30| The NIH Toolbox – With Dr. Julie Hook

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NAVIGATING NEUROPSYCHOLOGY

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Speakers: Julie Hook, Ryan Van Patten, John Bellone

Intro Music 00:00

Ryan Van Patten 00:17
Welcome, everyone, to Navigating Neuropsychology: A voyage into the depths of the brain and behavior. I'm Ryan Van Patten...

John Bellone 00:24
...and I'm John Bellone. Today we are talking about the National Institute of Health Toolbox, the NIH toolbox, which is a royalty-free battery of tests designed to measure cognitive, sensory, motor, and emotional functioning. The core battery can

be administered in about two hours and over 250 researchers from 80 different institutions contributed to the scientific and psychometric development of this measure. It was normed on people from age 3 to age 85. It's available in both Spanish and English and more to come. We're going to focus primarily on the cognition and emotion batteries, because these are obviously the most relevant to neuropsychologists.

Ryan Van Patten 01:07

A major strength of the NIH Toolbox is that many of the measures were designed using item response theory, or IRT. I'm going to spend just a couple minutes giving a quick background of IRT because it's so important and relevant. There's a lot of complex math involved in the technique itself, but I'm simply going to hit a few high conceptual points here. IRT is often compared to classical test theory, where the latter focuses on analyses of an entire test and the former investigates constructs at the item level. One way IRT is described is that each item is measuring the examinee's degree or amount of a construct of interest, such as reading ability, depression, episodic memory, or whatever else you're measuring. With classical test theory, statistical results apply only to the sample at hand while an IRT model parameters are invariant, meaning that they don't depend on a particular sample. This allows us to compare different scales measuring the same construct. It allows us to compare different examinees who completed different items, and facilitates computerized adaptive testing, or CAT. CAT is more efficient than full length tests without the loss of accuracy or precision. In other words, you could administer fewer items and still have the same psychometric properties as a measure where there are more items, that's clearly a major strength.

John Bellone 02:47

Everyone who's taken the GRE, the Graduate Record Examination, has been exposed to this basically. The CAT, the computerized adaptive testing, means that you might be given a test item and based on how you do on that, if you get it correctly or incorrectly, then there might be a different item that you're given versus if you had gotten that correct, for example.

Ryan Van Patten 03:07

Right. Depending on your performance on the first item, it administers the next most appropriate item, easier or harder, and you go from there. So it's a way to skip items at a difficulty level that are not appropriate for that particular examinee. In a moment, we're going to go through some of the tests in the NIH Toolbox. I do want to provide a caveat about IRT. Whereas self report measures can definitely be

designed with the IRT method, when we talk about neuropsychological tests, which are obviously very relevant to us at NavNeuro, we know that there are many different kinds of neuropsych or cognitive tests and only some of them are amenable to IRT. So keep this in mind during our discussion with Julie. When we get there, we'll let you know which of the cognitive tests in the toolbox were designed using IRT.

John Bellone 04:02

Yeah, and hopefully, people don't get scared. We're not going to talk a whole lot about statistics in this episode. We're going to give a very high level perspective of the NIH Toolbox. But it's good just to know up front the item response theory and computerized adaptive testing, just the theoretical overview before we get into the weeds.

Ryan Van Patten 04:23

Is some of your math anxiety coming out, John?

John Bellone 04:26

Well, you were scaring people away, I think. [laughs]

Ryan Van Patten 04:29

I think our listeners, I don't think you're giving them enough credit. I think this is your own insecurity coming out actually.

John Bellone 04:33

Fair enough. [laughs]

Ryan Van Patten 04:33

[laughs]

John Bellone 04:35

There are seven tests of cognition in the Toolbox, which takes about 30 minutes or so to complete. I'll just talk through the different tests. So picture vocabulary is one of them that measures receptive vocabulary and it uses IRT. There's a flanker task, which measures inhibitory control and attention. List sorting, measuring working memory. There's a dimensional change card sort which measures cognitive flexibility similar to the Wisconsin Card Sorting test. There's a pattern comparison test, which measures processing speed using visual stimuli. A picture sequence

memory test, which measures episodic memory using sets of pictured activities. And there's an oral reading recognition test, which measures oral decoding using letter names and words. And just so people know, many of these tests are demoed on the NIH Toolbox's website and we'll include a link to those in case you're interested in seeing the exact test that we're talking about.

Ryan Van Patten 05:41

Yeah, the oral reading recognition is the second of the cognitive tests that was designed with IRT. So it's just the picture vocabulary and oral reading recognition. In our conversation with Julie, we don't make that distinction so we wanted to do it upfront so everyone knows.

John Bellone 05:55

Yeah, and there's also a motor battery that includes five tests and measures someone's overall physical health - their ability to complete activities of daily living and health status as well. The tests capture muscle strength, balance, object manipulation, walking speed, stamina. There's a nine hole pegboard. There's grip strength. Standing balance. A four meter walk gait speed test. And then a two minute walk endurance test.

Ryan Van Patten 06:25

Right. And so, obviously, neuropsychologists won't always be using the motor battery, but we know that we sometimes use motor tests such as groove pegboard or finger tapping or grip strength in our batteries. So this motor battery from the Toolbox would allow a neuropsychologist to add those types of tests and measure those abilities as well.

