Transcript

00:00:00 Shelby Nielsen
Good afternoon and welcome. Thank you for joining us for today's webinar, What's Next in Traumatic Brain Injury Research. My name is Shelby Nielsen, and I serve as Assistant Director of Individual Giving and Engagement here at Kessler Foundation. On behalf of our entire team, I want to thank you, our supporters, colleagues, community partners, and everyone who shares our commitment to advancing research that improves the lives of people living with traumatic brain injury. At Kessler Foundation, we believe that meaningful progress in TBI research happens at the intersection of science, collaboration, and lived experience. Today's conversation is designed to give you a closer look at where the field is headed, how researchers are building on decades of discovery, embracing interdisciplinary approaches, and translating rigorous science into real -world impact. I'm honored to be joined by an exceptional group of researchers who are leading this work. Leading today's discussion is Dr. Nancy Cheverlotti, whose research tackles the cognitive and everyday challenges faced by traumatic brain injury.

00:01:02 Shelby Nielsen
And she's joined by Dr. Brian Sandroff and Dr. Silvana Costa, both advancing innovative brain injury research and practical rehabilitation at Kessler Foundation. We'll leave time for discussion towards the end of the program today, and we encourage you to engage, reflect, and ask questions in the Q &A section below as we go along. The recording, slides, and transcripts from this webinar today will be made available to all. An email will be sent in the following days, linking to our website's media center. Thank you again for being with us today and for your continued interest in advancing traumatic brain injury research. And with that, I am pleased to turn it over to Dr. Chevrolotti to begin our time together today.

00:01:48 Nancy Chiaravalloti
Good afternoon. Thank you, Shelby. I am really happy to be with you today, and I'm just going to share my screen. I'm going to be talking with you today about the traumatic brain injury research that we are conducting at Kessler Foundation. We are doing quite a bit of traumatic brain injury research and have some really interesting new work on the horizon that we're going to be telling you about today. So thanks for joining. So first, I want to tell you about, in general, the brain injury research that we do at Kessler Foundation. We have a great deal of research going on at the foundation, and that research spans several areas within traumatic brain injury. So we have work going on in cognitive functioning and cognitive rehabilitation, in sleep, and the impact of sleep or lack thereof on... daily life in traumatic brain injury. We have research ongoing in fatigue, which is one of the most common symptoms following traumatic brain injury and how that impacts daily life. We have work going on on reward processing and effort, on exercise and cognition, which Dr. Sandroff is going to tell you quite a bit about later, identifying neural mechanisms that underlie the traumatic brain injury itself, as well as functioning post -traumatic brain injury. We have work on cross -cultural considerations, barriers to healthcare access, caregiver burden and support, and also social cognition and social functioning. So we have a lot of work going on here, and we are going to be talking a bit about that today. But before we get started... Before we get into the specific lines of work, I want to talk a little bit about the intersection between neuropsychology, neuroscience, and traumatic brain injury, which is the intersection that we really focus on at Kessler Foundation. Neuroscience and neuropsychology interact to help us understand traumatic brain injury as well as other disease etiologies, as well as understand the challenges that individuals with traumatic brain injury face. TBI often leads to changes in behavior, including changes in thinking and learning abilities. Neuropsychology facilitates an understanding of

these things. So that is, neuropsychology focuses on behavior and thinking and why behavior and thinking are changing. Neuroscience, on the other hand, links these changes in behavior to brain function. So neuroscience helps us understand the changes in brain anatomy and function following TBI and how that relates to changes in thinking and behavior that we commonly observe. So all of that information taken together helps us develop effective treatments to facilitate improved quality of life and improved overall outcome.

