that loss. Huge. Now, the numbers I'm giving you are things that casualty actuaries would work on. Part of the reason I'm raising this, is the actuarial field does work in this area.

Question: We're probably a little less impacted by climate change in the work we do, but Larry, I think you've got a few thoughts on this due to some of the work you are doing.

Larry Lickteig: I was just going to mention that on the asset side, the general account assets, now we try to take into account more, like climate change. In the mutual fund world in general, there are ESG funds and things like that. Some of the indices we might deal with, there's probably going to be more ESG-type things there as well.

There are probably some difficulties in terms of reporting things. You hear about companies “green washing” now, which is kind of a new term where companies are scrubbing their balance sheets before quarter end so

that they can make it look good from an ESG standpoint.

Dave Dillon: I'm going to add something, and I'm going to preface my comments by saying I know nothing about climate change, and I have no idea how it impacts my job. I'm going to take this opportunity to broaden it a little bit and make a plug for the Society of Actuaries. One of the things that the Society of Actuaries has done and has noticed is, younger people. Newer candidates in the field are much more concerned about the environment and its impact on our roles and so forth. A friend of ours, Dale Hall, who is the head of research at the Society of Actuaries, has fantastic stuff on how climate change has impacted the health and life fields. If you are interested in that, I would highly recommend going to look at that. In addition, the big thing in the health world is social determinants of health. That is a new thing, and again, that is a focus that the SOA is going into because of the interest of younger people and younger actuaries and the broader social and environmental issues.

Barb Hogg: Yeah, those are all great comments because they are really important topics that we might only touch on a little, but they're out there. As Larry was talking about ESG funds, I thought about the retirement side. I work a lot on defined contribution plans and this has been batted back and forth at the DOL: "Can you put an ESG fund in and what are the requirements to put that in as an option for people to invest in?" But sometimes the government's like, "I'm not sure we can put it in on that basis. You don't get fiduciary relief if you do that." A lot of interesting challenges there.

Another topic that is out there, and we see a lot of organizations dealing with is diversity, equity, and inclusion (DE&I). (I just saw it in this building somewhere, Iowa has a division of DE&I). The organization I work for did a 2022 global survey and found that 93 percent of organizations and senior leadership actually support and sponsor DE&I initiatives. Three-fourths of organizations have developed a DE&I policy. The big companies are really focused on this. I know I've personally worked on DE&I projects. We do an analysis of what is a DE&I-friendly benefit program. We've also looked at retirement income and how pay gaps and wealth gaps create retirement gaps. EBRI, the Employee Benefits Research Institute, who I work some with, is just publishing something that looks at differences in tenure for people based on race and ethnicity.

Question: DE&I is a hot topic that's created some challenges in the insurance area. Andy, can you provide some background on these issues?

Andy Ferris: We could take this critically important topic in a variety of directions, but I'll just describe one real business issue facing the life insurance industry today. I'll put back on my underwriting hat. If you think about the underwriting process for individual life insurance, one component of that is an assessment of the applicant's health.

Traditionally in our industry, the applicant did a blood exam, and a urine exam, with a paramedic who comes to the applicant's house. Well, part of this revolution in predictive analytics that has come about is to use predictive analytics on a case-by-case basis to say, "Can I waive that blood exam? Can I waive that urine exam based on other data that I know about the applicant?" In some cases, those exams might be a waste of time and a waste of money, so that has really changed the industry. It's created a lot of efficiencies.

Well now, the DE&I challenge that is being faced is, "Are those predictive models introducing bias that we didn't expect?" For example, that medical assessment cannot consider certain protected class information. That underwriting process cannot consider your race, your religion, your national origin. But are those models now potentially introducing bias on those factors? Now the life insurance companies will quickly tell you, "Hey, we know we cannot underwrite based on that stuff. In fact, we don't collect it, we don't want to see it, don't let it anywhere near the walls of this organization." So, that's kind of the first response is, "How could we be biased when we don't even have that information?" Well, that's a short-sighted answer and that's not going to suffice, because in reality that bias can still exist, even if the insurance company does not have the data. We don't yet have a solution for this in the industry. It's real, it's facing underwriting organizations today. They have to answer a lot of questions about it, much more to come, but that is a real business issue facing life insurance companies today.

Dave Dillon: I'll touch on it from a couple of different areas. Similar to what Andy said, like in the health insurance world, and the ACA modified some of this, you can't ask a lot of those questions anymore. The flip side of the coin is, there's what we would call "risk classification," but someone else might call that discrimination. If you group like people together, what is that like variable? We're running into the same stuff in the health insurance world.

Andy Ferris: Proxy discrimination, right?

Dave Dillon: Correct. Yeah. We're running into the same thing. You can rate on certain variables and not other variables. But what if you know that information? How is that used or not used? We have to consider DEI in the health insurance world. We're starting to learn, and maybe we should have learned it before, there's a lot of lurking variables. When you consider social determinants of health, you find there is a large variation in network access under health insurance. We did not really take it into consideration that much before we started thinking about DEI. For example, I recently did a study for the state of Arkansas, and there are certain areas of the state that are very culturally different from other areas of the state. The access to hospitals is completely different. The access to certain specialists is very different. One part of the state had very few cancer doctors. Well, guess what that means to the outcomes in that certain area of the state. So, Arkansas is really working to try to be much more diverse. They're investing, they're working to get provider groups to invest in and move to those areas to provide access for all sorts of different cultures throughout the different areas of the state.

Barb Hogg: I think this is an area we're going to hear a

lot more because of some of the challenges: you want to use the data you have to make predictions, but you also need to be sensitive that you aren't adding to the problem in those predictive models. We've seen some examples of both, and so this is where I think, as Andy said, “more to come.”

Another current topic is legislation and responses to legislation. I often think of legislation as driven by Washington, but I know Andy thinks of it on a state-by-state basis. As an example, in December 2019, the SECURE Act, a retirement-related act, was passed in as part of the budget reconciliation process. It’s a bipartisan bill. Retirement is one of the few things where you see bipartisan support. I spent a lot of time in January and February 2020, deciphering the SECURE Act and figuring out what it meant. Then, in December 2022, we got SECURE 2.0. This legislation creates a lot of work activity. I know that all of us run into these changes and resulting activity.

Question: Dave, with your health care focus, can you comment on some unique issues you’ve run into due to legislation?

Dave Dillon: Yeah, with health care, I never realized I was going to have to deal with politics in my job. (This may be something back to the very first question of thinking of something that would have surprised my younger self.) I'm a health care actuary. I work with the Affordable Care Act and a lot of state insurance departments. I always joke that when the state of Vermont yells at me and the state of Louisiana yells at me, I know my answer is correct because I’ve got both sides of the aisle both yelling at me. The Affordable Care Act created a lot of that. I think most of you are aware it is a very political issue.

ACA also completely changed our working world. Before its passage, insurance companies could have certain health care provisions that the ACA threw out, and to compensate, they needed to implement new programs/provisions and those things had to be implemented everywhere. For instance, the state of Louisiana never required an insurance rate file. It's crazy. I was one of the two authors of their new legislation. I never thought I would do that. But that regulatory change, the ACA, completely changed the health insurance market. Now, every two years, with every election, something changes. One side wins, they try to poke a hole here. One example I will give, and sometimes there's a lot of unintended consequences, but we have to, as actuaries, assess each one of those things. There's a thing in the Affordable Care Act called the cost-sharing reduction. It's basically helping out lower income people with their co-insurance, deductibles, co-pays when they go to the doctor. Well, when the Trump administration came in, he basically said, “That funding is gone.” He thought he was knocking out the legs underneath the Affordable Care Act. He thought it was going to cripple the system. Guess what happened? It strengthened the Affordable Care Act because all 50 states in different ways decided on how they were going to fund it. The way they decided they wanted to fund it was another federal program that President Trump could not touch. The Fed actually paid more money into the program than they did before. It's kind of funny when you think about that. Literally, with every election, there's something like that that we, as actuaries, have to assess and address.

Andy Ferris: I'll be brief on this one. I'm going to go back to that example I talked about earlier with “Is there potential bias in the underwriting models?” As Barb mentioned, in the world of life insurance, it's regulated at the state level. So, there's very little federal guidance. Like I said earlier, “more to come,” but different states appear to be taking different paths for this. I’ll briefly describe two extremes on this topic: One extreme would say, “You know what, life insurance companies, start collecting race, start collecting that information, put it on the application, and you test for it. And you prove to yourself that you don't have bias.” The other extreme would say, go the other way. Drastically limit the amount of data that you can use in underwriting. Pull it all the way back. In the extreme, this would almost cause all people of the same age to pay the same rate for insurance. So, it's just two extremes and those are two states going down different paths. At the same time, you've got the actuarial organizations, and I'm a part of this, trying to come up with, I think, what is a more reasonable principles-based approach to going about some of this testing.

Barb Hogg: You’ve clearly outlined challenges you face.

Looking Forward

So, Andy brought us back to talking about the insurance industry. I just want to acknowledge the insurance industry is huge in Iowa. I think I saw some statistics that over 200 insurers call Iowa home. The insurance industry output makes up over 10 percent of the GDP of the state and probably employs about 6 percent of the state's population. You can see it’s really important to the state.

Question: Larry, you're the one here that works for an Iowa employer. I'm going to give you this two-part question: **How do you see the Iowa actuarial program helping the insurance industry of Iowa? Is there anything you'd like the Iowa actuarial program to learn as you think about what the insurance industry needs?**

Larry Lickteig: I think the department has always done a great job of training students and everything. At Transamerica, we always hire a lot of full-time students from Iowa. I know other insurance companies in Iowa do the same thing. It's always a good sign for the department.

It’s hard to say what should change or what shouldn't change. I think adding data science is really good. Obviously, that's a big thing in the insurance industry and outside of the insurance industry, as well. I think that's a big, important part of what the statistics and actuarial science department has done. Some of the work I've done in the past, I've worked a lot with derivatives desks and stuff like that. I always think, “Yeah, it's always nice

to know more on data science." Of course, it's been a while since I've seen exactly what we do at Iowa, but I would say that it's always good to get more derivatives and investment exposure if you can. And that's a technical field which fills in nicely with the actuarial program. That's my opinion.