John Bellone 06:46

Yeah, and similarly, there's a sensation battery that measures pain and smell, sight hearing, taste, which we might administer some of those, but not routinely, most likely.

Ryan Van Patten 06:57

Right. The other battery within the larger Toolbox that is very relevant to us is the emotion battery. These are all self-report measures, as you would imagine. The four subdomains within the emotion battery are negative affect, psychological well being, perceived stress and self efficacy, and social relationships. Each of those subdomains has scales within it. So, just as one example, the negative affect

subdomain includes anger, fear, and sadness. You can look on the NIH Toolbox website for the rest of the subscales. John, why don't you introduce Julie?

John Bellone 07:40
Yeah, so we talked to Julie Hook. She's a board certified neuropsychologist. She also has her MBA interestingly, and we talked to her about that at the very end of the episode. She is a research associate professor. She's the product manager at the NIH Toolbox, which is why we talked to her about these tests. She's at Northwestern University. So without further ado, we give you Julie Hook.

Transition Music 08:05

John Bellone 08:14
Okay, well, we're here with Julie. Thanks so much for coming on the podcast.

Julie Hook 08:17
Well, thank you for having me. I appreciate it.

John Bellone 08:19
Can you briefly describe the history of the Toolbox, including the Blueprint for neuroscience? How did it come about to begin with?

Julie Hook 08:26
So the NIH Toolbox, excuse me, the NIH Blueprint was established in 2004. It was a collaborative framework, comprised of 15 institutes, centers and offices. It was really meant to support research on the nervous system. A primary goal of the NIH Blueprint was to create research tools or resources that could benefit the neuroscience community and could be potentially too burdensome for one single institute or investigator to really develop alone. One of the things that was identified was this need to establish a set of standardized assessments that could be used to allow for comparisons of neurobehavioral data across studies and integration from multiple sites. My boss, Dr. Richard Gershon, in 2006, was charged with creating these assessments and worked with a team of over 250 scientists from 80 institutions to develop state of the art assessments in four domains that was cognition, emotion, motor and sensation.

John Bellone 09:35

Awesome. Sounds good. Awesome goal. What's your responsibility? What is the history of your work with the Toolbox? How did you become involved in your position now?

Julie Hook 09:45

I started at Northwestern about two years ago. I'm a research associate professor in the department of Medical Social Sciences, and I'm also the product manager for the NIH Toolbox. So I work on research grants, but I also oversee the distribution of the NIH Toolbox. So if you were interested in translations or training, those would be the types of things that I would help set up or oversee. One of my main things that I work with Dr. Gerson on is looking for the overall strategy of the Toolbox. So keeping the NIH Toolbox current and usable for the users. We also have weekly meetings with other teams, so it's really a collaborative effort. We meet with IT members, QA analysts, and customer service to make sure the Toolbox keeps running the way it should and also is usable for our end users.

Ryan Van Patten 10:45

That's a really unique and interesting position and different for a neuropsychologist. I think at the end, if we have time, we'll ask you a few more follow ups about your job that you're in right now. That's interesting. But, to start, we'll stick with the toolbox. In the brochure, it states that the Toolbox is meant to provide, "common currency for the study of neurological research". You referenced that in your answer a moment ago. Can you expand on what is meant by this "common currency"?

Julie Hook 11:16

Yeah, you're right. The NIH Toolbox, one of the main thrusts was to be able to provide common data elements. So if there is research being done across multiple sites in different studies, it would be one way to make the results of a study less likely to be due to different test instruments. So eliminating that variable. So you had potentially greater confidence that whatever other variables were involved in a study might be more attributable to your outcomes.

John Bellone 11:52

Is there a streamlined way for data to be uploaded into a repository for research purposes? Just along those lines, it sounds like creating an easy way to make a database would potentially help that thrust that you mentioned.

Julie Hook 12:05

The NIH Toolbox has an export feature. You can export aggregate data. There are three different files that can be exported - there's a demographic file, there's an item level content file, and then there's more of the composite or summary scores. And those can be exported into a URL. That would be a URL that you would need to create, or you can export it via email and then import it into SPSS or however you would like to look at the data. So there's a lot of options to help facilitate the creation of research answers commonality across research sites.

Ryan Van Patten 12:48

It'd be nice if a lot of people got on board and started doing that together. We could create these master data sets - multi-site, multi-institution, all using the same battery, the Toolbox, with very large sample sizes. There's nothing quite like that quite yet, is there?

Julie Hook 13:07

Well, you know, that was really one of the goals for the NIH Toolbox was to allow for that. There are a number of large, multi-site studies using the Toolbox in that way. One of them is called ECHO, it's an environmental health study looking at children's health across the nation. And there's, I think, thousands of children and caregivers being given the elements of the NIH Toolbox for that very purpose. So you can aggregate the data and look at these effects of environment or other health factors, and look at the effects on cognition across all these various data points and data sites.

