



Anusha: Hi, and welcome to DigiHealth Talks, a podcast created and hosted by the Brown-Lifespan Center for Digital Health in Providence, Rhode Island. I'm your host, Anusha Rahman. Join us as we meet some of the masterminds behind the field of digital health, leveraging the innovative technology around us to help the public improve their well-being. Today, we are interviewing Dr. Carly Goldstein, an Assistant Professor of Research and a research scientist. Her research focuses on optimizing digital health practices in heart health and weight loss. Thank you so much for joining us!

Dr. Goldstein: Thank you so much for having me. I'm really excited to be here.

A: We are so excited to learn so much about what you do. To start us off, can you tell us a little bit about your educational background and your current research focus?

G: Yeah. So I'm going to take it way back and tell you that in undergrad, I was a real nerd. I was a double major/double minor, and I double majored in psychology as well as dance performance and choreography. I double minored in women studies and public health. And the reason I bring that up is because psych and dance might not seem especially related, but back when I was, I think, an adolescent, I started to notice that when girls in my dance class, you know, when we would all hang out, it was a great time. We would laugh and joke around, it was great. When they would get injured, and then when one day when I got injured and broke my foot, their vibe seemed to change quite a bit, and so it was really the first time that I realized how your physical health and your emotional health are quite directly linked. I did that in college, and then I was very privileged to get to attend Kent State University in Ohio, where I completed my Master's and Ph.D. in Clinical Psychology. Kent State is really neat because they actually offer concentrations in their doctoral program, so I did both the health psychology and the neuropsychology concentrations and got to do a lot of work in heart failure and cardiovascular disease, but also some work in digital health, and things like medication adherence and cardiovascular disease prevention. And then I matched at Brown for my clinical psychology internship, or residency, and then I stayed here on the cardiovascular behavioral medicine T32 for fellowship. And then I was awarded a mentored research award through the advanced CTR program, and that allowed me to transition to faculty. And then shortly after that, my K23 from NIH was awarded. And so that's what I'm predominantly supported on now. So right now, my main areas are mostly cardiovascular behavioral medicine and intervention optimization. So cardiovascular behavioral medicine I would say is kind of the interplay between behavior and cardiovascular health. So that could be whether we're trying to help people engage in healthy behaviors to reduce their risk or reduce their likelihood of heart disease before they're actually really at risk, like in early adulthood. Or maybe it's helping someone get healthier once they've had a heart attack or helping someone with end-stage heart disease live their best life in some way. So to achieve any of those goals, we typically give

people an intervention or some sort of treatment. So I personally mostly focus on behavioral treatment, like helping someone exercise more or lose weight or adhere to a prescribed treatment, like medication or something else their doctor prescribes, or attending cardiac rehab, which I'll talk about later. However, a lot of those treatments that we give folks tend to have actually a lot of dead weight in them. So, there are parts that work and then there are parts that are actually doing nothing or, worst-case scenario, there are some parts that are potentially making the whole treatment less effective. So my optimization work focuses on helping us refine those treatments so that they're both efficient and effective, and it's basically all the stuff you need and none of the stuff you don't. So we want to make our interventions more efficient. And that's important because for patients, they really shouldn't be burdened with things that don't help. And it's also really important for science, so that we're spending our resources, like time, money, and people power, wisely.

A: Stepping back to something you'd mentioned earlier, you were talking about using behavioral health, that's your area of expertise, in helping patients improve their heart health. What does that look like? What does that actually include?

