In our first podcast, Science Spotlight, we sat down with our Chief Scientific Officer Marie Onakomaiya to discuss the principles of behavioral science, why it's being leveraged in clinical trials, and how it can be used to drive instrument compliance and engagement among clinical trial participants.

Jenna Jordan: What is behavioral science? Do you mind sharing a little bit more about this topic?

Marie Onakomaiya: At a very high-level you can think of behavioral science as a study of human decision-making or choices. It really considers both social interactions and cognitive processes. As humans we have principal ways to represent costs or burdens and benefits of every action or situation, and our experiences of a situation as being positive or negative is rooted in the context or our perspective or the framing of that situation. Think about every interaction we have with each other or situations we are deciding or choosing; behavioral science really helps us understand the "when" and "why" we make these choices or why we engage in specific behaviors. And this is really related to things like motivation, social norms, our identity, and even habits that we have. At least, this is what behavioral science teaches us to guide people's choices.

It's not just one field, it's a diverse group of areas of study that include cognitive neuroscience and psychology and behavioral economics. And there are even aspects of the law and political science that relate to behavior that fall under the umbrella of behavioral science. I'll say at Datacubed, we really apply behavioral science to what people think of as choice architecture. So how do we design and guide people's choices, specifically in clinical studies? And how is our goal to reduce the perceived or actual costs of participation and create benefits? So through rewards and motivation, the activities they do and the context of their overall is a net positive.

Jenna Jordan: Thank you for giving a little bit more insight. I'd like to take this just one step further. Would you be able to share some of the various principles of behavioral science? Let's dig a little bit deeper into that.

Marie Onakomaiya: Absolutely. There's no way I think I could go into all of them because there are several. But I will say there are many practical examples of behavioral science principles at work, certainly, in the work we do at Datacubed, but even in general. And so a lot of what I'll focus on is motivation, and we do that by managing expectations and losses, and we also do that by rewarding progress. You think about things like reducing friction using the concept of defaults or also using technology to really operationalize these behavioral science principles like using defaults and avoiding negative surprises. And then another area when we think about motivation is building identity or what we call identity lock, which is really about being very participant centric through communication and making participation a social norm.

To dive into some specifics, I mentioned managing expectations and losses. And so there's this idea of the reference point, and also loss aversion. When you think about managing expectations and losses, it's really based on this idea that every experience we have, positive or negative, we experience it to our expectation or what behavioral scientists refer to as the reference point. This is really one of the most powerful insights of the last quarter-century of behavioral economics advancements. When you think about loss aversion, we know that we as human beings really find losses to be so much more painful than a gain or benefit of an equal amount. And so there's actually this famous paper by Botond Koszegi and Matthew Rabin that really gave a great example.

For example you have identical twins working identical jobs at the same corporation, and they have the same pay, but it's promotion and raises time. One twin expects a $20,000 raise while the other one expects a $5,000 raise. They both get a $10,000 raise. As you can imagine, the one who expected $5,000 is very happy and thanks their boss, while the one who expected $20,000 is extremely upset and actually quits the job. But look at that situation -- they both got the exact same raise, but the only difference was their expectation. One of them expected less and got more and experienced that as a gain, and the other one expected more, got less, and experienced that as a painful loss, and was very upset about it. So that's just one example.

I also mentioned defaults, and this is a concept that you can use to structure a choice to guide people to make the decision that you most want by making it the easier path. We think of these as opt-out scenarios and, in this way, you're maintaining this perception that you have a choice. In actuality, you do have a choice, but because we've made an easier path, the one we want you to take, it makes you more likely to take that path. People use this in everything from organ donation programs in a lot of European and South American countries to even retirement plans -- 401ks in the US that have automatic enrollment at a minimum level. There's twice as many signups for those who automatically participate than if it was an opt-in where you have to take an action in order to participate.

Jenna Jordan: Thanks for the examples. I know you briefly mentioned this when I asked about behavioral science, but where is behavioral science applied? You touched upon it a little bit, but I's like you to share more about this.

Marie Onakomaiya: I think the easy answer is everywhere every day. And I'd in the last 25 years or so, we've really seen an explosion in the application of behavioral science principles across different industries and sectors. You think about advertising or what people think of as business intelligence, everything from government policy and public health programs like behavior change programs. The whole goal is for everyone to understand that our choices are not necessarily made based on objectivity as much as how they're framed. So you have federal governments and even organizations like the UN really thinking about how we can use behavioral science to address big problems like global health crises or political crises, to drive policy decisions. And of course, trying to save money you know, or drive consumer engagement in different ways.