Barb Hogg: Fantastic. I have one more question I'm going to ask and then I'm going to open it up for questions. So, start thinking about any questions you have. This next question is on the future of the profession, and I'm going to turn this to Andy and Dave, as they both recently served on the SOA Board of Directors and have some insights into this.

Question: What do you see as some of the biggest challenges facing the industry and what do you see the profession doing to help?

Andy Ferris: This is a little bit of a personal opinion. I continue to believe, I've believed for a long time, that this profession would be better off with fewer organizations. We were really close a couple of years ago with the CAS and SOA merging. I was disappointed to see that not happen. I think we'd be stronger as a profession with fewer organizations. We just mentioned DE&I which is critically important in so many ways for the profession and for the companies that we work for. And you've got the different actuarial organizations now, developing their own DE&I programs. Why aren't we doing that together? Why aren't we coming together to form a DE&I strategy for the profession in a coordinated manner? Let's be very clear, I don't foresee merger of U.S.-based actuarial organizations happening anytime soon. There does not appear to be an appetite for it, yet I continue to believe it would be best for our profession.

Dave Dillon: I think that one of the biggest challenges that we're still obviously working through and we don't know how it will impact is artificial intelligence (AI). When I rolled off the board two years ago, the SOA had a strategic plan that they updated every three to four years that includes their long-term growth strategy. How to deal with AI is one of the things that the Society of Actuaries is addressing with respect to the changing nature of work. I'll give you a couple of examples of it. While we don't necessarily know what's going to happen, what we think may happen is AI is going to do a lot of the number crunching. (This is what you might have done on your first job, right? It was when I first came out of school.) Now, a lot of that number crunching is now going to be AI. Actuaries can communicate and describe what happened, but they may not actually be doing the calculations in the first place. Here's the challenge: How do you train actuaries? How do you educate actuaries to understand and communicate models? You're still going to have clients and you're still going to have insurance companies. How do you explain what is done when you didn't actually do it?

Here's another wrinkle: I have dabbled a little bit with ChatGPT to help me write some reports. How do you cite that? I don't know, haven't figured that out yet. We have actuarial standards of practice that require you to document and explain what you do. What is that process going to be like when you tell a computer to do something, and it does it in 0.5 seconds and you don't know what it did? The challenge is we're going to have to have people get educated very quickly on how to communicate results of something that they may not have done.

Barb Hogg: That was sort of a depressing one to end on. I'm a little dumbfounded because if you hadn't gone through the analysis and you're at the start of your job, how would you ever be able to explain it? It creates a very interesting challenge.

Q&A Session

Let's see if anyone has a question. Any questions?

Kun Chen, University of Connecticut (PhD, University of Iowa, 2011): My name is Kun from University of Connecticut. I've graduated from here 12 years ago. I think all of you recognize the importance of predictive analytics and also the problems associated with it. Of course, we can find ways to improve it. One thing I think is important is to see data be integrated together. Like right now, for example, I work with health care data. Data with different hospitals may or may not be shared with each other. There's really a push to create these comprehensive patient databases, a big database about patient care, from different diverse clinical settings. I wonder if that's something that also happens in the insurance domain. If that may or may not happen, what's the impact or what would you see, that's the significance of data integration? That's my question.

Barb Hogg: Well, I'll just say it is an amazing question because in the work I do, data is so important. Not just for doing the pension valuations. We do a lot of research into financial security and all of that. I mentioned earlier, I do some work with the Employee Benefits Research Institute. They are a research group that's non-party affiliated and their data collection and databases are critical for their research. And one of the things that they're often talking about is "What databases do we have? Where's the data that helps us address a research question?" For instance, in the DE&I space, they often say, "We would love to research this, but where do we get the data?"

Dave Dillon: A couple of things you brought to my mind is, one, it's shocking to me how bad the data is at some of the largest insurers. There's a company, if I said the name, you guys would all have heard of it. A lot of the work I do is auditing or looking into their data. It is unbelievable. Even at the largest insurers, there's a lot of data problems. First problem is, "How do you collect a lot of different data from different sources when you don't trust all the independent data sources?" That is very hard. But what a lot of states are trying to do is what they call an "all-payer claims database." For major medical, they are trying to create a standardized data format that the health insurers will then send to the state. Again, I referenced the state of Arkansas earlier in that study I did. That was based on data submitted from all the health insurers and to the all-payer claims database. It is helpful; it is not a silver bullet though. As I said, there's even data issues there. It would be great to get all those sources together, but we're still in that stage that is not ideal, but they are working on it.

Barb Hogg: I think that was a phenomenal question and it is something we all recognize needs more work because it is the aggregation of the data that makes everything more powerful. That is an area where the Society of Actuaries helps. We mentioned earlier that we need to consider mortality. We count on the Society of Actuaries to compile mortality data. It's their tables we often use because they pull data from so many different sources. So that's a role you look for groups like the SOA to help with.

Other questions?

Tianrun Wang, University of Iowa Student (Actuarial Science MS): My name is Tianrun and I have a question for actuaries. I'm just wondering how much knowledge you have learned in school is applicable to your work? I ask this question because I have a friend who is an undergraduate here and his wife is an actuary at Transamerica. I won't tell you who she is. Her husband is learning probability and he asked his wife for help. His wife said, "I don't remember any probability." So, he asked me for help. I'm really surprised that an actuary can forget basic probability. That's why I think much of the knowledge we learn in school is not applicable.

Barb Hogg: Well, let me just make a quick comment. I have forgotten a lot of stuff, but my excuse is that I've been out for a long time. However, I often still go back to theory of interest, to the old formulas to find a present value. Then, I use my calculator to make sure I still remember how it works.

Dave Dillon: If Elias gave me a test on life contingencies right now, I would get a zero. I would not know any long-term math. I don't remember any of it. I know the concepts. I'll dabble a little bit in long-term care insurance, and I can relearn. I think that is how I would answer that. I may not immediately be able to calculate an annuity factor or something, but with a little research and getting back up to speed, I would be able to do it. As I said earlier, you have to be adaptable, you have to be flexible, and I'll go back and learn some of that. What I do use a lot on a day-to-day basis is more of the statistics stuff that I learned here, because health insurance is much, as I said earlier, shorter. It's more about things like ranges. So, I use the statistics nearly every day.

Larry Lickteig: I think in my work, it's going to depend a lot on what area you're in. If you're in experience studies or something like that, you're going to use it a lot. If you're with the derivatives desk, you're going to use a lot of technical skills there. I think for me, a lot of value is in the logic skills; just being able to analyze things and think clearly about issues and try problem-solving skills. I think that's what comes through for me. Like Barb was saying, I have forgotten a lot of stuff. But, those technical skills, problem-solving skills, and being able to think logically are what help you a lot.

Also, as your career progresses, things change. If you want to keep moving up, you're going to have different issues you have to deal with. You have to change what you are focusing on and start focusing on other problems. You don't always get to see all the technical stuff that you might when you're initially coming out of school.

Andy Ferris: My thoughts are along the same dimensions here. The principles that we learn in the profession and in this program remain absolutely foundational to the work that I do today. It's different than solving a textbook problem, as these guys have said. But the principles, I believe, are absolutely foundational. I consider myself to have the ability to be the engineer of a life insurance company because of this education. And I feel that is absolutely and directly relevant in much of the work that I do. If I didn't have that, I wouldn't have been in a position to help life insurance companies introduce predictive analytics as a way to change a core business operation, changing something they've been doing for a long time. You have to understand those concepts and apply them in a business setting. That's what I think is most important.

Barb Hogg: In other words, keep studying. Any other questions?

Yan Shen, University of Iowa Student (Actuarial Science MS): You just mentioned that companies nowadays are trying to model your client's behavior because of the impact to your company. Could you talk a little bit more about this, why you should model people's behavior, and also could you list some factors you want to take into consideration?

Dave Dillon: The kind of thing I'm referring to is called "risk adjustment." I mentioned earlier that with the passage of the ACA, "X," "Y," and "Z" went away, and they implemented "A," "B," and "C" to address that. One of those things that changed is what we would call "guaranteed issue" and "guaranteed renewability." Before the ACA, if you came up to me, I would assess right then how healthy or sick you were, and your premium would vary based on that. With the passage of the ACA, we can no longer do that. An insurance company has to take all comers. They don't know, they cannot ask the questions. When all of you come to me as the insurance company, I don't have a clue if you're healthy or sick. Well, as I said, in the major medical market, there may be 10 insurers. Everyone in the state is going to 10 different organizations. Some of those insureds may be healthy; some may be sick. On average, you expect your costs to be $500 a month. Well, what happens if you charge $500 a month and you get every sick person in the state of Iowa? You're going under. But what if you charge $500 and you get every healthy person in the state of Iowa? You're making all sorts of money, right? You're partying. Well, the ACA prevents those two situations. Risk adjustment moves the money around. What you get paid is based on the statewide average. Well, if there's 10 of you and you're only one of 10, how do you figure out the statewide average? That's where we start modeling. We'll take the last couple of years of data that we can — the federal government, CMS, Medicare. We'll release some information known as "preliminary data." We have to take that from the other carriers. But as I said earlier, and I've said it multiple times, January 1st is almost like a new starting point. We can take the data from the last year, but we have what we call "open

enrollment" in November. Everyone can choose a new plan. Guess what happens? A lot of people move around. We try to model what we call a risk score. Then they have what are called HCCs, hierarchal claims conditions. If you have a certain condition, you get a certain score. That's a lot of the stuff we have to collect on people. What conditions do they have? We put a severity score to it, and then we will model. Are these people going to stay with us? Are these people going to go to our competitor? Then are we going to get certain people covered by a competitor? Centene is a major insurer, and they do a lot of Medicaid work for lower-income individuals. One of the things we assume is they're going to get certain populations because they have always kind of worked in that area. We would model that Centene, as one of the 10, will get a certain population and we have to estimate what the other carriers would get, too. A lot of it is collecting data on our people, getting the risk scores, and then, because people move around, we might know that people will come back to us. So, we model that kind of stuff too.