G: So cardiac rehab is an evidence-based, insurance-approved treatment program for folks who have established heart disease, and the intention is to help get them on the right track and really prevent their heart disease from getting much worse. The way that you do that is you typically go to a center, whether that's in a hospital or like an outpatient facility. You go three times a week for an hour and 20 minutes each time, where the first hour is supervised exercise, and then the next 20 minutes is education about kind of all things heart disease and managing your health. And then in addition, people get to meet with Allied Health, so that could be like a registered dietitian. It's this really wonderful, holistic program that really helps people focus on all the behavioral aspects of cardiovascular disease management, whether that is improving their diet, exercising more, managing their medications, coping with stress, etc. So one thing we might do for someone who, let's say, had a heart attack, is prescribe them to attend cardiovascular rehabilitation, and through a combination of all of these different activities, hopefully they would be reducing their likelihood of having a second cardiac event. So that's just kind of one example of what a behavioral treatment might look like. You know, it could also just be trying to help increase someone's activity, manage their medications, coping with their stress, kind of any of those individual pieces as well. Those are just some examples.

A: And how does your background as a clinical psychologist allow you to do that?

G: You know, when I first started working in cardiac rehab, and a lot of times when I meet new patients now, they kind of joke like, "oh no, there's psychologist here to see me, what'd I do?" And a lot of people, even as they're going through it, are kind of surprised by how psychology interplays with their experience with a chronic condition at that point. So that could be again just coping with the stress of the situation. It might not even be them. Maybe their spouse was the one who discovered them as they were having their event and now is a bit traumatized and, you know, is maybe kind of nagging them too much because they're worried that they're eating too much salt or whatever. Suddenly now this couple might have relationship issues that

weren't there before. So that's one example. And you know there's this disconnect, I think, a lot of times, especially with medical doctors who I don't fault at all 'cause, they're doing their best. But they might say, you know, I really need you to exercise or lose weight, and the patient says "Yep, I understand will do." And then lo and behold, that doesn't actually work out. And that's because there's a lot more of the behavioral science that actually goes in between knowing what the right thing to do is, or the best next step, and actually doing it. Someone who is a psychologist like me can really help people breakdown these steps. Sometimes they're unpleasant. Physical activity cannot be super comfortable sometimes. So whether it's dealing with that or just getting yourself to do it and sustaining motivation, finding it enjoyable can sometimes be a challenge. There's a lot of different ways for a psychologists can help.

A: And I would say that that's the part of psychology that most people don't really recognize as part of psychology, would you agree?

G: Yeah, absolutely. So when I'm explaining kind of what I do to patients a lot of times, they're shocked that I'm not, like, working at an outpatient treatment center where you would just come and talk to me about your depression. I'm really only talking to people about depression or anxiety so much as it relates to their health. I refer to other people who do more standard treatment for all the different mental illnesses. But I might work with someone who, say, has schizophrenia and is managing the weight gain that's really common with antipsychotics and wanting to lose weight, but where maybe getting off their medication isn't the best option. So there's a lot of different ways that it all interacts. And typically people are initially confused and surprised for what I do, but as we start to work together like, oh, this makes a lot of sense. This is really helpful.

A: Very cool. Can you tell us a little bit about your current research involving digital health and weight loss?

G: Yes, I'm doing a lot of projects right now that combine digital health and weight loss. I'm really fortunate to be funded by the National Heart, Lung, and Blood Institute, which is a portion of the National Institutes of Health. I have a K award, which is a career development award, so it's for someone who is in their early years of being a researcher, like me. I have support for five years, and the grant is a combination of me actually doing a research study, but also ensuring that I get the training that I need to be a fully independent scientist who's kind of an expert in her field, so I've just started my last year of that grant and that research project seeks to build kind of from the ground up, a behavioral weight loss program for folks who are currently participating in cardiac rehab because a lot of people think, oh, we'll just tell cardiac rehab programs to also include weight loss. You would be shocked by how much they are jamming in into cardiac rehab. It's like seriously amazing of how efficient and comprehensive they are, and so adding in a whole other program is just not feasible. And so most people who are in cardiac rehab, they're making all these positive changes to diet, they are exercising regularly. On average, people lose 0 to 2% of their body weight while participating in cardiac rehab, and so that can be really demoralizing, as they're putting in so much time and effort, but not seeing the results they want. So the program that I'm developing is focused on using