Ryan Van Patten 13:48

I'm glad to hear that people are already starting to do that. I agree that it does sound like a great platform for that. It's much easier than if we have our clinical batteries, where mine is different from John's is different from yours and then we're trying to somehow integrate those data together but we have all these different tests. So I like to hear that. To back up a little bit, what do you see as the main advantages to using the Toolbox over are more typical tests of cognition and emotion or even tests that are out there for motor skills and sensory abilities? So why should I choose a Toolbox over my typical clinical battery?

Julie Hook 14:27

You know, the Toolbox is designed to be quick and reliable. It uses statistical models like IRT and is designed to assess a construct quickly, but still offer you good psychometric properties. I think that's a real advantage. The other advantage

is the broad age range. You could assess children as young as 3 all the way across the lifespan up to 85 years of age. If you were to use the NIH Toolbox, and you and your colleagues were perhaps sharing it, you can use it across the lifespan. Other advantage is cost - it's a yearly cost of $500. And it's unlimited use for admin and scoring. So you could use it 1000 times and it would still only be $500. Also, the whole dataset is co-normed. So in the normative sample, those who took the cognition test were the same who took motor and emotion and sensation, which is a nice feature across a normative sample.

Ryan Van Patten 15:35
Yeah, those are compelling advantages. I want to get into some more detail about several things you said. Let's start with IRT. We provided a brief description of IRT to our listeners in the introduction, but will you give us your thoughts as to the advantages of using IRT for the Toolbox?

Julie Hook 15:53
I'll make an example. I think we're all probably pretty familiar with the GRE. You know, years ago, when you took the GRE, you went to a large classroom, and it was a paper and pencil booklet, and you had a set number of items, and you took all, you know, 40 items in the math or however many items there were, and then you moved on to English and so forth. In today's world, you would go into a computing center, and you would be given a medium level math item. And if you're doing very well, your questions would get harder until it found your ceiling. And if you weren't doing quite as well, the questions would start getting easier until it found your ability level that way. So I think applying that statistical model to psychological constructs, and the assessment of them is really innovative and a great feature of the NIH Toolbox. It's very time saving in that way.

Ryan Van Patten 15:54
You're referring to a computerized adaptive testing where we can shorten tests without losing any psychometric power, essentially.

Julie Hook 17:03
Yes.

John Bellone 17:04
Can you tell us a little bit about the validation procedures and the normative sample for the Toolbox?

Julie Hook 17:10

Sure. So the NIH Toolbox was - one of the original tests for the NIH Toolbox was to do a survey of experts across a number of different domains and better understand what they thought of as the important or salient features that should be assessed or tested in that domain. So, for cognition, executive function was one of the top subdomains and then followed by episodic memory and so forth. After those subdomains were selected, the NIH Toolbox working groups looked for relevant existing measures that were out there. I think something like 1400 different measures were examined for being intellectual property free, that they had good psychometric soundness, and could be used across the age range of 3 to 85. So one of the built in components for the NIH Toolbox were the selection of measures that were valid or sound. After tests were selected, they were then put into a validation study where 400 to 500 people took the different NIH Toolbox tests along with more gold standard types of tests. So, in cognition, that would be like elements of the WAIS or the D-KEFS. And overall, the NIH Toolbox tested fairly well - where the convergent validity would test that you would expect and divergent validity would test that you would expect it to be different. Like the picture vocabulary test had good convergent validity with the PPVT and wasn't found to have great association with something like the BVMT.

John Bellone 19:06

Awesome. The Toolbox is also available in Spanish as well as English right? Are there other languages that it's been translated to?

Julie Hook 19:14

The NIH Toolbox is currently available in Spanish and Cebuano. The Spanish version of the NIH Toolbox is much like the English version where you have four domains. Something also to consider for the NIH Toolbox Spanish version is that it was re-normed in a US Spanish speaking population. And two of the tests will be redeveloped - the two language tests, the vocabulary and oral reading, to be more specific to the Spanish language. The Cebuano app is a subset of cognition tests. So if you were to purchase the Cebuano tests, you would only be getting four cognition tests. And that just has to do with the requester and what they needed those tests for. We're currently translating the NIH toolbox, and to Dholuo and Swahili, which are two African languages, Hebrew, Portuguese, and Chinese.

John Bellone 20:12

When are those anticipated to come out?

Julie Hook 20:15
You know, varying time horizons. In part, it has to do with what tasks are being translated and what the requester and where their time requirements are. So we'll probably have - the Dholuo and Swahili are slated to be some of the first ones to come out. And that in part, again, just has to do with who requested them and how they got on the slate of translation, and then how quickly those translations are being done. There's a pretty stringent translation process that we go through.

John Bellone 20:47
Gotcha, awesome. We have an international listenership, so maybe some people will be interested in their specific language for their country. How many people currently use the Toolbox? And I guess wrapped into that is who is able to use the Toolbox? Is it only for neuropsychologists to administer and interpret?

Julie Hook 21:05
The NIH Toolbox is currently used by probably 1500 to 2000 people. Interestingly, we have insight into subscribers, so I know how many subscriptions are sold. But I don't always know how many users there are and that's because we don't limit the amount of users to one subscription. So if you were to buy the NIH Toolbox, both of you could share the subscription or you could share it with multiple people. So, the 1500 to 2000 is a rough estimate, but it's probably somewhere in that neighborhood.