00:04:54 Nancy Chiaravalloti
Much of the work that we do at Kessler Foundation is translational in nature. What that means is that we are conducting research and we are translating that into meaningful real -world outcomes. We really care about how people are functioning in their daily lives. People who have a history of traumatic brain injury often deal with unique challenges for years. They may have deficits in cognition. They may have difficulty maintaining employment. They may have challenges in emotional functioning. Some have difficulty socially relating to people and facilitating relationships. And then they can also have physical functioning challenges. What any one individual struggles with really depends on the individual as well as the injury itself. Years of research. has made efforts to understand these changes following TBI, and that research continues at Kessler Foundation as well as other locations. But what we really want to emphasize in our work is how these changes impact daily life. We do that through several mechanisms. We use self -report, and that's when we ask the person with a brain injury about what's going on in their own life. We use informant report where we ask similar questions to a close family member or a friend. And then we also use tests that are designed to address and understand functioning in everyday life that we may be able to do in our lab. But that everyday life part of how an individual is doing is really, really important. So in doing all of this work, we really value the partnerships that we have with individuals who have TBI as well as their families, and we call them our consumers. So I'll refer to the individuals with TBI and their families as consumers. Those partnerships help us guide our research. We have several mechanisms in place to help facilitate communication and consumer input, and those are depicted on the left side of your screen. Two of those mechanisms are our Consumer Advisory Board and our Consumer Consultants. The Consumer Advisory Board is a group of individuals with traumatic brain injury, family members, clinicians in the community, as well as advocates in the community. Our Consumer Advisory Board meets a few times a year, and they hear about our research progress and our future directions. They provide input. They share their opinions. They let us know what they think of the work we're doing. And they really add direction to the work that we are doing. They suggest areas of emphasis, and they may suggest alternate paths that we might pursue. We talk a lot with them about the challenges that they have in their daily life or challenges that they think need to be addressed through research. We listen to these thoughts and ideas, and we value them as they influence the direction of our work. So the consumer consultants are people with TBI or family members of someone with a TBI, and the consumer consultants work on specific projects with us and give us feedback on aspects of that specific project. So on the right side of the slide, you see dissemination tools and activities. These are regular activities that we engage in to facilitate communication with individuals with TBI and their families. So starting in the top left and moving clockwise, you see an image for Brainwaves. Brainwaves is our consumer newsletter. It's published three times a year in both PDF format and in print. And this is a way for us to reach out to our consumers, share our research, and discuss other topics that might be relevant to them. Next, we have free quarterly webinars called Brainstorm. These are consumer -focused webinars on various topics and with a variety of different speakers. Our next Brainstorm is actually coming up next Thursday if anyone is interested in joining us. On the bottom, you see an image depicting our consumer conference. That's the picture with several people sitting at a table. Our consumer

conference happens every other year at our West Orange facility. It is a great opportunity for us to interact with individuals with TBI and their families. The day includes several speakers and panelists to discuss topics in traumatic brain injury that are important to patients and caregivers. It's also an opportunity for us to spend time with consumers and their families. So this time helps us understand the community needs and how we might address these needs through our research. Our next consumer conference is actually coming up this year. It's on September 18th. So stay tuned for more information that will be coming out on that. The last image you see is of real life science. This is one of our newer consumer publications. And it is a publication through which we translate our scientific work into lay language. And this is so that non -scientists can read it and understand it easily. If you check our website, you'll find that all of these consumer publications and webinars are available there. And we have both current issues and past issues. So I really encourage you to jump on our website and take a look.

00:10:34 Nancy Chiaravalloti
A final point I just want to touch on before we talk about the actual research is how we get from identifying a problem to identifying new treatments and getting those out there. That's a complicated process that can take years, and it is depicted on this slide. So in the top square, you see the problem, the identified problem. That's where this starts. That's where the cycle starts. The problem could be identified by anyone, a clinician, a researcher, a caregiver, or a patient. And that's one of the reasons that we focus on maintaining the relationships with our patients and caregivers. Once the problem is identified, we brainstorm. We come up with different ideas, toss around different ideas, and how the problem might be able to be addressed. Once we have a possible solution, we design a pilot study. A pilot study is simply a small study where we look at the potential solution or the potential treatment in a small group of individuals. Sometimes it works, sometimes it doesn't. If it seems to work or it shows potential, We then design a larger study where we test the intervention in a very large group of participants. This is often done through federal funding because it can be very costly and it is also very time consuming. Once that larger study is complete, we publish our results and we share our findings. As soon as we can, we try to get our information out there as soon as possible. Because at that point, we move on to clinical implementation. We get it out into the rehabilitation facilities into clinicians, to clinicians in the community. And we do that as soon as we can so that people can start to benefit from this new treatment. So it's a complicated cycle. It takes a lot of time and it can be costly. But that's how we move our research generally from theory to clinical practice. So that is a general overview of the focus of the traumatic brain injury research at Kessler Foundation and some of the activities we engage in to facilitate communication with the community. Now we're going to move on to talk about some specific areas of research. And I'm going to start that off. But we've chosen three areas on which to focus our discussions. I'll start by talking about cognition and cognitive rehabilitation. Then I will pass the baton on to Dr. Sandroff, who will talk a little bit about some of the work he's doing in exercise and how exercise might be applied to the TBI population to facilitate better outcomes. Finally, Dr. Costa will talk a little bit about our groundbreaking work looking at eye movements and eye tracking and how we might apply that work to individuals with traumatic brain injury.