something called the multi-phase optimization strategy, or MOST. It's just one framework for treatment optimization, but it's a really good one. And so I am doing an optimization design study, where I'm trying to develop a program for weight loss and cardiac rehab. Again, that includes all only components that are really effective and useful and that cuts out anything that's not really helping these folks. I'm really fortunate to work with Dr. Graham Thomas, who is a researcher at the Miriam [Hospital] and Brown [University], and he has developed, with Dr. Rena Wing, an online behavioral weight loss program that we've tested a bunch of times. We know it's really effective. It's a really wonderful program, so I've tailored that program to be a bit more appropriate and responsive for cardiac rehab patients. And then I'm testing four additional tools to see if adding them to this already-effective weight loss program, if it helps them lose even more weight. So these tools are things like access to virtual meetings with a clinician; a physical activity intervention where we give folks a Fitbit as well as online lessons and regular feedback; this virtual reality computer game that's about weight loss and a device that they wear on their wrist that helps them track eating; and if they're having trouble losing weight, we actually calculate a bite prescription. So how many bites about in a day they should be taking to help them lose weight and so that is one of the studies that I'm working on. Another study that I'm working on is kind of similar to the cardiac rehab study, but this is just meant for the general adult outpatient population. So we're also doing an optimization design to figure out what are the best add-ons again to that weight loss program that I mentioned and that is currently going on. It's really cool and we're seeing some really promising results so far. And then lastly, I'm also working again with my mentors, Dr. Graham Thomas and Dr. Rena Wing. I'm working with them on a statewide dissemination of that program that I mentioned, where we are actually working with different primary care offices to get the program in the hands of clinicians, and therefore into the hands of patients. That study, in my opinion, is really interesting because we're doing two tasks simultaneously. One is, we're asking a traditional scientific question. In this one it relates to the best way to help people maintain weight after they've lost it, but we're spending a considerable number of resources on also evaluating the real world implementation of this program, where we're focusing on: How do we actually get this to be sustainable? How do we make it work for offices that really serve different groups of patients? What are the clinicians saying that they need? And that's all because a lot of times, academics like me, we will develop these programs and then we're like, here you go, folks in the community. Congratulations! We did all this work for you. Surely it'll be perfect. And then we ghost them. And so really, what we're trying to focus on is, how do we actually get this to work in the long-term, in a sustainable way, where we're really listening to our stakeholders. So we're listening to the clinicians who would actually be giving it to people. We're listening to the overall professional, like the practice organizations that would be providing this to the clinicians to provide to the patient. And so it's been this really awesome partnership that I think is really exciting, and it really is the new frontier, and what the new focus needs to be in science. It's not enough for us to be just creating these interventions and just dropping them out of a plane and hoping it all works out. So it's it's been really fun.

A: The optimization designs that you've mentioned a few times, how would you compare that to the traditional, or I guess the "gold standard", randomized control trial?

G: So a lot of people who think that there's folks like me who are super into these optimization designs, they think that we hate the randomized control trial, and that's straight up lies. I love the randomized control child, my BFF. You know, best friends forever. The randomized control trial is typically a part of the optimization design, where the problem is, in science right now, we're using this research design, we're using the randomized control trial to answer questions the randomized control trial was never meant to answer. And so if you put garbage in, you're going to get garbage out. And that's what we're doing where we will test these treatments all together as a treatment package, and then at the end of the RCT, you just know how your treatment package worked in comparison to a control. And let's say it didn't work super well. You don't know what parts of it were working and what parts weren't. When you do an RCT, and it doesn't show, let's say that your treatment was superior to your control. You don't know what pieces of your treatment package were working well. You don't know which pieces of your treatment package were not working well. And you especially don't know if one piece of the treatment package had a negative effect on another piece, where if you just took out that one piece, that seems to be acting negatively on the other, if the whole thing would actually work. And so a lot of people would use all these different statistical techniques that try to get at that, but that's a really inefficient way of doing science. It's not super exact, and it's really still hard to tease all those effects apart. And so instead we can just put more work upfront to build the packages from the ground up to only include the pieces that work well and that serve that particular community where you might have a bunch of different components of an intervention that could work well, but maybe it's not feasible to deliver all of them. And for certain, you know, patient groups, you want to choose different combinations. These optimization designs, it's one way of getting it back, and it's really exciting. I really enjoyed doing it so far.