The second question you asked was who could use this tool. The NIH Toolbox follows the standards for educational and psychological testing. If you're familiar with the purchasing of psychological tests, if you've purchased from any of the lead test publishers, you've seen that there's a variety of different levels of tests. The lowest level would be needing no special qualifications, like a survey test, all the way up to something called C level qualifications, which would require a person to have a PhD in psychology or related field or a master's degree with specific types of training in test administration or interpretation. We've limited this and we use that qualification standard because we want to control for possible overexposure of the test items and also of possible misinterpretation of results from cognition tests. That being said, the NIH Toolbox tests were designed to be easy to administer. So if you're used to giving neuropsych tests, I don't think you would find the NIH Toolbox to be overly burdensome to administer. Novel administrators can learn to give the NIH Toolbox using our YouTube videos or e-learning. They're both freely available online. And they can also come for on-site training, either at Northwestern or at a variety of different conferences that we go to and we teach at those.

Ryan Van Patten 23:22
John and I watched some of the demos for the cognitive tests and the emotion tests and I gave a few of the cognitive tests to a friend as a training once. So I agree with what you're saying in terms of them being straightforward and user friendly to administer.

Julie Hook 23:39
Great.

John Bellone 23:40
They're very similar to many neuropsych tests, like you mentioned. We'll have a link in our show notes to the demo page so that if people are interested, they can watch the YouTube videos on those. Obviously, people outside the US can also use it. You mentioned several languages that it's being translated into. Even though this is an NIH project, it's still internationally available, right?

Julie Hook 24:04
Yeah, we sell the product through Apple and Apple's App Store. So, interestingly, when people talk to us about purchasing things, that's not an exchange done with Northwestern. That's an exchange done through Apple. And because it's for sale through Apple, our usership can be international because that store is international. And I'd say, gosh, maybe about 10 to 12% of our user base are international. As you might anticipate, the next greatest users are English speakers and other English speaking countries, and that would be true. Canada and Australia would be the two leading users outside the United States. China is the lead for non-English speaking countries. And, as I mentioned, we are working on a Chinese translation. Part of that, I'm sure, is our collaborations with different teams, both in the US and in China.

Ryan Van Patten 25:03
Yeah, that will open up a whole new world. John and I are both interested in international and global neuropsychology and certainly having these translations and having tools like this freely available - the same or very similar tests that we're getting here can also be given in Beijing and all over the world, that's a really powerful tool.

John Bellone 25:22
You can develop normative populations all over the place. And there's so much to do with that.

Julie Hook 25:28
Yeah, we're very excited about it. Certainly, we're always looking for collaborations and are certainly always interested in having people reach out if they're interested in translations or just working with us.

John Bellone 25:40
The cognitive battery measures attention, processing speed, working memory, language, episodic memory, executive functioning. These tests were selected to maximize sensitivity to change across the lifespan, from my understanding, and [from] your description earlier. How specifically did that process unfold? Like, the specific criteria used to select the cognitive tests or the domains?

Julie Hook 26:05
I think I alluded to it a little bit earlier. With each domain, and let's talk about cognitions specifically, there were around 100 experts who were selected. They were research scientists, clinicians, and they were asked what was the most important aspect of cognition that should be assessed to understand health or important in understanding good cognitive function. From that, executive function was the number one that was listed, then episodic memory, followed by language, processing speed, attention. And so from that, the NIH Toolbox team looked for measures that would be freely accessible, that could be used from 3 to 85, and also be done relatively quickly. So after collecting available instruments, they did more of a thorough research and literature review to better understand how these tests work and how they could be viewed throughout development. So something like executive function, you would expect as children are aging and growing up that their brain is developing and executive functioning starts improving and getting better. It seems to stabilize a bit over adulthood, and then can decline as you get to be older. So there's this U shaped pattern. So part of what the developers in the NIH Toolbox looked for was in the validation sample, did it have that expected pattern? Did it seem that children were gradually starting to get better at these things as they are becoming adolescents and then more stable through adulthood and then declining with age certainly? Crystallized intelligence tests, like vocab and oral reading, you would expect to be more stable through adulthood and not necessarily decline, and that too was shown. So those were some of the ways in

which they looked for that specificity across the lifespan or being able to use it across the lifespan.

John Bellone 28:18

I see. There are some supplemental tests that are built into the Toolbox. But there's nothing stopping people from giving the Toolbox and Logical Memory. So you get a story learning and recall for research purposes, right? I mean, you can supplement with whatever neuropsych tests that you want in addition to the Toolbox.

Julie Hook 28:36

So when you said supplemental tests, I'll just let you know there are actually supplemental tests in the cognitive battery. So we have core cognitive tests and those core cognitive tests can be given in totality for either an early childhood battery score and then as you grow a little bit older, you can get a crystallized and fluid and then a total battery score. If you want to give our supplemental tests in addition to that, you can do that both within the app or you can do exactly what you said. If you want to do delayed memory, right now we don't have a delayed memory test in the app. So that is something that you would have to supplement with. If you wanted personality function, you would need to supplement with a personality test. So there are certainly things that aren't available in the app and, absolutely, I would encourage anyone to supplement with that.