00:13:35 Nancy Chiaravalloti
So the first line of work we'd like to discuss is cognition and cognitive rehabilitation. This is the focus of my work, and I'm really happy to have the opportunity to tell you about it a little bit. So a first important question we always ask is, why do we study cognition and cognitive rehabilitation? Cognition makes us who we are. If you think about your life, It's cognition that allows us to create and maintain relationships, interact socially, pursue

educational activities, pursue work, and maintain an overall high quality of life. When cognition declines, engagement in all of these life activities could decline as well. And that has a significant impact on someone's everyday functioning and quality of life. So we really need to find ways to strengthen cognition in the face of brain injury or any illness that impacts the brain, as well as in healthy aging.

00:14:42 Nancy Chiaravalloti
With the importance of cognition in mind, I want to share three goals that we have in the line of work that addresses cognition and cognitive rehabilitation in TBI. First, we are always looking to further understand the complexity of cognitive deficits and the interaction between different types of cognition. Second, we want to develop and evaluate cognitive rehabilitation programs, and I am going to tell you a little bit about one of those programs in just a few minutes. And then the final goal I'm going to talk a little bit more about is understanding the impact of cognitive rehabilitation on everyday life. This is very important because improving a person's everyday life is the ultimate goal of any rehabilitation.

00:15:36 Nancy Chiaravalloti
So let's talk about our first goal, which is understanding cognitive challenges after TBI. There are several cognitive challenges that people may face after brain injury, and this again differs with the person as well as with the injury. But in general, we can potentially see deficits in these areas of cognition that I have written here on the right side of the screen. So different areas of cognition that could be impacted include attention, processing speed, working memory, executive functioning, and learning and memory. All of these cognitive domains interact, as depicted on the left side of the slide. So cognition is a complicated process, and all the different components of cognition interact to lead to how you're functioning in your everyday life.

00:16:31 Nancy Chiaravalloti
The research we're talking about today focuses on learning and memory. But keep in mind that all of the other areas of cognition will impact memory. Memory is depicted in the small purple box in the middle of the figure. And all of those other areas of cognition impact learning and memory. So you see arrows going to and from all of those other areas. So in addition, the deficits in the other areas of cognition also impact a person's ability. to benefit from memory rehabilitation. So we have several studies we've conducted where we've demonstrated that deficits in other areas of cognition, such as working memory and processing speed, clearly impact a person's ability to benefit from a treatment specifically for learning and memory deficits.

00:17:26 Nancy Chiaravalloti
With our focus today being on memory, I want to tell you a little bit about a memory rehabilitation program developed at Kessler Foundation, the Kessler Foundation Modified Story Memory Technique. This is a computer -mediated cognitive rehabilitation program that teaches the use of two strategies to strengthen memory, context and imagery. It teaches those two strategies in anywhere between 10 and 16 sessions, depending on the person, and the treatment goals. And we have several publications that exist showing that this program works in several populations, including TBI. We've shown efficacy on three different types of outcome measures, paper and pencil tests of memory, tests of memory in daily life, as well as functional neuroimaging. So we're showing changes in how the brain is actually processing and remembering information following treatment. The program also has many versions. It can be administered in person, and that's how it was originally developed, but it can also

be administered remotely. It is or will soon be available in several languages. There is a version that was developed specifically for children with traumatic brain injury, and there's also a version that can be administered in a group setting. In addition, a supplemental program is in development. And this includes a caregiver module so caregivers or significant others can understand what strategies their loved one is learning in treatment. And this supplement also includes a tabletop game that individuals can play at home with their caregiver, which will enable them to practice the strategies they're learning in treatment at home in a more relaxed setting through a fun and interactive game.