Barb Hogg: I think that's a great example of modeling behavior. I have just a little different angle on modeling behavior. One of the things we work on is retirement and financial security. There's a lot of behavioral analysis there. Behavioral finance comes into play a lot in the work we do. Richard Thaler at the University of Chicago wrote a book called "Nudge," and it's about how we use what we know about people to nudge them to better behaviors. The Obama administration was very focused on the nudge factor in their retirement initiatives. It's all about analyzing behaviors to help determine how to best design a retirement program to get individuals to better outcomes in the long term. That's a different angle from where Dave's going with that behavior, but it's another way we use and model behavior.

If there's another question, we can do one more.

Nariankadu Shyamalkumar, University of Iowa Associate Professor: I'm Shyamal from Iowa. I had a question on this indirect discrimination. Two things, one is whether this is within the scope of societies and elaborate on how they might interact with the regulatory boards. The second question is, are consulting companies going to have some kind of auditor role to basically certify that this is not happening in companies?

Andy Ferris: I'll first say, there are more questions than there are answers around the things that you just said. The societies can be helpful here in talking about techniques. One of the ideas that's out there is, "Life insurance companies don't collect this information." Could you, with sufficient accuracy, infer race or infer some of these things? For some, that's a non-starter. They don't want to infer such information for fear that the inference could be incorrect. But for others, they say, "Maybe there's some potential there." Some of the organizations are working on, "Are there techniques that are sufficiently accurate to infer some of these sensitive data fields?" If you can do that, then you can go back within the walls of the insurance company and ask yourself, are there processes that are biased against those?

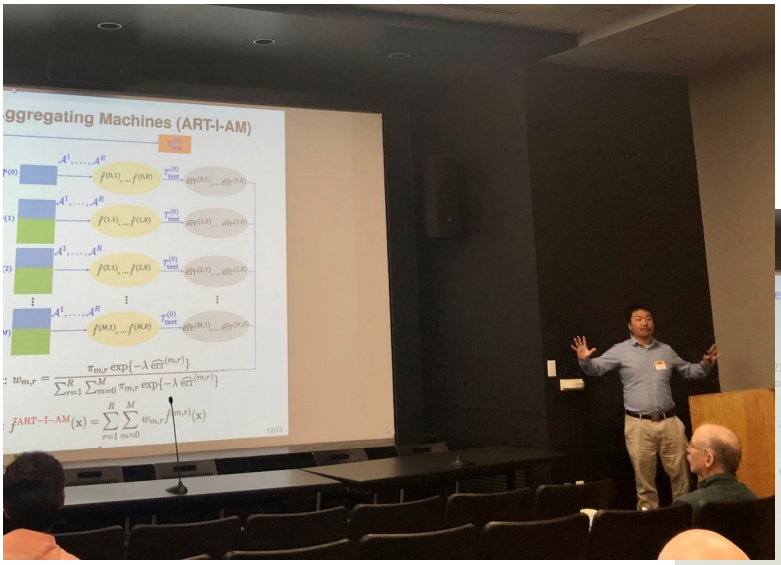
The consultancies, is there a role for them? Well, sure there is. Maybe every week, I am asked for a simple solution: "Can you just tell me, Andy, whether we have bias or not in our processes?" No. There is not a simple answer to that question. I say this often: "First, define it for me. Pick any of the sensitive topics you want. Tell me when I know that my underwriting process has racial bias, or any other type of bias." Let me just give you one layer of detail there. We can underwrite based on medical conditions. We can underwrite based on things like BMI. Well, imagine putting up a chart of "race A," "race B," and "race C," and looking at the distribution of BMIs across race "A," "B," and "C." Do you expect them to be the same? They're not. Do it again for medical conditions. There is different prevalence of medical conditions in different races. You can't start from the premise that we think all races should have an equal distribution of assessments of the underwriting process. That is a faulty starting point. I'm giving you one layer of detail here to demonstrate that this is a really complex issue. I think with implications in so many different areas, we, as an industry, just have more questions than we have answers right now. I'll come back in five years, and I'm not sure we're going to have it entirely solved by then. We're going to be better at it, but this is something that is really complex.

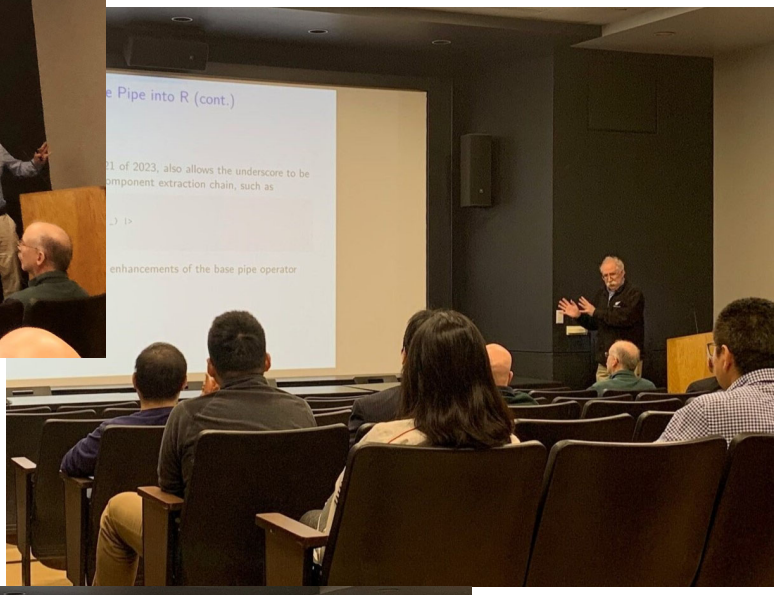
Barb Hogg: When Dan was presenting the batting stats and digging below the top line results, I thought "That's a lot what we're doing with the DE&I." A lot of people throw out the one number, but you need to dig beneath it. There are differences in wealth and "wealth inequity." It could be pay inequities; it could be different personal opportunities; it could be different education levels; it could be gender and gender biases; age can come into play. The question is, "How does that all add up and is there something else at play too?" We can come up with a number or we can come up with "here's how it compares," but you really need to look below it to understand those drivers. If we look at retirement outcomes, a lot of people like to look at the differences and say, "It's all an income issue." If there's an income issue, that can also be a cause as there may be unexplained income differences. You've got to dig below that too. So, it's tough to fully understand the drivers. We'll continue to learn more.

Kung-Sik Chan: We just had a really wonderful, very stimulating and informative panel discussion. I enjoyed it very much and I trust that all of us enjoyed it. Let's give a round of applause to the panel. I think it will be the end of the first day program and the conference will reconvene at 8:30 tomorrow, but we will move to the IMU in the Big Ten Theatre, which is room 348. Big Ten Theatre in the IMU, Saturday 8:30. We will have refreshments and pastries. I'll see you there. Thank you.

Hogg and Craig Lectures – The 50th Festival
Day Two

Day Two (April 29) of the festival began with opening remarks by Kung-Sik Chan, followed by a Departmental Faculty Research Showcase. Dan Nettleton presented his second lecture, “Who Is Winning? Determining Whether a Candidate Leads in a Ranked-Choice Election.” Next, Research Talks on Emerging Topics and Practice in Data Science was followed by panel discussions on “Paths to Becoming a Successful Data Scientist.” Day Two concluded with a banquet dinner, with closing remarks by Kung-Sik Chan and Barbara Hogg.





Boxiang Wang (above) and Luke Tierney (right) presenting at the Departmental Faculty Research Showcase

Aaron Christ (below) presenting during the Research Talks on Emerging Topics and Practice in Data Science

Day Two cont'd.

Panelists discussing "Paths to Becoming a Successful Data Scientist"

Kung-Sik Chan speaking to festival attendees at the banquet

Hogg and Craig Lecturer Dr. Dan Nettleton at the banquet

Serena Tiong, department administrator Tammy Siegel, and Tzu-Hsien Wang at the banquet

Zhijiang (Van) Liu and Dale Zimmerman at the banquet

Barbara Hogg delivering her closing remarks, “On Hogg and Craig — More Than a Book”

Transcript: Panel Discussions on "Paths to Becoming a Successful Data Scientist"

On April 29, 2023, the panel discussions on "Paths to Becoming a Successful Data Scientist" featured (from left to right): panelists Yeh-Fong Chen (Food and Drug Administration), Rui Jin (Novartis), Zhijiang (Van) Liu (Google), Bo Wang (Meta), and Levent Bayman (Labcorp Drug Development), and moderator Hai Liu (BioMarin). The transcript of the discussions is below.

Hai Liu: Thanks everyone! We'll have a panel discussion on how to become a successful data scientist. We are fortunate today to have five successful data scientists sitting here and talking with us about statistics, data science, and everything in their career development. My name is Hai Liu and I'll be the moderator for this panel discussion. So, without further ado, let's get started. I think let's do a quick introduction about ourselves and I'll start with myself. My name is Hai Liu and I graduated in 2009 under the supervision of Dr. Kung-Sik Chan. About myself, well, after graduation, I went to Indiana University as an Assistant Professor of Biostatistics. I do see our logo right on the wall there! After six years at Indiana University, I moved from Indianapolis to California and joined the industry. The first stop was Gilead. After several years, I took a little detour, went back to China, joined Alibaba for one year; and I came back, joined a startup company called GRAIL doing cancer detection using genomic data. After several years, I'm kind of moving back towards the biotech and pharmaceutical, now with BioMarin Pharmaceutical Inc., a mid-sized pharmaceutical company based in California.

Levent Bayman: My name is Levent Bayman. I graduated in 2006 from the Stat department with a master's degree. I started working at the joint project of UIHC Internal Medicine and VA, in a research center named CRIISP. I worked in VA for around four years under the appointment of University of Iowa Internal Medicine. Then I switched to the Clinical Trial Center under the Department of Biostatistics and I worked at the Clinical Trial Statistical Data Management Center until 2021. About two years ago, I switched to industry to work at a Clinical Research Organization (CRO). I work on Phase I, II, and III clinical trials.

Bo Wang: Hi everyone, my name is Bo Wang. I graduated in 2018 with a PhD in Statistics and my advisor was Professor Kung-Sik Chan. After graduation, I got into Liberty Mutual Insurance, and I worked there for three and a half years as an Assistant Director of Data Science. Then I got an offer with Meta, and I have been there for one year as a Senior Data Scientist.