Ryan Van Patten 29:30

Circling back to the initial selection of the cognitive tests for the Toolbox. I like the process whereby you had these experts look for tests that already existed and that already had a research base. For example, in the world of cognitive neuroscience, Mike Posner's flanker task has a lot of research support. I've seen talks on it and I'm broadly familiar with how much work has been done on it. So rather than develop a brand new test, why not incorporate a solid cutting edge test like that? I think neuropsychology needs more cognitive neuroscience tasks to be incorporated into our batteries. We could benefit from that a lot. So that sort of gives me more confidence in the Toolbox that you're using these evidence based tests.

Julie Hook 30:23

Great. Yeah.

Ryan Van Patten 30:24

So, in that vein, let's spend a few minutes talking in some depth about the research evidence on specifically the cognitive and emotional batteries, since that's most relevant to neuropsychology. You've touched on this thus far, some of the psychometric properties. One area I'd like to zero in on to start with, which I'm generally very interested in is criterion validity, specifically predictive validity for neuropsych tests - to what extent can we predict some sort of ecologically valid outcome later on in time? Are you familiar with any research currently or planned for the future that might support this predictive validity of the Toolbox measures?

Julie Hook 31:06

I think there's emerging evidence of predictive validity. There was a recent special issue in Rehabilitation Psychology where one of those articles was looking at TBI groups and the NIH Toolbox cognitive battery did a reasonable job at predicting TBI severely impaired from moderate and then controls. So there's been some work in TBI. There's also been some work with older adults. And the NIH Toolbox seems to be fairly good at differentiating healthy older adults from Alzheimer's groups. One of the current grants that we have and have been working on is a grant called ARMADA, it's funded by the National Institute on Aging. We're really looking to further validate the NIH Toolbox test in being able to assess for mild cognitive impairment, early Alzheimer's disease, and also expand the norms beyond 85 in healthy older adults. But just harkening back to the original question with predictive validity, we have and we're lucky to be included in a lot of large national studies that are longitudinal in nature. So, hopefully, there'll be even more articles coming out. Looking at these longitudinal studies, if you had given the NIH toolbox at time one, and it's now, I don't know, four or five years later, could that have predicted whatever outcome different subgroups or populations had?

Ryan Van Patten 32:42

Gotcha. And just to be thorough, you had referenced reliability and convergent and discriminant validity earlier in terms of the Toolbox measures, is there anything else in terms of different types of reliability or other forms of validity that we haven't asked about? Evidence that you want to briefly go over or have we covered it?

Julie Hook 33:01

I think you've covered it fairly well. There is a special issue and JINS that really goes through the validation, not just of the cognitive domain but each of the tests. For audience listeners who might be more interested or want to do a deeper dive into it, I think that journal series could really provide that information for them.

John Bellone 33:23

You mentioned trying to validate this with MCI and Alzheimer's disease or other forms of dementia. Ryan and I both work with adults and older adults quite a bit. We talked about how there's no recall portion of testing…

Ryan Van Patten 33:37

Delayed recall.

John Bellone 33:38

The delayed recall part of the Toolbox. I'm curious if you have an awareness thus far about what other measures are surfacing as to discriminating between normal aging and MCI and dementia?

Julie Hook 33:52

Well, I'll tell you for that particular study, we are including delayed memory tests. So any subscriber to the NIH Toolbox could actually see any of these what we call the beta or experimental tests. We're including a paradigm called F-NAME, or FNAME (pronounced fah-name), excuse me, if I could record that as FNAME. I think F-NAME sounds a little dicey. [laughs]

Ryan Van Patten 34:20

[laughs]

Julie Hook 34:24

Dr. Hook and the F-NAME. [laughs]

John Bellone 34:27

I like it. [laughs]

Ryan Van Patten 34:30

[laughs]

Julie Hook 34:30

That'll be my own coined one. [laughs] But as part of our ARMADA study, we are including a F-NAME paradigm in that test, which will allow for this delayed recall, which has come to be found as such an important part of an assessment with older

adults and differentiation of different types of aging, whether it be an older adult through healthy age or MCI or Alzheimer's disease.

John Bellone 34:55
How do the Toolbox measures compare to the more traditional paper and pencil tests on important characteristics like sensitivity and specificity? Do you have a sense of that right now?

Julie Hook 35:09
I would say the NIH Toolbox has fared pretty well against comparable types of traditional neuropsych tests. So just in the validation study, when there were select WAIS or D-KEFS tests that were given as gold standard measures, the NIH Toolbox did fairly well. Just this month in JINS, Scott et al. published an article looking at the NIH Toolbox cognitive tests compared to traditional neuropsychological tests and I think it fared fairly well. There are certainly some caveats of use, but compared to other deeper neuropsychological tests - if you really wanted to look more deeply at executive function, I don't know that the NIH Toolbox is the right test for you. But, certainly, with specific uses in mind, I think that it would be a good competitor against some of those more traditional tests.

Ryan Van Patten 36:13
The correct comparison would be a battery of paper pencil tests that is the same length as the Toolbox, right?