00:19:22 Nancy Chiaravalloti
Final goal I mentioned, and one thing that has been thread throughout the conversation so far, is understanding the impact of cognitive rehabilitation on everyday life. As I mentioned earlier, the impact of any treatment on daily life is very important. Neuroscientists and neuropsychologists want to understand how a given cognitive rehabilitation program impacts memory performance. And that memory performance is typically done in a quiet testing room on a standard memory test. But as you can imagine, daily life is very, very different. And what people with brain injury and their families care about and what insurance companies care about as well are how treatments improve everyday life. So that's what we really need to do is understand the impact of all of our treatments on everyday life and identify what programs really improve daily life. So on this slide, you see a graph that shows that a treatment, the story memory technique, is effective in improving daily life in persons with MS. So everyday life cognition improves in that population. However, we do not see this impact on daily life in our traumatic brain injury data, which is our goal. We see robust changes in... how a person functions in that quiet office setting without distractions, but we're not seeing how they're improving in their everyday life. And that brings us to our next goal. Our next topic is how we maximize the impact of our cognitive rehabilitation work on everyday life. So in order to do that, we're pursuing new and innovative designs for treatment. We are combining forces across disciplines and across approaches to maximize outcome following cognitive rehabilitation. Some of our current work combines cognitive rehabilitation with exercise, which Dr. Sandroff is going to talk more about in a few minutes. In the future, we plan to combine cognitive rehabilitation with brain stimulation, which is pictured in the bottom left. Finally, on the bottom right, you see neuroimaging pictured. Much of our work seeks to understand the impact of cognitive rehabilitation on functional neuroimaging, which we accomplish through this cross -disciplinary work with neuroscientists at the foundation. So the combination of various different types of expertise to new and innovative approaches helps us address the challenges individuals with TBI face in their daily life. So with that, I'm going to turn it over to Dr. Sandroff to tell you a little bit about how exercise may be used in rehabilitation and future directions of this work in traumatic brain injury.

00:22:29 Brian Sandroff
Thank you. Well, it's a pleasure to be here today. So after hearing from Dr. Ciaravillotti, you may be wondering, why would exercise, a physical behavior, potentially be considered as an approach to improve cognition and or brain health in people with neurological disorders. So the plan for today is to take the next few minutes and share what we've done at Kessler Foundation to support such a consideration. But first, quick history lesson on our field of exercise and cognition. So our field isn't ancient. It's only been around for about 60 years and began with the very first fitness influencers, like our friend Jack Mullane, shown to the right, who loved to preach about the importance of having a healthy body, which includes having a healthy mind. And that message inspired the first research in this field to come out in the 1970s, where studies demonstrated that trained individuals may

have physiologically younger nervous systems based on better cognitive performance relative to sedentary individuals. So once that research came out, the field began to shift focus a little bit and started to really hone in on whether or not engaging in more physical activity or in a structured exercise program could actually improve cognitive performance in sedentary older adults to help combat age -related cognitive slowing. And here is really where our field became famous for the very first time in the late 90s and early 2000s, where for the very first time, exercise research began to be published in the top scientific journals in the world. Who would have thunk it? We were famous. Well, that's what we thought until we really became famous when those results began to become picked up by Saturday Night Live, specifically in the weekend update segment in the year 2000. where anchor Tina Fey announced to the world, a recent study published in the journal Nature reported that exercise improves cognition in older adults. And she stared directly into the camera and deadpanned, well, there are some exceptions to the rule, while flashing a picture of then -President George W. Bush running. But fast forward 25 years to the present day. There have been thousands of studies that have been published on the cognitive benefits associated with exercise training in older adults. And we know that from these thousands of trials that these cognitive improvements don't just occur in one domain of cognition. They occur across many different domains of cognition. We also know from these thousands of trials that these cognitive improvements aren't just improvements on tests that take place in quiet environments like Dr. Chiara Ovalade was just talking about. But instead, the cognitive improvements stem from actual changes that occur in the brain. We also know that this doesn't just apply to healthy older adults. It applies to older adults with pathology, including older adults with mild cognitive impairment and Alzheimer's disease. We know that the cognitive benefits aren't just limited to one type of exercise. In fact, many studies report improvements with aerobic exercise, with strength training, and combinatory training. And the final thing that we know from this abundance of evidence is that engaging in more exercise tends to be better for cognitive and brain health relative to engaging in less exercise. Based on the abundance of evidence in older adults, there's certainly a strong rationale to consider exercise as a promising approach to improve cognition and brain health in those with neurological disorders. And this has been the primary focus of our research over the past 17 years. And we started by focusing on multiple sclerosis as one such neurological disorder that presents with cognitive impairment as a major feature of the disease. And just like... the evolution of the field in older adults, we had to start from the ground up. So before we got into the game as a group in 2009, there were two randomized control trials that examined the effects of exercise on cognition in people with MS. Those studies evaluated the effects of largely unsupervised aerobic exercise and yoga. And then the second study involved the effects of largely unsupervised combined aerobic and strength training on cognitive outcomes in people with MS. And unsurprisingly, neither intervention resulted in significant improvements in cognition, which is... wildly inconsistent with the wealth of evidence I just presented to you in older adults. So at the time, we looked very closely at these two existing studies and identified several methodological concerns that may have explained the null results in persons with MS. Specifically, both studies involved largely unsupervised exercise that occurred at an intensity that was lower than what's typically prescribed in older adults. In addition, neither study recruited cognitively impaired people with MS as those who presented with the problem that's actually being studied. And finally, neither exercise program was really designed with the primary intent of improving cognition. Rather, they were just general exercise programs that weren't specifically designed for that purpose. So based on those concerns, we thought it may be a good idea to go back to the drawing board to see if we can better evaluate the effects of exercise for improving cognition and brain health in MS as a first step. So to do this, we created something that we like to call the systematic research roadmap, which starts with a very important question. That question is what's most likely to work? And our research here ad-