A: And so what are some of the long-term effects of these optimization designs?

G: So in terms of the long-term effects of optimization designs, I think we're going to be able to move science along much faster than if we're just relying on traditional pilot studies and randomized control trials because we've clearly shown that good interventions take a really, really, really long time to develop and even longer to get them to the patients that need them, if we're just relying on pilot studies and RCTs. So I'm really excited about what these designs could mean for science and society. And I think just the process of actually doing science will be more efficient in and of itself, which is sounds really fun.

A: It does sound fun! Shifting a little bit away from this, some of your research specifically involves geriatric patients who may be less comfortable with technology. How do you bridge that gap and make technology more accessible to them and easier to use for them?

G: So in working with older adults, I found that in general, the folks that I've worked with have been really, really excited to actually adopt technology, but they've been a bit apprehensive, and I think one of the main reasons that they said to me, and that we figured out together, is that the way that you may be trained a young adult on a new piece of technology should potentially be really different than the way that you train an older adult and someone who's

not familiar. And so by really adapting the training, and perhaps splitting it into a few different trainings, focusing just on the features that you need to show them and showing basic skills, like how do you swipe, how do you get to your home button? What if you have an iPhone that doesn't have a home button, how do you figure out how to get back to the main screen? If you focus on the building blocks of what they need to use the technology successfully, it works really well. Additionally, I have found that you want to really make the device useful to them in ways beyond just the actual intervention. So for example, I worked on a study quite a few years ago where we gave adults ages 45 to 90 iPhones, folks who didn't have them, and we asked them to use an app on there to track their medication adherence. I also would help them look at the weather. And maybe that was really helpful for just figuring out how to open an app and maybe I would program the different locations that their grandchildren lived in and that would allow them to figure out how to swipe between locations. And that was maybe a skill that they needed for the app, and it was just something that made them excited about the device itself and promoted engagement with the device overall. And so really, I found that older adults, provided you give them the skills and you're also mindful of what devices work for them. So for example, many older adults prefer tablets to phones because the print can be larger. And if, let's say their hand is unsteady for some reason, it can be a little bit easier to select what they're meaning to select on a tablet as opposed to a phone. But provided you're mindful of all of these things, I've generally found adoption and excitement for using technology to be quite high.

A: And so you found high adoption. What about adherence to technology?

G: Yeah, we also truthfully have found high adherence as well. I mean, I think that one of the main things that tech researchers need to keep in mind, in order to develop successful interventions, is you don't want to use tech just for the sake of tech. Just because you can put something on a phone doesn't mean you should. You know, by speaking of intervention, putting it into the digital space you want to be solving some sort of problem that a non-digital option was causing. And so when folks are mindful about that and really trying to solve issues and translating interventions to be delivered digitally, it tends to go really well, in my experience.

A: And so a final question for you, how do you hope research on digital help optimization will impact the field at-large, say 20 or 30 years from now.

G: I just really hope that we have more powerful programs. Programs that work well, perhaps even with less patient effort and take less time and are easy to do and to sustain for a long time. But I also hope that patients have equitable access to them because there are some facets right now of digital health that are inequitable. And same goes for just managing chronic conditions. So I'm curious to see the ways that technology might help scale those issues, and in general, I just hope that cardiovascular disease and other chronic conditions are more easily managed because they really affect the patient and the entire family tremendously and can be an incredible source of stress, and I'm just excited to see the ways that technology can help alleviate some of that stress.

A: Well, thank you so much for your time, Dr. Goldstein. I learned so much.

G: Thank you so much for having me. This was really fun.

A: To learn more about the Brown-Lifespan Center for Digital Health, check us out at [digitalhealth.med.brown.edu](https://digitalhealth.med.brown.edu). Don't forget to listen to our past episodes, available wherever you get your podcasts.

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