Julie Hook 36:20
I think that's right.

Ryan Van Patten 36:20
We could test someone with paper pencil for five hours and get more information than we would from the Toolbox. But that's not fair. It's apples to oranges, right?

Julie Hook 36:28
Right. Right. So if you were to go back to the full Halstead-Reitan battery, you're just getting more information. So, with that, you certainly have greater specificity.

Ryan Van Patten 36:41
We'll link to that Scott et al paper. It's very timely that it came out just this past month, so that our listeners can read in more depth if they are interested.

John Bellone 36:51

Do you know how high the test ceilings are and how low the test floor is? So, in other words, how well do these tests do in terms of measuring cognition and emotion in really high functioning individuals and lower functioning, you know, throughout the spectrum? Do you have a sense of that?

Julie Hook 37:07

I think the tests in general do fairly well. I'll give you an example using the IRT or CAT administered tests. If you have a child, say, a 10 year old, who comes in who has very good vocabulary, you would start them with an age appropriate item on the vocabulary test. But if they got all the questions right, they could go up to a PhD level language very quickly, and be able to assess that range. We also have the opposite as well. If you have an older adult or an adult coming in who is intellectually disabled, because of the range of items we have in there, it can go lower for different individuals and you don't have to worry about possibly [whether the test has] enough questions that it could reasonably assess these ranges. So I think because of how the test was developed, it could address those concerns with the floor or ceiling pretty well. That being said, we are working to develop other norms and extend our norms for 85 and above, and also, with children to really kind of beef up those tests. Always, you know, trying to look to improve.

Ryan Van Patten 38:34

A theme that I'm seeing here that appears to be a big strength of the Toolbox is flexibility. We have a very large age range that's ever widening. It's available in multiple languages, and you're continuing to release it in even more languages so that it's hopefully culturally applicable across different groups of people. With the IRT/CAT approach, we've got flexibility in terms of level of difficulty. As opposed to some of our tests that might really only be useful in a narrow demographic and narrow range of people. It's quite flexible.

John Bellone 39:13

It's also flexible in terms of being able to make changes on the fly and in a way that our paper and pencil test can't do necessarily, right? It would take a long time to create another version of a paper and pencil test. With this, you can roll out new normative data as soon as it comes available. You can just automatically update it for all your subscribers.

Julie Hook 39:34

Yeah, that's something - when we get a new test or we've expanded our normative range, we add that to the subscription. We're a nonprofit. We're, you know, not looking to charge more. We want to make the test useful. We want you to use your feedback. We want people to feel like they have a good product that they can use and we want to do what we can to get the word out so that people know what's available and feel like they can use it in different arenas and in different ways.

Ryan Van Patten 40:07

Another important aspect of flexibility that is touted by the Toolbox is the ability to measure change over time. I know reading from the brochure this is something that was kept in mind as the Toolbox was being created. We are able to assess people across the lifespan, we want to be able to do longitudinal research, so we want tests that we can give multiple times. With that in mind, what are the data in terms of practice effects, especially on the cognitive tests?

Julie Hook 40:41

I would say the practice effects for the NIH Toolbox are no more or less than you might find with traditional neuropsych tests. So if you've done the dimensional change card sort test, that's a set shifting task, much like the Wisconsin Card Sort test. If you're familiar with it, and you've done it once, there's a learning curve and there's certainly practice effects. The NIH Toolbox tries to control for that using IRT and CAT. We also have alternate forms of the picture sequence memory test. But we do not have a reliable change index built into the test suite right now. And that's certainly something we've identified as an area that we could grow in. We're really trying to address that moving forward.

Ryan Van Patten 41:31

That makes sense. You mentioned IRT and CAT addressing this to some extent. The way that those methods would address practice effects is because if I take the test twice, I'm not guaranteed to get the same items, right?

Julie Hook 41:46

That's correct.

Ryan Van Patten 41:46

Depending on how I do on the first item, I might get item C or item F next, meaning that it's not the same as taking the exact same test twice.

Julie Hook 41:57
And you can get the same score twice without having the same items.

Ryan Van Patten 42:02

The emotion battery uses constructs that are less common in neuropsych clinics and not directly from the DSM. Things like negative affect and psychological well being as opposed to depression and anxiety. There's certainly nothing wrong with this. I'm just curious if you could talk about the utility of these constructs as compared to depression on the Beck Depression Inventory, etc.

Julie Hook 42:30

The NIH Toolbox was designed to assess the general population and look for emotional health. Something like the Beck Depression Inventory is designed to look for some sort of pathology or symptomatology. So that's partly, I think, when you're looking at the terms of the emotional health subdomains, what you're seeing. So it's looking to assess emotional health rather than a psychiatric or distress state. How those compare - I'm not familiar with a specific study that does a head to head comparison of the NIH Toolbox emotional health and what you might anticipate as more of a common clinical depression item questionnaire. I know that there are some items in say, the NIH Toolbox depression questions that - like the suicide item on the Beck is not part of the depression measure in the NIH Toolbox. So there are certainly some differences there. I would suggest, if you're interested in using it that way, you can actually just look at the specific items and see if it would meet your needs. I'm not familiar with a specific head to head comparison of them, but certainly anyone who's interested [in] any of these materials could be available and they could take a look.