Zhijiang Liu: Hi everybody, my name is Zhijiang (Van) Liu. I graduated from University of Iowa in the year 2019. I was under Professor Dale Zimmerman. After that I moved to Chicago. I worked for United Airlines and I lived in an apartment that's 20-minute biking distance from the home court of the Chicago Cubs. One year later, the pandemic hit the industry, and I thought, okay, maybe it's time to leave. Then Google was hiring, I just applied and I was able to go to Google in 2020. I have been there for about three years. Currently I'm working in the Google Ads team. We are actually specializing in the measurement data measuring the incremental behavior of the users.

Rui Jin: Hi everyone, I'm Rui Jin. I got my degree in 2020 and my advisor was Professor Aixin Tan. When I graduated, I joined Eli Lilly as a Biostatistician, and after one and a half years, I switched my job. Now I'm working for Novartis, still as a Biostatistician. I'm responsible for late phase clinical trials supporting trial submission, and also drafting statistical analysis plans, like clinical trial design and developing new endpoints. That's basically everything. Thank you!

Yeh-Fong Chen: Good afternoon, everyone, this is

Yeh-Fong Chen. I'm thrilled to be back at my alma mater here at the University of Iowa today to share my work experience with all of you. I'd like to start by giving a special thanks to the department for this wonderful opportunity. I graduated in 2000. My PhD advisor was Professor Richard Dykstra. I have been working at the Food and Drug Administration (FDA) since August of 2000. I'm currently a Supervisory Mathematical Statistician at the Division of Biometrics IX of the Office of Biostatistics at the Center for Drug Evaluation and Research (CDER). The specific area for which I'm currently reviewing the drug application is non-malignant hematology. During the past 22 years working at FDA, I have reviewed many drug applications in numerous disease areas, including psychiatry, neurology, oncology, gastroenterology, hepatology and cardiovascular diseases, as well as diseases due to inborn errors. In non-malignant hematology and inborn error areas, there are many rare diseases. Although my primary duty at FDA is to conduct regulatory reviews of new drug applications submitted by the sponsors, I have engaged in regulatory research, and I work with the statistical clinical colleagues both at FDA and the academia. In the summer, I also mentor student interns. My research focus is on missing data, multi-regional clinical trials, and innovative designs such as adaptive design, enrichment design and two-stage design to address high placebo-response clinical trials. Thank you so much. It's a great honor to be here.

Hai Liu: Thank you. As you can see, we have a pretty diverse group of data scientists covering quite a few industry sectors, biotech, pharmaceutical, high-tech. As you can see, it says statistics is everywhere, right? Especially in the industry. Just by now, we have representatives from academia, Yeh-Fong coming from the government sector. So yeah, let's take a deep dive into the conversation around the topic of becoming data scientists in industry. I'd like to start with, as you can see, this panel has prepared these questions. I forgot to mention, thanks Boxiang and thanks Tammy. Really, it's a true accomplishment to organize such a great event and have these great data scientists sitting here talking with us, and hopefully we'll enjoy the next half an hour. I know we have a full event today, so I'm trying to make this more kind of interactive with the audience, with the students especially. If you have any questions, feel free to raise your hand. I'll try to accommodate your questions, maybe in between the questions the panel has prepared.

Hai Liu: Let's get started with our first question. What does a typical day look like for you as a statistician/data scientist?

Yeh-Fong Chen: Before I answer this question, let me spend a minute introducing to you FDA and its mission. FDA stands for Food and Drug Administration, which is a U.S. federal agency that regulates all food and medicinal products. One of its major missions is to protect the public health and bring safe and effective products to the public with efficiency. To fulfill the FDA's mission, all reviewers at FDA not only thoroughly evaluate the submission, but also provide trial sponsors with good guidance based on the most up-to-date knowledge and policies, especially in study design and analysis. The FDA has seven centers, including CDER, CBER, and the CDRH that we commonly hear about. I work at the Division of Biometrics IX of the Office of Biostatistics at the CDER. Our regular work as a statistician at the CDER involves reviewing different types of drug applications. The drug applications include INDs and NDAs as well as BLAs. The INDs are those submissions including the sponsor's protocol and the statistical analysis plan, we call SAP. The NDAs and the BLAs are submitted after the trials have been completed and the data are analyzed. The sponsors submitted their reports or findings for the pursued drug of interest to the FDA for evaluation before the drugs can be marketed to the public. So, our daily work includes reviewing drug applications as well as conducting regulatory research to guide sponsors on how to conduct successful clinical trials. As a supervisor and a leader for the Non-Malignant Drug Products team, my main view is to make sure that my team members produce high-quality reviews with in-depth analysis and superior reports. During summer, I have consistently worked with student interns on important projects related to our review work. Over the years, I have led my team and students to perform research in the disease area that utilized innovative design and real-world data for historical control. Many of my past intern students are actually from our Statistics and Actuarial Science Department, and many of them joined the FDA after they received their PhD. If you are interested in joining FDA as a summer intern or formal employee, please reach out to me. I also have sent Tammy some related information about FDA and also our Office of Biostatistics. You may ask her to share that information with you. Thank you!

Rui Jin: A typical day for me starts at 6 or 7 in the morning. I will first check my calendar to see how many meetings I have got for that day, and I will classify these meetings into two groups — the meetings that I must attend and the other meetings that I will not. But after that, I got basically the blocks of my available time. Then the next step for me is to list out the tasks I need to get done by today. Because when I'm at work, the difference between student life and working in the industry is that I don't have a huge continuous time blocked for me to do one project. I have to divide the project into small pieces of mini tasks and I will squeeze those many tasks into my available time blocks. So that's the second step. Then I also need to do some review tasks or housekeeping tasks. I would like to keep those tasks after lunch. I'm saying this because I will force myself to do those. So, that's basically how I start my day, and how I plan my day at work.

Zhijiang Liu: Similar to Rui Jin, I classify the meetings into three groups — the ones I must go to, the ones I don't have to go to, the ones I can go but put as background. So yeah, I start the day by first checking my email and messages, whether there are some things I need to take care of immediately. If not, I can have my breakfast in the cafe. If yes, I will take breakfast to my desk. So that's the start. Then I will look and check my priorities. So, first of all, I'm going to check the meetings, especially the ones I need to do some regular updates; or maybe I can check tomorrow to see if I have anything to update tomorrow, to get an idea of how urgent it is, like what updates are the most important ones. So that's my priority, really. So I'll make a list: I have to finish this, I haven't finished this, like P0, P1. If I have time, I can do that. Then that's the start of my work. Then I'll do my work.

Bo Wang: My answer will probably not be as specific as the previous panelists. About 70 percent of the time I focus on analysis, and analysis can vary in different aspects. For example, we can do headroom analysis to see whether we should move forward with a direction, and how many opportunities and risks there are. And there are so many other types of analysis we can do. For example, to improve existing models, we can evaluate the quality of training data and try to improve it. And then 30 percent of the time, we focus on ad-hoc tasks. That includes goaling, planning, and tracking progress for the goals we set up. We may also want to build some dashboards to track our progress towards the goals and see if we are on track.

Levent Bayman: The team I'm a part of is around 12-13 statisticians and we all are unblinded statisticians for different clinical trials. As you know, most of the clinical trials are double blinded, and sometimes just single blinded or open-label extensions. We always work as unblinded statistician, so we know which patient is assigned to which treatment group. Around 50-70 percent of my time goes with working with the unblinded assignments or preparing reports or safety reports for the studies. I am responsible for around 20 different clinical trials. So, every other week on average I have a DSMB (Data Safety Monitoring Board) meeting. I prepare unblinded reports and I present them to the doctors and show them what's going on with the study, because the blinded statistician or the sponsor never see which AEs (adverse events) are observed in which group. So, most of my time passes by working with the unblinded tests/reports. And the remaining about 30-40 percent of my time is preparing the protocols or SAPs (Statistical Analysis Plans). I take over the proposals for the clinical trials, I help develop the protocol or the SAP and sometimes tables/figures/listings shells. Then around 10 percent of my time goes to randomization scheduling; I do randomizations and kit listings for different clinical trials.

Hai Liu: Thanks! I do see quite a few terminologies. For example, SAP, probably not many students know what that's about. SAP stands for a set of tools of analysis, which is the central part of the biostatistical planning in the clinical trial. Basically, it's a roadmap. Before we see the data, we have to pre-specify everything, including how we deal with data under almost any foreseeable circumstances. So, when we do the data unblinding in a blinded clinical trial, we basically follow the SAP and implement the data analysis to get the results and interpret them.

Hai Liu: So just to add on a little side question. We have just been through a pandemic, COVID. The question is about what's the typical day, like sort of daily work. Did COVID change anything? Like what style, or maybe a more specific question is, where do you perform your job nowadays, as compared to pre-COVID?

Levent Bayman: When the pandemic started, I was still at the University of Iowa at the Clinical Trial Center. We switched to working from home like everyone else. And I realized that when you work from home, it doesn't matter if you work for the academia in the same city or from outside the private company. So that's why I decided to change my position. A difference for meetings is that at the University of Iowa we were almost always required to turn on the camera, but at the private sector, they generally say, "You don't need to turn your camera on."

Bo Wang: I joined Meta during the pandemic, so most of us just work from home. And I think starting this year, some companies start to require employees to go back to the office for two or three days or even more days in a week. And for our team, our manager set a rule for two days per week, but that's kind of flexible. So, I don't need to go to the office every day.

Zhijiang Liu: Similar here. I also joined Google during the pandemic, and actually for the first year I worked from Chicago. All my team members are in their homes. I feel like a major change to recent Googlers is that it has become a norm that you have a team from different locations. Before the pandemic, tech industry policy was that if you are based in the office in Irvine, you cannot be a team member in Mountain View. But nowadays, your team will be populated by your teammates from different places. Like my team, all our data scientists are in the Mountain View area; however, our engineer partners are all in L.A. All the meetings will be mixed. So, you either have people mixed at different offices in different places, or also some people from their home. I think especially New York folks, they like to work from home. And also, you need to speak loudly because the microphone doesn't work that well. Also, when you show something, you have to show up to the camera, not just the people in front of you.