dressed the development of an optimal exercise prescription. to eventually be included in an intervention within a clinical trial down the line. And our research here could be considered stage zero research consistent with the NIH stage model of behavioral intervention development. So once we first identify what's most likely to work in our roadmap, well... Then we have to test it and see if it actually works under tightly controlled laboratory settings, which is in -person exercise, where research here would examine the effects of an exercise intervention over, say, three or four months on cognitive and brain health outcomes, again, in person. And this would encompass stage one or stage two research. So once we've identified something that's most likely to work. and then it actually works in the lab, well, then we have to dig to the streets and see if it works in the real world. Or here we would test and optimize our exercise interventions under home and community -based settings as we're really interested in benefits for the entire population. And research here would be considered stage three, stage four, or stage five. So within our roadmap, if we first have evidence that something's likely to work, Then we test it in the lab and it works. And then we test it in the real world and it works. Well, then we are well on our way towards our overall goal, which is to provide comprehensive evidence to develop exercise -specific guidelines for improving cognition and brain health in persons with neurological disorders. So now let's transition to what we've actually done here at Kessler Foundation within our Systematic Research Roadmap NMS first. So again, our roadmap began with asking what is most likely to work. And this process took about 15 years of research. So now I'm going to take the next 60 seconds to describe 15 years worth of research. Sounds pretty tough. I hope I do an okay, John. But when we're trying to identify something that's most likely to work in this particular context, what we wanted to do is design two different types of studies. The first type of study is where we identified relationships among engaging in more physical activity and having higher physical fitness with having better cognitive performance in MS. And a bunch of studies that we did here did demonstrate such relationships. We also discovered as part of this process that a single bout of exercise, which is called acute exercise, results in small cognitive improvements and actual changes in the brain itself among persons with MS. So collectively, this what is most likely to work research identified that aerobic walking exercise represents a stimulus that we think is most likely to improve cognitive processing speed, which is the most common cognitive problem in MS in certain groups of people with multiple sclerosis. So once we identified what is most likely to work, well, then we actually tested it in three different randomized controlled trials under tightly controlled laboratory supervised settings. And we replicated the same result three different times. And that result is that 12 weeks of aerobic treadmill walking exercise training resulted in improvements in cognitive processing speed, as well as improvements in thalamic MRI outcomes in different MS samples. and relative to different control conditions. So putting the evidence together, we think that our program does actually work in person. But around 2020, we decided that it may be a good idea to translate our supervised in -person program. into a remotely delivered and supported aerobic walking exercise training intervention. And the reason why we did that had a lot to do with the COVID -19 pandemic. As all the barriers associated with COVID caused people, not just with MS, but anybody, to learn how to do things virtually, to learn how to do things more efficiently. I think we're on a webinar right now instead of coming for an in -person lecture series, right? This has been a very real world phenomenon. So when we did translate our program into a remotely delivered version, we performed two different trials in the last couple of years. The first trial reported that four months of remotely delivered and supported aerobic walking exercise training improved cognition in people with MS who were pre -screened for having MS -related cognitive problems. The second trial, which we very recently published, is even more exciting. where doing this remotely delivered and supported aerobic walking exercise training intervention was feasible for a year in people with MS who were cognitively impaired. And that program resulted in cognitive improvements. And perhaps more