Ryan Van Patten 43:56

There's nothing magical about the DSM categories either. So we reify them and measure major depressive disorder and social anxiety disorder, etc. But actually newer, more innovative models of psychopathology, like the research domain criteria, tend to take an approach more similar to the NIH Toolbox and look at transdiagnostic categories. So, to me, it sounds like you're saying the choice of the constructs in the emotion battery were based off of the fact that this is not simply a measure of pathology, it's meant to measure emotion in healthy people as well. But also, to me, it sounds more consistent with an RDoC type approach where we're not wedded to the DSM.

Julie Hook 44:46

I know I can speak to that two fold. First, I know in the DSM there is a designation of cross cutting symptoms where depression, anxiety, insomnia are thought not to be pathognomonic of any one thing but can be present across a number of disease states. Some of the questionnaires from the item bank from which our NIH Toolbox emotion tests were developed were from the PROMIS item bank and the PROMIS test looked at the DSM-5 committee as being part of the way to assess those cross cutting symptoms. So I think harkening back to something you said, where you're looking at things that go across instead of just a specific area. That being said, we also have a study that we're doing looking at the emotional health questionnaires as part of the NIH Toolbox and how they map onto that RDoC as a feature forthcoming information.

Ryan Van Patten 45:58

That's really interesting. I'm always excited by new RDoC research like that. It's good to hear it's a good way to use the toolbox, I think.

John Bellone 46:07

Yeah. For our listeners, the RDoC is a little bit complicated to explain. But Ryan, you want to give a very quick overview? Since you're aware of it.

Ryan Van Patten 46:17

Research domain criteria. This is an NIMH, National Institute of Mental Health, initiative that created this framework that is meant to decouple research from the DSM so that we have an alternative way of thinking about mental illness where we're not forced to write grants and be tied to DSM categories. There's a RDoC matrix we can link to, a paper or two that have really good descriptions. The RDoC matrix includes different constructs such as negative affect, for example, that are transdiagnostic and that we could benefit from studying. We want to understand mental illness from the smallest level, like genes and molecules, all the way up to the largest level behavior and self reports. I would say that in a nutshell, in case people aren't familiar. But let's move on and talk a little bit about a new feature of the Toolbox that is really exciting. In 2015, the NIH released an app that allows for iPad delivery of the self report and performance based assessment measures of the Toolbox. Julie, can you tell us a little bit about this feature?

Julie Hook 47:35

The NIH Toolbox, currently, you're only able to administer it via the iPad - that was a change in 2015. What I think is one of the great features about the NIH Toolbox is

that you only need one iPad. There are some systems out there where you would need two tablets, one for the examiner and one for the examinee. What's nice about this is you really just need the one tablet or one iPad. We do, on our website, list the iPads that we would recommend. So iPads, there are certain sizes that we support and then versions of the iOS system that we support. On our website, we do list those, so any interested listeners can look and make sure that they're getting a supported iPad that is running one of the later versions of the operating system to make sure that it properly supports the NIH Toolbox. I'll tell you, if you use an iPad that's a different size, you'll get a banner on the administration that says this isn't a supported administrative size of an iPad. We do that specifically for the cognitive tests because the size of some of the picture sequence memory, how big it is or how small it is, could affect the response. So we try and standardize that. If you are using a large iPad or a small iPad beyond what we recommend, and you're doing emotional health or maybe something from the motor battery, it's probably going to affect your results less. Though clearly you don't want the question on the emotions test to be so small that somebody can't read it. But you're not going to find necessarily that size, I think, is going to affect it quite as much.

Ryan Van Patten 49:22

So, Julie, we've talked a lot about the research evidence for the Toolbox measures as well as how the Toolbox can be used for research purposes. Another area that John and I are both very interested in is to what extent can these Toolbox measures be useful right now clinically. In my experience, I haven't seen neuropsych clinics that are using these on a regular basis for patients but I don't see any reason why that couldn't happen. What are your thoughts about using the Toolbox, especially cognitive and emotion measures, for clinical neuropsych patients?

Julie Hook 49:59

The NIH Toolbox was conceptualized initially to be a research tool. It wasn't thought to be a substitute for in depth assessment of behavioral domain or a subdomain and it wasn't developed to be targeting a specific disease. Over time, as we'd hoped, people are using the NIH Toolbox in different clinical populations. We've seen a variety of articles in TBI, traumatic brain injury, spinal cord injuries, cancer, stroke, and dementia, as we talked about previously. I would always say with any new instrument, if you're looking to use it as part of your clinical assessment, to try it out with things that are tried and true to you and behave in a way that you've come to learn and understand and see how the NIH Toolbox works against them. Ultimately use clinical judgment as to whether or not you think it would be an asset to add on. The beauty of the Toolbox is if you want to add on one of our tests, no

one test takes longer than about five minutes to administer. So if you wanted to try it out, you could give, say, the vocab test and just add about three minutes to your clinical evaluation. So not a lot of added time to get a sense of whether or not it's behaving in a way that's familiar to you and that means something to you. That's how I would encourage users to think about using it in clinical practice.