Jenna Jordan: Where is behavioral science applied specifically in the clinical trial and decentralized clinical trial space?

Marie Onakomaiya: I'll say this is an area that Datacubed has really led the way in many ways. Our application of behavioral science in clinical trials is really based on this idea on how can we keep participants engaged and motivated throughout a study by increasing the benefits of participating while decreasing the costs or burdens so that they're compliant and stay until the end of the study. And the whole goal of clinical trials is how can we collect good data -- complete data -- to help understand the impact of an intervention on patients. You think about the work that behavioral scientists have done to give us the strategies and tools to really do that and we can now apply that using technology in clinical trials. I know I talked about some of these principles, but they could really be readily applied in the clinical trial space.

Going back to that idea of managing expectations and losses, you can actually use that to motivate participants and reduce friction that are associated with things like lost time or lost money. If you think about a clinical trial specifically, you want to find where the costs or burdens lie in regard to participation and how you can reduce or eliminate them so that people then get

increased benefits of participation. And if you can't eliminate a cost, you can hide it in the reference point. Again, set expectations. If you want to give bad news, you want to give it all at once. Don't break it up.

An example I use that is hopefully relatable in a clinical trial context is someone is having a long wait at a clinic visit – possibly 30 minutes for the participant to see a provider. You want to set that expectation very high and say it's going take us 45 minutes before we can see you. Initially they'll be like, wow, this is bad news, I have a lot to do. Now they know it's going take 45 minutes but when you then come after 30 minutes and say, “We’re ready to see you,” they'll experience that as a net positive. If you think about airlines and the way they say, “Oh we're delayed for another 30 minutes.” And then it's an hour later and they're like, “It's going to take another 30 minutes,” You really want to avoid this sort of wrong reference point or expectation setting. And instead, if I told them, it would take 15 minutes and it took 30 minutes, they're going to be really upset because now it’s 15 minutes later, even though in both scenarios like those brothers, it took the same amount of time.

It really is all about the reference point. You start to think about these kinds of things in clinical trials, whether it's study visits, or how to better communicate with your participants and encourage them to stay in the study. I think about how you can motivate or reward them, not necessarily just with money, but with really treating them like your fellow researchers. So a conversation about motivation, especially in a clinical trial isn't complete without thinking about identity. And when I see identity, this is really a sort of intrinsic motivator so that when things are difficult to do, we find it very hard to not to do them because they are in line with identity. And part of that is because identity is connected to social norms. It’s very human to want to feel like you belong by meeting social expectations. So if you think about a clinical trial, if you can create a social norm of participation, being compliant, or completing your ePRO, you can actually help participants feel more like fellow researchers in your study and therefore, they are more likely to be compliant, and more likely to stay in the study to the end. And this is one of the things we really try to do through various elements of our platform as well.

Jenna Jordan: Where at Datacubed have we applied behavioral science when it comes to the clinical trial space?

Marie Onakomaiya: Of course. That's a perfect segue. You know, Datacubed was founded by a behavioral economist, Dr. Paul W. Glimcher, PH.D., who's our chairman and a professor at NYU. From the beginning, behavioral science has been at the core of everything that we do. It's integral to the design of different elements of our platform, and I'd say I'd probably go so far to say that we believe that using technology to corporate behavioral science in clinical trials really is the future of this space. And so because of that, we spend a lot of our time working on ways to improve participant experiences to really promote this idea of patient centricity in clinical trials using behavioral science. There's so many examples of how we do that. I mentioned, how can you create a social norm of participation?

One way we really encourage that is through communication. You want to share messages; you want to target information to really create that sense of community. You're also increasing the number of touchpoints between you and your participants so that they feel like they are engaged, and they feel like you recognize their contribution to the research study. This is something that we do a lot in our app. We work with different clients to help develop the content, how it's framed, how it's presented, so that it's easy to digest. We also encourage things like where and when you can integrate virtual visits and telemedicine, instead of making people take time off work, spend the money, get into a site.

Another thing is I know I've talked about motivation and reward but want to go deeper with this. This is an area that we really spend a lot of time on at Datacubed, and when we think about motivation and reward, it's really based on our understanding of reward learning, which is a type of reinforcement learning and it occurs at multiple time scales. And we've built into our platform short-, medium-, and long-term rewards. These are really based on how we know if you reward people immediately after they complete an activity - an ePRO study visit. This can release dopamine. Since you are immediately reinforcing that, doing this activity is a positive thing because you're rewarding them. And the more you do that, eventually that activity itself can be rewarding on its own.