excitingly, didn't, sorry, it resulted in no changes in thalamic volume. And first you think no changes, that's bad. But thalamic atrophy is a very real feature of MS that is considered a nature biomarker for MS -related neurodegeneration. And these results have led us to have a bit of a foundation to, for the very first time, examine exercise as a potentially disease -modifying behavior in people with MS. So, slowly but surely, since 2010, we've been advancing... towards our overall goal, which is to provide that comprehensive evidence towards generating guidelines. But we're not quite there yet, as our next steps involve scaling up the research quite a bit, as we now need to perform very large -scale clinical trials, again, usually dependent upon federal funding, to evaluate questions like focusing on efficacy, effectiveness, and even implementation, where our remote program may be able to be delivered through MS clinics. But that's just the tip of the iceberg. Another very, very important extension of our research involves performing this systematic research roadmap in people with TBI, as our model, looking up top, is disease agnostic. And I'm happy to share today that we have been doing some research in those with brain injury. Importantly, our recently completed, our ongoing, and our upcoming research has addressed all three pillars of our systematic research roadmap. In terms of what's most likely to work, my colleague Carly Wender recently completed some studies that suggest that aerobic cycling exercise, perhaps even when boosted with virtual reality technology, represents a very likely approach to improve cognition in people with TBI. In terms of what actually works. As Dr. Ciarolotti alluded to earlier, we have an ongoing study that's been funded by NIDILRR that examines aerobic cycling exercise as a complement to boost the benefits of cognitive rehabilitation in individuals with traumatic brain injury on cognitive outcomes and brain health outcomes as well. And very excitingly, recruitment for our very first real -world remote exercise study to examine the effects of walking exercise on cognition in people with TBI begins on Monday of all days. So we're very, very enthusiastic about how this research will evolve in those with TBI. And the last point of today's presentation is that our systematic research approach is highly collaborative, which is why you may have noticed that I didn't use the words I, me, or my very much in this presentation. Instead, the word we is far more appropriate as our research is very team science oriented. As you can see with this map. Our collaborative research network is pretty comprehensive as we've been able to identify 144 unique individuals that include 19 different mentees across North America, Europe, and beyond that are committed towards advancing our cause of using exercise as an approach to improve cognition and brain health in those with neurological disorders. And although our group at Kessler is leading the way shown in that green triangle, it really is this collaborative network that has allowed us to really push the envelope going forward. And we're excited to continue to collaborate in the coming years. So with that, I will pause and pass the baton to Dr. Costa.

00:36:34 Silvana Lopes Costa
This is an eye tracker. It is a non -invasive technology that basically uses two cameras to record eye movements while participants are doing tasks and games on a computer. The beauty of the system is that it's completely portable and we can use it in different settings.

00:36:53 Silvana Lopes Costa
of the system is that it's completely portable and we can use it in different settings. Like one of our recent studies, we were doing evaluations with the eye tracker at the hospital while individuals were still in patients. And so here you can see a participant looking at a screen and then our researcher taking control and looking at what's going on with the eyes and also the presentation of information. Shelby, can you move, please? So this is one of the examples of what we are doing with eye tracker technology. So this is... that we measure processing speed. And

we know that processing speed, and especially this task, is very sensitive to brain injury and also development of brain disorders. So our question was, okay, so we know that this task is sensitive, but why is it sensitive to...

00:38:03 Silvana Lopes Costa
brain impairment. So with the eye tracker, we are looking at what happens when the participants are doing the task. So these, we have three participants. One participant is a healthy control. One participant is a person with MS without crossing speed deficits. And the other person is a person with MS and also crossing speed deficits. So in each of the three figures, you can see that there's two little points. Those two little points are the eyes, the left and the right eye. Shelby, can you click each figure, please?

00:38:44 Silvana Lopes Costa
So as you can see with an eye tracker, we don't have only the responses to this task, but also we have the ability to see the process and analyze how participants are doing the tasks. So, so far we learned that individuals who struggle to complete these tasks in a fast time, they are looking and they are spending more time to analyze each visual stimulus. They are also the ones who are going backwards to the key for longer. And I apologize, I forgot to explain how these tasks...

00:39:28 Silvana Lopes Costa
is executed. So on top of the screen, you have keys and letters, and on the bottom, you have only the symbols. And we ask the participants to call out the numbers as fast as they can. So what we're learning with the eye tracker is that the pattern of performance of the task is different for those who are able to execute the task in fast times versus those who need more time to do it. And this will allow us to develop more focused cognitive rehabilitations for the future.

00:40:00 Silvana Lopes Costa
for the future. Can we go to the next slide?