Rui Jin: I started my career during the pandemic. So, at the beginning part of my career, I was

isolated. I just know the voices of a few members, but I have never met any of them. Last year, Novartis required us to come back for three days per week. So, after that, I know the statistical team members, but I still don't know the other functional team members because they are located in Europe or India. We never met in person. But besides that, I think I prefer working on site. This really improves efficiency. Sometimes communications through Teams might cause certain confusions.

Yeh-Fong Chen: We are also working at home. It looks like most of the internal meetings, I mean FDA meetings, we don't need to turn on the camera. But for the sponsors' meetings, the speaker needs to turn on the camera. We do have some colleagues hired during the pandemic. We never saw them. So usually, their name is just their attendance. Sometimes we call them, they don't even respond. We don't even know whether they have joined the meeting. Yeah, that is an issue. But it's sort of like that. As a supervisor, I don't normally check my members, but as long as I text them, if they respond, I'm okay.

Hai Liu: Thanks everyone. Yeah, I can quote one of my colleagues saying, because this year we are beginning to really see each other in person and someone saying, "Oh, I see you in 3D!" In the COVID, you know, it's all on Zoom on screens and really lacking the connection, especially for those who joined the company as fresh [hires], so really haven't seen each other face to face. So that brings a lot of, I'm not sure if I can say, some kind of inefficiency. But we are picking up. But I don't know whether it will be the times where we'll fully go back to the pre-COVID situation. Or like Dan just said, "It's probably a little more moving forward."

Question (Hai Liu): Okay, next. Well, this is an interesting question. What do you enjoy about your job and what do you dislike?

Zhijiang Liu: I think the way I enjoy the job is that I have the opportunity to collaborate with a bunch of brilliant minds and different ideas. In the industry, we have all these different ideas. Sometimes when you meet with them in a room, we can really try to tackle this problem with different ideas. Sometimes they can just have all these sparkling moments, and somebody can say, "Hey, we can do that." And the others may say, "Oh, this is actually not a bad idea." So, when we have the same kind of purpose, we're trying to solve one very complicated question. First, we'll try to find out exactly how to formulate the question first, then how to tackle it. I enjoy this kind of exchange of knowledge and sharing of their thoughts. Um, dislike... Sometimes this communication can be very frustrating and exhausting, especially when it's virtual. Sometimes we can easily chat back and forth about a topic, like this: "Do you mean this? No, it's not what I mean. Do you mean this? No, it doesn't. Okay, let's discuss." When both of us are aligned, 15 minutes have already passed. Usually it goes well, but sometimes, that's when we aren't necessarily very efficient. Like Bo just mentioned, sometimes all the work comes at the same time. I will make a priority list. because it's so busy. So sometimes you have to replan everything. So maybe that's something I dislike, but we have to do it.

Bo Wang: There are three aspects I enjoy about this job. Number one is the people, as Van just mentioned, that people are really nice and they have great ideas and are really easy to work with. They are also highly motivated as well. Secondly is about data. We have access to massive amounts of data across the world. And social media data is easier to interpret than the insurance data that I worked with. And that also adds some interest to analysis. Interpretability is really important because you know what we're doing, for example, we're modeling for the number of comments, likes, viewer point views, shares — just the ease of understanding the data can help you understand the problem better and make improvements faster. And number three is the impact that Meta is able to make. You can see how this improvement got launched and changed the way that Facebook was used and that's something that motivates our work. The thing I don't like about this job is, as a company grows bigger, there are many different orgs and that could be an overlap of work. If two orgs are doing the same thing, then alignments need to happen. I don't like this but we need to do this often. And also, suppose there's a launch and that is like a combo task included in the launch, then that means there are so many different proposals going into the same launch and they all come from different orgs. In this case we need to figure out ways to attribute the launch gains. Suppose we see there is an increase of 0.3 percent of DAP (daily active person) and how do we attribute this to different teams? And it involves a lot of work and negotiation and communication as well.

Rui Jin: Thank you. I'll discuss working for a pharmaceutical company. The first thing I like about it is that because we can use statistics to make sure that we can appropriately interpret the clinical data, that we try to deliver correct interpretations about how the treatments are, which is meaningful for patients. And besides that, I think it's really nice to have a chance to work with brilliant minds. Some of them can, in some ways, communicate with statistical results in one sentence, so that other functional members without any math background can easily understand the conclusion. I admire that because in one mission I presented step-by-step how I got those results. At the end of the meeting, the other functions were just confused and asked me, "So based on your simulations and those slides, what should we do?" I guess, because I still have the mindset as a graduate student, I tried to present as clearly as possible how I got those results. When you work in a company, they just trust you, because that's your expertise. What you need to do is let them know the

supporting evidence for decision making. At that time, a senior member of the team just used one sentence to summarize, and the other function immediately got all the ideas. Yeah, I really admire that I'm still learning how to get there. Oh, on the dislike part: Because the company grows larger and larger, for one particular task, there is a chance to have one separate team to be in charge of that task, which means the communication between different teams is getting harder and harder. You might have the same problem in federated learning. We have this thing, and especially in that scenario, communication isn't really possible.

Zhijiang Liu: We have a term for that, called siloed.

Yeh-Fong Chen: The FDA is really a great place to work. It is an organization with important issues, and with the largest number of statisticians in the world. This is what I was told, but I didn't really check on that. For CDER alone in the Office of Biostatistics, we have more than 200 PhDs in the system. So, as you can imagine, it may be true. The impact of having so many statisticians in one organization is to guarantee that our work at FDA will be a lot of fun. Everything is related to numbers. When you engage in daily interaction with many brilliant colleagues who possess strong logical and quantitative skills, you can expect yourself to become smarter and smarter each day as well as your family and your children. Most FDA colleagues from different disciplines are also experts in their field. Therefore, working at the FDA allows us to access and learn the newest knowledge and technologies with first-hand information and trainings, so that we never feel bored and outdated. Of course, there are some challenges working here, especially at the oncology and hematology areas. We are consistently overwhelmed with heavy workload. As a result, I cannot take a long vacation for many weeks during a year, even though I have many leave hours left unused but needed to donate to others in need.

Levent Bayman: A part I like is that people are very helpful. It was one of the first things I noticed when I switched to the private sector. It's not like the people in academia were not helpful, but I was not expecting asking a question and getting the feedback or the response immediately. And also, another part I like is working with the unblinded data. It is both great and sometimes depressing, because we, as unblinded statisticians, know if there's an issue with the drug being tested in the clinical trial. I conduct interim analyses or prepare reports. I check the efficacy if the drug works or if the drug doesn't work at all. So, heading into the sponsor at the end of the project, if it's a good drug, then they are very excited to hear it. But if it's a futility, then they get disappointed. They get sad because they have spent a lot of time and a lot of money for that drug. But working with unblinded data is really great. I can see what's going on. The part I dislike is, like everybody else in the panel complains, the communication. We have different teams in different countries; asking something to the, for example, China team takes one day, then you respond on the next day, then you get the feedback on the second day. Or you have to attend the meetings around midnight, so that they can join at 8am in their time. So, there are issues like that. And also, sometimes, there is more paperwork to fill out and also complying with the SOPs (Standard Operating Procedures), so you might be either writing an SOP for a step-by-step action plan for specific tasks and what to do in specific cases, or you go with the SOP so that you can fit into the well-defined area. Sometimes, short tasks take a lot of time to complete.

Hai Liu: Thank you. I do see a few issues that are pretty common, especially in big corporates, lots of data, hierarchy, and because of COVID and pandemic, that creates a lot of data, and communication, and inefficiency. So, students, enjoy your free time before you get a job like this. There are a lot of great things about going into the industry. But as you see, there are lots of challenges, especially as a new grad entering into this. So, before we switch our focus a little bit, we want to take a little pause and see if there are any questions from the audience.

Audience Question (Lyle Paukner): Are there any particular pieces from your courses that you find yourself using on a very regular basis, or any of the courses that you wish you would have taken?

Hai Liu: That's our next question! Never mind, we'll take it. Other questions, comments?

Audience Question (Ling Zhang): I'm a nearly graduating student. I would like to know what are the challenging things for a new PhD when they start application of data science.

Rui Jin: Well, I can describe the challenges. Because working in pharmaceutical companies focuses on making decisions and statistics is only part of the procedure, so only knowing statistics is not good enough. We need to know other things like operational difficulty and even some clinical knowledge. When I graduated, I just knew statistics. I didn't know anything about the other parts. So, when my manager gave me some tasks, I could write it as homework, to derive those formulas step-by-step and simulation results in a very technical way. So, from my own perspective, I wanted to show them the clarity of how I got there. But it is not what they want. After several times, I started to realize that. I also needed to learn how to present the statistical results and how to incorporate other parts into my recommended decisions, because it's not just about statistics. For example, we can calculate sample size based on our statistical knowledge. But some calculations are not possible in real life. Operationally, it's just not possible. Like, optimization problems, or the domain of that optimization problem, is not purely based on statistics. It's also based on other things like operational possibility. I think realizing that really helps you to

adapt to working as a statistician.

Yeh-Fong Chen: I want to add that actually right before I graduated, Professor Dykstra told me something because I asked him, “I don't know anything about FDA,” and I asked him how I can do the work successfully. Then he just said, “If you have the ability to learn, you should start.” I want to encourage you.

Bo Wang: I can also add on to that. I agree with what the other panelists have said. I think there are a few differences. One thing is the context. In the school setting, we were given a project and we came up with some modeling and we had the beta’s, and you can submit your work to the teacher. And that's all. But in industry, you need to understand the context. Why are you doing this? And understanding the big-picture questions will really help solve the problem better. And number two is working with ambiguity. In school, you have a very definite problem, right? So, there's kind of a normal equation and solve that. But in industry, there is a lot of ambiguity and a lot of imperfect things. For example, maybe you have a really important variable, but the variable is not available at the time they need to do the prediction. So many things like this can happen. And also, a lot of uncertainties you need to deal with on a daily basis.