Then we think about medium-term reward. This is thinking more like three days to a one- or two-week time scale, and this is a more cognitive sense reward. We're now going back to those earlier concepts of how you manage expectations and loss aversion by promising these shorter milestones that people need to reach to get rewarded. You're starting to reinforce their progress to the study. And then we think about long-term rewards because retention is so important. We want to make sure people get to the end of the study. We focus on the goal of getting to the end of the study and here we reward people with larger and or rarer rewards that are big enough and that motivates them to keep participating in order to get it.

And there are ways that you can even incorporate Identity or Identity Lock which is another concept of behavioral science to help participants feel like getting to that reward is in line with their identity and a positive thing that they want to do. And so all of these different ways that we've sort of tried to build in these concepts, into the elements of the platform, really help to drive compliance retention, and really this idea of patient centricity. I'll also say that clients ask us how this actually has impact. And so we ourselves are spending some time looking at the data, especially like a lot of user behavior metrics, which is how people interact with the app and what we find.

One question I get is how do older adults react to this app? Because our app does use a gamification approach to presenting these behavioral science elements. And we found that older adults, those in the 55 and older cohort spent the most time clicking on the avatars and using some of these more gamified elements four times a as much time on those than they did just on ePROs. So, they're actually spending time in the app that they don't need to, which suggests to us that they're having a positive experience within that context.

Jenna Jordan: I know we covered where behavioral science is applied specifically in the clinical trial space, and I know you just mentioned how Datacubed has applied it. When do you feel that behavioral science became more prevalent in the life science space specifically as it relates to clinical trials?

Marie Onakomaiya: I'll say it really is just emerging in this space. As I said, it's been 25 years sort of emerging in a lot of sectors. And I think finally in the clinical trial space, you're starting to see that we at Datacubed are pushing this forward, you're starting to hear more and more people talk about behavioral science at conferences and such. So I think we're in the moment.

Jenna Jordan: I love that we are in the moment of this all. Let's get into the "whys." Why is behavioral science so important in our space?

Marie Onakomaiya: I think that's a very relevant question. And I think the reason is that there are so many challenges with participant engagement in clinical trials and people are starting to

understand the impact of participant engagement on the success of your trial and a successful trial also means better return on your investment. So how do you find ways to address those challenges? We know participants generally feel like research subjects. I know earlier I talked about this idea of helping them feel like fellow researchers or partners in a study by building identity. This is a real challenge for a lot of clinical trials. I talked about communication and how we do that through the app. There are often very limited interactions with clinical trial participants outside of their study visits or when you need them to complete an instrument or an ePRO or something like that.

All of these things can really impact retention and every single participant you lose is a cost, not just to data integrity, but also to the actual cost, like the monetary cost of the trial. And I think finally there is this digital transformation that's happening in clinical trials right now. It's an opportunity to really not just add technology to how we conduct clinical trials, but do it in a way that actually enhances the participant experience while increasing the quality of data and the richness of the experience for both site sponsors, CROs, or whomever's involved - and definitely for participants, because we want to make sure that this change really takes us to a place where the same ways people interact and communicate in daily life are happening in the clinical trial as well.

Jenna Jordan: Why are life science companies beginning to see its value?

Marie Onakomaiya: You think about the impact of engagement, challenges on compliance on retention, and the cost of running a clinical trial. This can really delay or even decrease the data collection that's possible. That impacts their regulatory approval, their time to market. And regulators are so focused now even on the quality-of-life impact and patient centricity in clinical trials. Everyone's trying to think about how to decrease the burdens of the study. I think this increasing trend toward patient-centricity -- decreasing the burden of participation and the benefit of participation is part of the driver of why life sciences companies are really seeing the value of this movement. We're now starting to recognize how behavioral science can contribute to that because everyone understands the importance of the participant's voice being an integral part of what you're doing.

I'll say pretty much every client we've had over the last year talks about this. To some extent whether they are saying what they're hearing from participants and talking about the need for better communication and engagement with their participants, it's really encouraging how we can encourage participants to understand what this trial is about and why this trial is important and engage them better, so they're not dropping out and are more compliant. And I think Datacubed, having been founded on behavioral science at its core, is poised to lead the way in this space.