00:40:09 Silvana Lopes Costa
So in this study, we are using the eye tracker as a human -computer interface. So one of the problems that we have in neurological populations is a lot of times upper limb function can be compromised. For example, due to a stroke, traumatic spinal cord injury, and sometimes even due accidents. So we are using the eye tracker as a human computer interface to assess cognition. So instead of the participant doing the task using their hands, doing clicking the computer or writing, we're just using the eyes. The participant look. where they want their response to be, and the eye tracker captures the response. So for example, on the left side,

00:40:57 Silvana Lopes Costa
thank you, on these tasks, we ask people to look for the number three. So every time they look for the number three for two seconds, the computer registers as their response. On the right, in these tasks, we ask participants to do towers. So the original test, people have to move the desks along the pegs. With the eye tracker, we ask participants to look for two seconds for the desk that they want to move, and then the desk moves to wherever the participants wants the peg to move.

00:41:36 Silvana Lopes Costa
peg to move. Next slide. So one of the things that we know that it's very sensitive to traumatic brain injury and concussion, it's the ability to move their eyes. So doing very simple tasks that we normally don't even think about. How to go to look up and right, up and down, left and right, and also doing circles. So in one study, we looked at using eye tracker to assess... Presence of traumatic brain injury and traumatic spinal cord injury. So traumatic spinal cord injury, there's often traumatic concomitant traumatic brain injury. Think about a car accident. The results in a traumatic SCI, but it often results also in a traumatic brain injury. However, because the traumatic SCI is the... life -threatening situations. A lot of times the traumatic brain injury goes undetected. So we are looking if we can use the eye movements in this population as a sensitive biomarker to diagnose traumatic brain injury. So, Charlie, can you click on the six videos, please? So on the bottom, you can see what the examiner sees. So you will see the eye of the participant and also

00:43:05 Silvana Lopes Costa
how the participant is doing the task. On the top, you just see what the participant sees. So the left, all the way on the left, it was just going moving left to right. And on the middle, it was up and down. And then the right, it was doing the circular. So our pilot data, can you move to the next slide, please?

00:43:34 Silvana Lopes Costa
So our pilot data was showed is that, so as we expected, individuals without any brain injury, when going up and down, that is the first two lines, left and right, and also, and then on the bottom, the elliptical, you can see that it's like a very small line. There's very little variability. Again, click. For those with traumatic SCI without traumatic brain injury, we can see that it's like very close to the healthy control, but with some little variability.

00:44:12 Silvana Lopes Costa
Next. And now we can see a person with traumatic brain injury with traumatic SCI. You can see that the lines are like, if we look at the vertical lines, instead of being like this, instead of being like a clear line, they are almost...

00:44:31 Silvana Lopes Costa
And this is a very common in traumatic brain injury. So it looks like our pilot data is going, is showing that eye tracker can be sensitive to the presence of traumatic brain injury and traumatic ACI. But this is just pilot data and more studies needs to be conducted. And that's it. And thank you so much for your attention.

00:45:01 Shelby Nielsen
Wonderful. Thank you, everybody, for speaking with us today about traumatic brain injury and the cross -collaborization of it all. want to encourage everybody to go ahead and put some questions in the chat if you have any um i'm just going to pull up one more screen um that includes the registration details that dr chevril already mentioned before for our upcoming spring brainstorm which is this april 2nd um which is this thursday um get this screen shared for everybody And then in addition, so there's a QR code here that you're more than welcome to scan. And then in addition, wanted to link to our community resources. This, Dr. Sheverlati and the team have developed. quite a number of resources, not just the dissemination tools that she highlighted in her presentation, but also just a number of other really helpful resources. So you can go ahead and scan the QR codes here on this screen. I'm going to leave this up for a little bit and highly encourage folks to take a peek while I go and grab our

Q &As here.

00:46:15 Shelby Nielsen
Our first question is about location. So Carol Russell asks, Dr. Chevroletti, the research you conduct at other locations, does this happen at universities? Could we as a university learn about getting involved?

00:46:34 Nancy Chiaravalloti
So traumatic brain injury research is being conducted all over the country at a number of different universities. And the best way for you to find out if it is being conducted at a university or rehabilitation center near you would be to jump on their website and see if they advertise the work that's being done. One of our larger research grants is our TBI model system grant, which is a network of centers across the country. So I know of definite research in major medical centers, in 16 major medical centers across the country. You could also reach out to us if you drop one of us an email or reach out to Shelby. She can pass it on. And I can also let you know of anything I know going on that's going on in your area. I'm happy to do that.

00:47:28 Shelby Nielsen
Research studies at KesslerFoundation .org is a wonderful resource. Our research recruitment team can help answer any questions that you may have about participating specifically, or they're a wonderful resource to help connect us with the different researchers across the institution. There's many ways to get involved. Even if you go to KesslerFoundation .org, we have a little tab that says get involved. So even if you just find that, we will get in contact with you, Carol. That was a great question. Thank you.