Zhijiang Liu: I totally agree with what the first two panelists just said. I would like to add one more. You have to adapt. There are three things you need to adapt to. You have to adapt to the imperfection in the data, in you and in the people around you. So, first of all, the data. In the real industry, the data is never clean. You're always running into nitty-gritty. There are things that are not working. You have to have a lot of that. Probably the first thing when you want to use the data, you need to have a lot of checks. Like, is the data what it's supposed to be? If not, why? These are the questions you need to ask before you do any analysis or any model. But even after that, you probably still have 1-5 percent of data that's just not fixable. There you need a trade-off, if you want to fix that by using extra effort or you are dealing with that kind of imperfection. So that's the induction data. Second, adapt to the imperfection in yourself. We have different specialties and knowledge bases, and we don't know everything. You need to find your helpers, especially in your team. Once you join the team, the first thing you need to know is who owns what knowledge base. If you have certain questions about a certain part, who to ask. So, this is the second part. And also, the third part is the imperfection in the people around you. They also have these questions. You may have expectations of them, like you may expect them to answer a question that you ask in one or five minutes, but usually it's not the case. If this happens, don't be surprised, and just try to adapt to that. That is my recommendation.

Question (Hai Liu): Now, let's move on to our next set of questions. So, it's more focused on the students. The question is, what courses or skills should students interested in data science focus on?

Levent Bayman: That's a hard one. Communication is the biggest or one of the most important skills you should have when going to either academia or industry. I don't know if we still have it, but we had a consulting course when I was a student. It was really helpful during that time, because it helps you to talk to the layperson in accessible terms. Most of my meetings are with the non-statisticians, and also once a week for the DSMB meetings, I meet with the doctors or project managers. I might talk in statistical terms to the doctors and they might use the medical terms. So, we have to find the common point to describe what's going on in the study, like what does it mean by a p-value, what does it mean in terms of statistical significance. Communication is one of the biggest parts of the skills.

Bo Wang: I think the first one that can be really important is Statistical Inference and all the theoretical and applied Stat courses. Maybe you will be surprised, when I go to an interview, they do ask me Bayes Rule, how do you find the probability of a certain event. Yes, these are the questions that come up, and they really carry a large proportion of the final score in the interview. So really taking those courses seriously. They are really important. The other thing that I wish I would have done better is the computing part. I think that it would be something that would be really beneficial to us. In the interview, there are some questions like, how you want to design simulations. And I hope that I can do more practice in school about computing. And also, I want to say I really appreciate the program that our department has provided, in that it gives us a really solid foundation of statistics. Reinforcement learning, deep learning, all those cool stuff are based on those Stat courses and the Stat knowledge that I have learned in school.

Zhijiang Liu: I think I really benefited mostly from the foundation courses, like mathematics, applied statistics I & II that we've gone through. I think maybe you'll forget many details, but those foundations are always the ones we come back to. If you really don’t understand what the p-value of hypothesis testing is, you probably won't be able to solve many problems. So yeah, I still recommend that you focus on the basics first and also find your interest. During my PhD years, I have focused on statistical computing. I've learnt a lot from that. Also, at the same time, because I know I am pursuing a position in the industry, I want to learn some Python. I actually took an undergrad CS course with a bunch of undergrad students. Today I still benefit a lot from that. If you want to learn Python, I know somebody can learn by themselves, but I can't, so I would take the class. So, just leverage whatever you can have outside of this department. It's very good.

Rui Jin: For me, I would like to choose the Computer Intensive Statistics course by Professor Tierney. I

learned many things like computing speeds, how to design sampling algorithms and how to design machine learning algorithms, etc. I think the most important is Professor Tierney is continuously updating the material. It is quite different from what I learned in 2017. I just downloaded the slides, because I need to recast some of the results. Some new material has been added to that course. So, I'll highly recommend that course.

Yeh-Fong Chen: If you're interested in working in the data science field, you should also possess some biostatistical knowledge or be proficient in some subject areas, such as clinical trials or epidemiology, that you can apply data science techniques to. Although our Department of Statistics and Actuarial Science is not really focused on biostatistics, students from statistics departments, in my opinion, compared to the biostatistics departments, are generally stronger in terms of performing regular research (I know some students from the biostatistics department are here, but that's my opinion) — thanks to their solid statistical foundation and strong computational skills. Nowadays, most PhD students in statistics also have taken Bayesian statistical courses. Of course, basic training in data science and machine learning applications will help. Students who are interested in having some hands-on experience in data science can join our Division of Analytics and Informatics, which is composed of many master-level data scientists, providing data analysis need for statistical reviewers at the Division of Biometrics I to IX, whose main duty is reviewing drug applications. Thank you!

Question (Hai Liu): Okay, next. If you could go back to school, what would you do differently? Maybe I'll give you a few minutes to think about it. It's a tough question.

Yeh-Fong Chen: All courses I have taken from my graduate study are helpful, even though I may not use it directly to my work at the FDA. The theoretical statistical courses I took equipped me with good logical and critical thinking skills. The applied statistical courses provided me with adequate knowledge to analyze data and give correct interpretation. Excellent programming skills I learnt in most applied courses help me conduct analysis and simulation for my research. Something I wish I had taken the time to develop when I was younger are communication skills. Even after 23 years working at FDA, I still believe that I can improve and have more room to grow.

Rui Jin: For me, I think from the coursework perspective, it's not that important because if you're curious about something, you may always force yourself to learn. So even if you didn't learn it during your graduate life, you can learn after joining a company. One thing I worry about is my communication skills. You might see that I need to improve it even now. Without that skill, even if you have fancy math results, you cannot let other people without any background know what you have done there. I think if we compare ourselves as a function, we have inputs and outputs of that function; without communication skills, first, we are not sure what the problem is. Even when we make sure we know that part, we cannot describe what it is up to. It's actually really a fact of our working performance, especially in the industry.

Zhijiang Liu: For me, first, probably, I will try to make some more friends from the CS department, because collaboration with software engineers becomes part of our work life and we have communicated a lot. Sometimes, I feel like they are thinking very differently, and it's not separated from academic training. I feel like I should know them from college life or when I am back in school, to probably get a better idea why they are thinking something different. Also, I would probably try to take more deep learning courses. I used to sit in my deep learning course in MacLean Hall, but I was a bit lazy and dropped in the middle. I didn't finish the natural language processing part. Yeah, I will try to take more courses.

Bo Wang: There are things that I always thought I would have done better, computing, computing, computing. And I also want to get a copy of Professor Tierney's updated computing lecture notes, if you allow me.

Levent Bayman: For me, I kind of did that "different" thing. When I graduated in 2006 and started working at the hospital, I realized that I had to take some epidemiology and biostatistics courses as well. I started taking courses on the side from the Department of Biostatistics and I completed another master's degree; now I have a master's in statistics and a master's in biostatistics. Since I'm in the healthcare setting, two masters helped a lot, with the theoretical foundation of the statistics department plus the application side of the biostatistics department. If you are interested in healthcare, I would suggest taking up some biostatistics courses as well.

Question (Hai Liu): I do hear from what you were saying, communication is really important, as a soft skill, of course, on top of what our specialization lies in, statistics, data science. So, one question for all of you is how should students improve or practice their communication skills when at school?

Levent Bayman: Partnering with your classmates is the best way to practice as a first step. Because when you partner with other students, you are going to see what action works and what doesn't work. In either case, you could learn something for the future. And also, I believe it's important to consider checking out Lynda (LinkedIn Learning) as a vast source of team building exercises/courses. I suggest going to Lynda, and you can learn by taking courses from there.

Bo Wang: I think the most effective way would be to have an internship. I think, do that as early as possible, so that you can get an expectation of what's going on in the industry. And also, when I was in school, I took a consulting class that sort of resembles the real life in industry; and also, I think in Professor Lang's class, he asked us to interpret p-value to people in layman's terms. They ask those questions in the interviews as well, so I got prepared for those questions.

Zhijiang Liu: I think the key is communicating with non-technicians, so you can start trying to talk about your research with your parents to see if you can help them understand this. I feel like this is a very helpful way to not only make your research concise, but you also want to explain it to the other people. This will be very helpful. Also, I think one thing you need to practice is active listening and proactive listening. When you listen to what other people are saying, you want to give them some feedback and try to confirm you understand what they are saying. That is very helpful. It can save you a lot of time in your work.

Rui Jin: For me, I think doing an internship really helps, because you're under that circumstance for a couple of months, and it will help you build up your communication in a short time.

Yeh-Fong Chen: Communication skills are especially crucial, but for how to improve our communication skills, I would like to introduce you to the Toastmasters Club. I don't know how many of you have heard of this Toastmasters Club. It is a club composed of humble people who like to enhance their presentation skills and improve their ability to face impossible issues. The FDA has two Toastmasters Clubs. I'm actually the president of one of those clubs, and we meet weekly. Besides the opportunity to learn how to deliver a presentation successfully, joining the club here has the benefit of meeting good colleagues as well as gaining leadership skills. As the president, I work with other club officers to make sure that we have good meetings conducted with useful topics all year long. Maintaining a distinguished Toastmasters Club depends on team efforts. It is not something that one person can accomplish.

Question (Hai Liu): Alright, I do hear several people mentioning internships. So, any thoughts? I know internships, we pretty much all agree, if you want to go to, especially go to industry, internship training and practice is crucial to get you to a job. So, any thoughts on recommending, especially to our students, how to find internships, and how do you find internships are helpful?

Bo Wang: I would say number one is build connections. And I'm so proud that I'm in this department and there's a tradition of passing down the connections. I was helped and referred to a few companies by some UI alumni. Congrui referred me to Expedia and many others also referred me to many other different companies. I really appreciate that. And now it's my turn to do the same thing. And I hope that you can pass it down to whoever might need your help too. And also, the other part is that don't be afraid to ask and reach out, and there are many public resources online like LinkedIn. People are inclined to help others. This is also an active way for them to build connections with you. So don't be afraid to ask and reach out. Yeah, I think that's it.

Zhijiang Liu: Yeah, I think Bo gave a lot of ways to find an internship. I think I can add one more pro to the internship. Even if you have not decided to go to industry, if you are still lingering between whether you want to go to academia or whether you want to go to industry, I will still recommend you to do an internship because it helps you a lot to make a decision, because if I have not had an internship, I would have no idea how an industry works. But because of the internship, I know perfectly that I can work in an industry setting. So that helps me a lot. So even if you don't know which way to go, you can just take an internship. You can say, ah, it's not my thing. Or you at least know, okay, I can do that. That's all.

Levent Bayman: I'd suggest going to different internships and deciding which way to go in the future. Even if you don't like that particular area, it's still helpful to learn what you don't like.