00:48:00 Nancy Chiaravalloti
I also just want to mention that many of our studies, we're trying to do many of our studies remotely, which does allow you to participate from across the country. So check out our website for remote studies that we may have because you could also participate in those. And Dr. Sandroff actually mentioned one that's just starting in exercise and brain injury. So definitely check that out as well.

00:48:22 Shelby Nielsen
Very, very good point, Dr. Chevrolet. We have more of a specific question here, which is from Grace. Are concussions considered a traumatic brain injury? I've been diagnosed with a post -concussion syndrome and have received conflicting information.

00:48:39 Nancy Chiaravalloti
Concussions are a mild traumatic brain injury, yes. So traumatic brain injury is graded into mild, moderate, and severe. And concussions are mild traumatic brain injuries. Typically, after concussion, within about two weeks, people are back to normal. But there are instances where the concussion, post -concussive... Post -concussive symptoms can stick around for quite some time. There are, in many major medical centers, concussion clinics, and I would suggest that you try to find one near you and try to get evaluated at a concussion clinic to see if they can help you with your symptoms.

00:49:25 Shelby Nielsen
And then we do have another somewhat... Specific question is, this person's TBI is DAI. As such, their memory issues don't appear to be improving. Do you believe that there is any opportunity for improved memory?

00:49:44 Nancy Chiaravalloti
So DAI refers to diffuse axonal injury. And what that means is in... The way the brain is composed, you have white matter, which is the areas of the brain that facilitate communication. And then those are networks. So if you think about an electrical, electrical lines, that's kind of what that looks like. And when the brain moves either front to back or back and forth, those networks twist and move back and forth and they could tear. So that's what DAI is. And DAI does come with cognitive symptoms, and it can sometimes be traumatic brain injury in general. It can be difficult to treat and difficult to treat the symptoms that stick around for a while. And in DAI in particular, that can be the case. cognitive rehabilitation, I would suggest that you continue to pursue cognitive rehabilitation. We have included folks with DAI and we continue to in our research because it is amenable to treatment, but it's a matter of finding the right treatment that can help you the best. Great.

00:51:01 Shelby Nielsen
Going through.

00:51:12 Shelby Nielsen
So we have one, it looks like one more question. What information do you have regarding gamma waves and glial cell coordination related to Alzheimer's stroke? Are there any studies?

00:51:24 Nancy Chiaravalloti
Probably best handled by me as well. There are not studies at Kessler Foundation. I don't actually know where they are doing that research. If you're in New Jersey, I would suggest that you check out Rutgers University. They have a Center for Alzheimer's Disease and Dementia that has a number that's more basic science research. We do more translational research. And Rutgers University has a number of basic science researchers that are looking into this, and they have their newly developed Alzheimer's Disease Research Center. So that's a really good place to look.

00:52:04 Shelby Nielsen
And it looks like we have one last question, which is, are we aware of any studies focused on cranial nerve damage from traumatic brain injury?

00:52:16 Nancy Chiaravalloti
That research, again, is not being conducted here. And honestly, I don't know who is doing that research right now.

00:52:28 Nancy Chiaravalloti
I don't know the answer to that question. Again, I would send you to some of the major medical centers near you because that would involve very advanced imaging techniques and that would be more likely to happen at a

major medical center where they have several high -intensity scanners. There's another question. I've developed a therapeutic. board game after sustaining a TBI and having a great rehab. It has been tested and used for 2 .5 years. I'd like to discuss the usefulness of it in research and for families who support patients. Please send us your email and we are open to talk about it, of course.

00:53:17 Shelby Nielsen
Yes. And then there is a few questions about getting access to the recording and the slides. There'll be an email sent out in the coming days to all registrants. It will link to the media page on KesslerFoundation .org. So not only registrants to this webinar will receive it, but anybody who has access to the internet can find this recording. I have someone dropped their email in the chat box. I have that copied here. I want to say thank you again to everybody for joining us. It was a great conversation. I think we look forward to continuing these conversations. There'll be additional webinars like this throughout the course of the year connecting to the other condition areas that we focus on here at Kessler Foundation. So stay tuned via email. Don't forget to follow us on socials to stay updated on the latest research and findings. And if you have any questions, please don't hesitate to reach out. You can reply back to our emails that we sent and we will get back to you. everybody have a wonderful, beautiful day. I have some emails here I'm seeing. Thank you, everybody, for dropping your information down in the Q &A. We will talk very soon.