Rui Jin: When I was a student, I never had any internships. So, I agree with Zhijiang Liu's comments. Even if you have a strong desire to be a professor working in academia, I still would recommend you to have a flavor of our life in the industry. You can find the truth. For me, I kind of hope I had an internship in that way in order to make a decision more suitable for my situation.

Yeh-Fong Chen: Experience gained from internships is definitely helpful for finding suitable jobs after graduation. Back in 2000 when I graduated, not many students had internship opportunities, and it was not a requirement for applying for a job. However, for students graduating in the past 10 years or so, having a successful internship experience during school years becomes a trend and almost a basic requirement. Internships can significantly benefit one's job search. Internships provide an excellent opportunity for students to practice applying the knowledge they learnt from school to real-life applications. Additional benefits are to have some publications added to their CVs before graduation.

Hai Liu: Alright, I think we can take another mini-pause before moving to our final part of the session. Before doing that, let's do another round of chat. Any questions or comments from the audience, from the faculty, students?

Audience Question (Sam Dannels): I know, I've been on the data science job market for a little bit

and the interview processes can be pretty intense. There's usually assessment and then a coding task, and you're going to go around different types of interviews. Can you talk about what your interview process was like and any advice you might have on getting through that?

Hai Liu: You are talking about a high-tech data scientist, right?

Sam Dannels: Even outside of that, in some of the other jobs, they have four or five rounds of interviews.

Bo Wang: I know that there's something that you will go through the first round. I don't know if I could share this with you, but I will talk about what might be helpful. I think those are, as I said, probability questions, get lots of practice on them. And also, brain teaser questions. There are so many open resources online and you can search and you will find them. But I didn't really do a lot of homework before I went to the interview. But I was lucky that I learned something in the coursework, so I also was able to get through that. And also, internships also help a lot, so you have experience to talk about the behavior questions, right? So like, they'll ask you, what would you do in some certain scenarios? And suppose you have some stories that you can talk about, you can share them in different angles for different interview questions. So at least have something prepared about how you deal with partnership; for example, a group of people are doing joint coursework and someone is not contributing and how do you deal with this in this scenario. And also, computing! They will give you a very limited amount of time to work on each problem. So, you need to make sure you can do this really fast. And then, I would also recommend brushing up those skills even the night before the interview. Because sometimes you think, hey, I know this question, but then maybe a few days pass, and then maybe you forget, or you get stuck on a part of it and then you can't go anywhere. Yeah, that's all I have.

Yeh-Fong Chen: I'm not sure about your question. Are you asking about the process of the interview?

Sam Dannels: Yeah, just generally what tips might I have on how to do it.

Yeh-Fong Chen: Usually we will screen, we call the candidates to have a screening interview first. Once we are satisfied, we will have a full-day interview set up for the candidates. And many different divisions will have a 30-minute interview in one spot to interview with the candidates. And the candidates need to give a seminar. But I do have an advice to the candidates: Don't give silly answers. I once interviewed a candidate. I asked him, "Why do you want to move to the FDA?" He just said, "I thought the federal job is a place for retirement." And we are telling, no, no! So don't give silly answers.

Zhijiang Liu: I think I can give you a few tips about interviews. First, usually when you take interviews, you've already got a lot of pressure. So, when you start your interview, I usually start with some small talks. Don't think those small talks are meaningless. Those are the ones setting a light mood you need to get prepared. So, I would recommend doing that. And second, when you do an interview, do not treat your interviewer as a teacher or as a supervisor. That will incur a lot of pressure. Think of them as your future colleagues. Think about it, if this is my colleague in the future, and we are discussing this question, how would I talk to them? So, this is probably also helpful. And third, so when you're trying to solve a question, don't hesitate to ask what this question is about before you even think about a solution. Because sometimes you don't understand the question well, you give a solution, which is not the right question, you've wasted 20 minutes already. So always make sure, double check, triple check, with your, whoever have you got this — is this what you're asking, or has any condition on that? Once you are aware of that, then you can propose a solution. If you don't have a full solution yet, you can talk about your thinking process. You can talk about what you think about, ask for feedback, then you can proceed.

Bo Wang: Sorry, the last one on that asking clarifying questions, that is super important. Like this is a big red flag if you jump directly into the answers without understanding, without asking clarifying questions. They will look for the people who ask clarifying questions and look for the people who want to know the big picture before you jump into any specific solutions.

Hai Liu: Just to add on, I think it depends. That's why I was asking what kind of industry you are looking for as a data scientist. It varies a lot based on my experience. For example, Google, Facebook, those high-tech companies — those tend to conduct interviews in the same way as they are interviewed at a software engineer. They do rounds and rounds of technical questions. Sometimes, give you a white board, asking you to write pseudo codes and trying to solve the problem. While in the biotech or pharmaceutical, it's different. It's more kind of based on your CV, resume, dissertation. And most often, if you're a PhD candidate or PhD student, you will be asked to give a seminar talk to your future colleague statisticians as your job interview.

Levent Bayman: I think for the pharmaceutical industry, SAS is the standard software used, but I saw only one CRO that asks SAS questions, but if you are SAS-certified or similar level, then you can answer those questions easily.

Question (Hai Liu): Okay, this is the final part of questions for our panelists. It's about the statistician as a data scientist. So, the question is, any thoughts on losing the identity of a statistician to data scientists? First of all, maybe, comment a little bit on your

thinking, what's the difference between a statistician and a data scientist? Or is there a difference?

Zhijiang Liu: I think the definition of data scientist varies by companies, a lot. Also, within the same company, the definition of data scientist varies by team, a lot. Even at Google, I have switched my team once. The reason is because I had a feeling that I lost some identity as a statistician in the first team; I feel like the data scientists are the kind of mixture of a statistician and data engineer. I preferred to do traditional statistician work, and we also have to find out what the data pipeline, the data look like, the data structure, and then deal with that part. However, how much percentage of those, it's really different, which really depends on the different teams. In my first team, I feel like my statistical part is only taking 10 percent. For 90 percent, I'm dealing with routine works like large data pipelines and production code check-in. I don't use much statistical knowledge. And also, I'm starting to write pipelining code. I feel like I'm kind of like software engineering, which I don't like. I could do that for a year, but I don't want to do that for three years. For that's kind of the reason I started looking for other opportunities. Fortunately, the high-tech companies are pretty open to you to find a different team. Usually your manager, your director, are very supportive about that. So, if you find opportunities elsewhere, they usually help you with the transition. I was blessed to have a manager who helped me a lot in this process. Now I'm in a team in which I use more statistics. I wish I could see the confidence intervals and p-values, which I missed a lot. Like I said, you probably won't know what you are doing until you are in the team for a couple months. But don't be afraid, be prepared to know the situation. Also keep your eyes open to different opportunities, different teams, and know what other people are doing. Make some friends or schedule one-on-ones with other teams.

Bo Wang: I also think along the same line. I think the curse of being in a big company is that we have many orgs, and the benefit is also that we have many orgs, so we can switch teams. I totally agree with what Zhijiang said that on different teams, even in the same company, data scientists and statisticians can mean different things. For example, at Meta, in a team, data scientists may need to do a lot of dashboards building and dashboard monitoring work. So like, if one metric drops down one day, all of a sudden, then the data scientists need to do some firefighting work to figure out the reason and to troubleshoot. And also, a lot of ad hoc analysis will come up for product data scientists. And then I'm working at AI teams, so I'm kind of at the back end. I don't need to deal with a lot of that firefighting work, and have some time to focus on the analysis I want to do. But I think, like in Meta, there's no clear boundary between the data engineer, data scientist, and also even software engineer, or machine learning engineer. There's no rule saying, hey, you cannot go to the code base, that is the job of a software engineer. You can go to the code base and learn those codes and you can also like pulling and making some modifications. Just to make sure that you follow the rules and data privacy guidelines. But otherwise, there are many things that you can do across job functionality. So, there's like no clear line between the job functionality. I'm not really concerned about that.

Rui Jin: In Novartis, my role is quite like a statistician, but we also have a methodology group which is more focused on data science, machine learning because we have different purposes. For me, we want to make sure that the data is precisely interpreted. In that sense, we're going to use a lot of causal inference framework to make sure that what we estimated aligns with what we claimed. And for the methodology group, they have their own purpose, like they can use personal devices to collect the health data and analyze data while preserving patients' privacy. So, they apply methods like the differential privacy method and federated learning method for this type of tasks. And we can choose either role, and we can also do rotations, like spending 30 percent of time on one team and 70 percent of time on the other team. So we can choose. There's no fixed thing. For me, I choose the role of a biostatistician.

Yeh-Fong Chen: I'm not worried about the losing that identity of a statistician to data scientists. Good data scientists must have strong statistical background and solid programming skills. Both can be obtained from our statistics department. About the different questions, I'm less familiar with the data engineers and software engineers. My basic understanding is that the data analysts develop infrastructure and a tool to store and process large sets of data, whereas the data scientists develop software applications or websites. In my field, data analysts are those who perform data analysis using traditional models with different types of assumptions, and typically use the data to create research hypotheses or answer research questions, while data scientists are known to work on machine learning and AI models with minimal assumptions, that can be used by people to develop predictive models that can be used to make a prediction.

Hai Liu: Thank you all. I know we have one minute left, so we will stop here with the questions to our panelists, but I will leave the final question to the audience.

Audience Question (Erning Li): Speaking of computing, what languages do you normally use? I know SAS for your clinical trials.

Levent Bayman: Yeah, SAS is the used language for clinical trials. We also use R.

Erning Li: But besides that, are there languages that you use most often on your team?

Bo Wang: There is no clear rule, you can use R or Python. Those are the most commonly used. But there is no rule that you have to use Python. You can choose.

Zhijiang Liu: For us, it's SQL and Python.

Yeh-Fong Chen: Most of the time, we have the same things and SAS.

Audience Question (Sreya Sarkar): My question is kind of similar to what Sam asked, like what does an interview look like for an intern compared to a PhD candidate who is already towards the end of his or her graduation? How should we prepare for an internship interview? Is it different than a job interview after five years, or is it similar?

Rui Jin: I would say it's different. Because for Novartis, before posting that internship position, they need to submit their research or project proposals, like half a year before. After the proposal gets approved, they're going to hire the interns. So, that proposal has a clear layout, what needs to be done. It has pretty clear needs about certain parts of knowledge, like it needs some candidates to analyze the time to event data. But for hiring a new graduate student, I think that has to be quite different.

Yeh-Fong Chen: For internship, all the time I prefer to take University of Iowa students. I don't really go through the whole list of the CVs. I always just directly contact Professor Chan. However, if you don't really have that connection, you want to find an internship somewhere else, you can always reach out to people you know. It's better to have some connection. And the interview is just like 30 minutes, and we just quickly go through what you know, what courses you have taken. We don't really want to challenge you.

Hai Liu: I say the internships, the bar is a little bit lower than the full-time employee.

Yeh-Fong Chen: Oh, not really! One or two times, Professor Chan doesn't really have a student. I need to go through a list of the CVs. I do need to search for students. I need to compare them to see whether they have good knowledge we can use.

Bo Wang: I think one of the biggest differences will be the interview questions. The expectation of the internship interview is that you do not have any industry experiences before. But for full-time, it's good to have some experience. So, for behavioral questions, for internship, I would suggest you think about some stories in terms of the coursework and how to deal with the conflict.

Hai Liu: All right, that concludes our panel discussion. Thanks to our panelists, and thanks to the audience for your time.

Transcript: "On Hogg and Craig — More Than a Book"

On April 29, 2023, the festival concluded with a banquet dinner featuring closing remarks by Barbara Hogg of Aon (right), who spoke about the namesakes of the lecture series, Bob Hogg and Allen Craig. The transcript of the speech is below.

Barb Hogg: We've had two great days celebrating the 50th anniversary of the Hogg and Craig Lectures. This lecture series is named, in part, after a book, *Introduction to Mathematical Statistics*, otherwise known as *Hogg and Craig*. But it's also named after the two influential Iowa statisticians who wrote the book.

First of all, let's test the room — how many of you knew or met Hogg? I see several hands raised. Many of you knew him as Bob, some of you knew him as Professor Hogg, and, if you were lucky like me, you knew him as Dad. My father was a gregarious individual, an extremely outgoing "people person." If you met him, there is a high probability you would remember him.

How many of you knew Allen Craig? I was pretty sure there would not be many hands raised and, as it turns out, my hand was the only one. Which is probably why I'm here to talk about both of the people this lecture series is named after — Hogg and Craig.

Robert V. Hogg and Allen T. Craig had several things in common:

- They both served in the Navy in WWII.
- They both got their PhDs at Iowa: Dad in 1950 and Craig in 1931. (Craig had attended the University of Florida for his undergraduate degree.)
- They both joined the Iowa faculty after getting their PhDs.
- They both had an extremely long tenure at Iowa. The University of Iowa was the only place that either taught, as both started teaching at Iowa after they received their PhDs and both stayed until they retired. Craig retired in 1970, nearly 40 years after he started. Hogg taught at Iowa for an unbelievable 51 years and even came back after that to teach one semester.
- They were both known as great statistics teachers.
- They both made enormous contributions to the statistics profession. For instance, Allen Craig was the first Secretary-Treasurer of the Institute of Mathematical Statistics after the IMS was formed by Henry Reitz, another Iowa statistician and Allen Craig's PhD advisor. He also was Associate Editor of the *Annals of Mathematical Statistics*. Among other things, Dad was president of the American Statistical Association in the late 1980s.

Despite all those things in common, they had several differences:

- Craig was a bachelor who never married. Hogg was married and had four children.
- Craig grew up in Florida and had a quiet, southern gentleman style about him. Hogg was a Midwesterner who was born in Hannibal, Missouri, and grew up in Rockford, Illinois. Anyone who knows him can attest that there was nothing quiet about him.

- Their Navy service during WWII was very different. Craig, who was on the faculty at Iowa, volunteered and served as a senior officer, a Lieutenant Commander, assigned to a destroyer. Hogg, who was in college, joined the Navy's V-12 officer training program. Based on Dad's stories about his experience in the Navy, he took college classes, played lots of gin rummy, and went to Red Sox games while his ship was being built in Boston. I'm not sure he ever actually went out to sea.
- They had very different teaching styles — Craig was known to be a very polished lecturer. While Dad was a great teacher, which I know from others and personal experience, I wouldn't exactly call him polished. Energetic? Enthusiastic? Entertaining? Yes. But not polished.

The paths of these two men crossed after Hogg graduated from University of Illinois in 1947. He started his post-secondary education at Rockford College, a women's college in Rockford, Illinois, where my grandparents had lived. Rockford College opened it doors to men during WWII in a cooperative agreement with the Illinois Institute of Technology. Then, he joined the Navy's officer training program. After the war, Hogg finished his bachelor's degree at Illinois. When he graduated, he had no idea what he was going to do or, as he would say, "What do you do with a math major?" One day, he and a couple of his buddies were inspired by a sign on a bulletin board which said, "Do you want to be an actuary?" and they headed off to the State University of Iowa.

Once here, Dad took a course from Allen Craig and found he loved statistics. He decided to change direction and stay at Iowa to work with Craig on his PhD. When he got his PhD in 1950, the job market was tough. Enrollments at all universities had soared when the war was over, but they were now in decline. That made for a tough job market for aspiring academics. At that time, Allen Craig was the only statistician in the math department, so he launched the idea of adding another statistician to the faculty. And, thanks to Allen Craig, it worked. Hogg stayed on at Iowa, giving the math department two statisticians — Craig and Hogg.

They were collaborators. Both men loved statistics and spent many hours in MacLean Hall "doing statistics." As they were teaching, they brainstormed better ways to teach statistics and tested those ideas in the classroom. They ended up pulling those ideas together in writing. Those notes eventually became the book, first published in 1958, *Introduction to Mathematical Statistics*, by Hogg and Craig. Perhaps a bit to their surprise, the book took off. The first edition of the book was picked up by Berkeley which probably gave it the push it needed to become one of the more popular math stat books of its time.

I went to Iowa. Like Dad, I was pretty good at math, so I told Dad, "Maybe I'll be an accountant." His response was simply, "You should be an actuary," and I followed my father's advice. For years, I've appreciated that nudge Dad gave me even if he may have had ulterior motives. He was the chair of the statistics department at the time and maybe he just needed more undergrads doing actuarial science.

The first statistics course I took was with Professor Tim Robertson using a different book, *Hogg and Tanis*. Then, I took the first semester using *Hogg and Craig* from Jim Broffitt, followed by the second semester of *Hogg and Craig* from Dad. I must have taken Professor Broffitt's class in the spring because for Christmas that year, Dad gave me my very own copy of the 4th edition of *Hogg and Craig*. The book was simply signed "Robert V. Hogg" and it came with homework. He had listed out a bunch of problems he thought I should work on to make sure I was ready for the class. Maybe he was worried I'd embarrass him if I didn't do well or maybe it was just that teacher instinct coming through. I'm pretty sure I never did any of them.

Why am I focusing on my personal experience using the book *Hogg and Craig*? When I was taking actuarial exams, Part 2 was statistics and *Hogg and Craig* was the primary textbook on the syllabus. When I started working, nearly every actuary I met would know of the book, and I was often asked, "Are you related to Hogg and Craig?"

While I may only be related to Hogg, not Craig, there is more to Hogg and Craig than just a book. Allen Craig was Dad's advisor, his mentor, his colleague, his collaborator, and his friend. As an example, the book is known as *Hogg and Craig*. As a rule, you list the senior author first, which would have made it *Craig and Hogg*. Yet Allen insisted that Dad's name was listed first. It was a great gesture by a mentor to promote his younger colleague. Dad was forever grateful for Allen's generosity.

As I said, Dad and Allen became close friends. When my mother and father got married in 1956, my two aunts, Allen Craig, and another friend of Dad's made up the wedding party.

When my sister was born the following year, Allen was her godfather and my two aunts were her godmothers. In fact, Allen was godfather to each of the Hogg children — we all had different godmothers, but Allen was our godfather.

My parents named their first son after Allen. It was my younger brother that was named after his grandfathers. My brother Allen went on to name his son Dylan Craig Hogg, which delighted my father. He especially loved that the Craig came before the Hogg in Dylan's name.

When we were little, Allen Craig was part of our lives — like a great uncle.

Allen would go to Florida during the summer. I recall a family trip to Florida before Disney had reached Orlando. Instead, we visited Allen. I recall he lived in a trailer on his brother's property. I remember being in awe because he could walk out of his trailer and go pick an orange off an orange tree. A few years later we had another trip to Florida. This one was to see our grandparents, as my grandfather was in Tallahassee to help them start their law school. Allen came up to Tallahassee and we saw him again that trip.

In thinking about Allen, I went through a bunch of our old home movies and found Allen at our house, Allen at kid birthday parties, a picnic with Allen Craig, Allen reading to us, Allen pulling my sister in a wagon. He was at all our baptisms. He was out at our grandparents' house on a small farm north of Iowa City. My other grandparents lived in Hannibal, Missouri, and I even found one movie from a Hannibal visit. Dad was taking pictures of people coming out of my grandparent's house and Allen Craig was there. He was part of the family.

When Allen retired in 1970, he moved back south to be near family. I have a memory of all of us going to the train station in Iowa City and waving good-bye when Allen boarded the train and left. That may have been the last time I saw Allen, although I know my father was able to visit him on a few occasions. When Allen Craig died in 1978, my father gave the eulogy at Allen's funeral. After Allen retired, Dad wanted to honor this person who was so important to him, to the university, and to the statistics profession, so he started the Craig Lectures. When Dad passed away in 2014, Joe Lang, who was chair of the department at the time, asked the four Hogg kids what we thought about renaming it the Hogg and Craig Lectures. I have to admit, I paused when he asked because I knew how much Dad wanted to recognize Allen when he created the lecture series. Yet, recognizing them together also felt right.

Those are just a few thoughts on Hogg and Craig. And, notice I say *on* Hogg and Craig. My father learned from Allen the power of the word "on" because it gets you off the hook. You don't need to know everything and your talk doesn't have to be comprehensive. My goal was simply to give you a glimpse into Hogg and Craig — it's more than a book.

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