John Bellone 51:39
That's a good way to think about it. Just to go back to some of the nuts and bolts, how might someone go about learning to administer and score the measures? Let's start there.

Julie Hook 51:50
Okay, so administering and scoring - I'll tell you first, the beauty of the Toolbox is it's automatically scored. So you don't have to do that.

John Bellone 51:59
That's nice.

Julie Hook 52:01
The administration, I think, again, if you're familiar with how to administer something like the paper and pencil form of a Wechsler test, you've got the NIH Toolbox. It's not, I believe, as complicated as that. It does have some nuances. So even for experienced test administrators, I would suggest looking over our videos reading through the manual. Come to one of our on site trainings. We try to have one at least every quarter of the year at Northwestern University in Chicago. So try it out. If you have any questions, there's also YouTube videos you can watch. And there's a really nice series, it's an e-learning series that's also available on our website, that's a didactic series where you'll be presented with an audio but also slides much like you're sitting through a PowerPoint presentation. And at the end, there's a self quiz. So you can learn more about the tests and administration and a lot of that online and come to one of our on site trainings as well if you have additional questions, or you just want the hands-on experience.

John Bellone 53:13
Lots of ways to learn. With regard to administration, it sounds like you only need one iPad, do you need an internet connection to administer?

Julie Hook 53:24

The beauty of the NIH Toolbox is that it is self contained. So once you've downloaded the NIH Toolbox and set it up - you know, that would be getting that cognition access code. We talked earlier about needing certain credentials or qualifications to access the test and then you would also need to purchase a subscription. You would need to have an internet connection for both of those things. But once you've set it up, you can administer the tests and they're, again, automatically scored anywhere. You do not need to have a data plan, Wi Fi, anything like that. The next time you would find yourself needing that internet connection is wanting to export the data. We offer individual score reports on an assessment so if you wanted to see a report on a one time visit, or we even have a longitudinal report, so you could see a comparison. We talked a lot about exporting data earlier, but if you wanted to export those aggregated files, again, for any of those things you would need another internet connection. But for the admin and scoring you don't.

John Bellone 54:39

How flexible is the battery? Can the user pick and choose which tests to administer and different orders? Or they have to stick to the structure?

Julie Hook 54:49

You don't have to stick to any one structure. If you liked one particular test on the NIH Toolbox, you could administer just that one test. If you wanted to build your own battery - say you wanted motor dexterity and you wanted a couple of the cognition tests and maybe an emotional health test, you could create your own battery on the NIH Toolbox so that battery would always be available to you. That's also a useful feature if you have a research study or technician working for you. You could create your order of administration that you wanted and then those people could just run it off that created battery. And lastly, we offer prefix batteries. So if you want to administer the core battery to get all the composite scores, or you just simply want the core battery and you don't want to have to create your own battery, those are all pre-loaded for you. But, again, you don't have to select them if you don't want them.

Ryan Van Patten 55:49

I imagine that some people may be wondering why they have to pay for the Toolbox measures at all, given that their tax dollars have gone into developing the batteries initially. How would you respond to this question?

Julie Hook 56:04

Yeah, you know, that is probably one of the questions I get asked the most. "Why do I have to pay for this?" And, really, the tests themselves are royalty free. We're not looking to make money off the test. What we're doing is we're aggregating our maintenance costs across our user base. So every time Apple updates their operating system, say, we have to pay programmers to update the code, we have to pay QA analysts to make sure tests are working as designed so that you have continued confidence in using the tests. Anytime we update things and keep things running smoothly, customer service, all those things cost money to maintain and so we charge a fee to our users to try and help keep the NIH Toolbox running as expected.

Ryan Van Patten 56:59

It makes sense. That's helpful to hear. I wanted to circle back to something you had referenced earlier and ask you to expand on it a little bit, which would be the PROMIS measures and relatedly the Neuro-QOL. My understanding is that along with the Toolbox, these are part of a suite, the health measures or the Pearson centered assessment resources. How are these related? And then if you could really briefly describe for us the PROMIS measures and in the Neuro-QOL.

Julie Hook 57:26

Sure. So interestingly enough, another question I get is, “How are health measures related to these things?” Health measures is a portal that really helps disseminate these different measurement systems. So those different names you mentioned - the PROMIS and Neuro-QOL, and there's one other one called Ask Me, and the NIH Toolbox - they're all measurement systems that have literally hundreds of different tests. Within the NIH Toolbox app, you get access to a selection of PROMIS and Neuro-QOL tests. These tests largely look like those available in the NIH Toolbox emotional health domain. They are patient-report outcome measures to assess different aspects of functioning - so quality of life, negative affect, and some of the things that we've talked about before. They're all what I think in neuropsychology we would think of as a questionnaire like an inventory response. They all have that feeling or nature to them, but many of them also utilize IRT and CAT. So they're much quicker at assessing different levels of functioning and you can also get fixed forms if that's your preference. The PROMIS measures can be used in a general population and also individuals living with chronic conditions. The Neuro-QOL measures, while they have a similar look and feel to them, were designed only for neurologically impaired individuals. So that subset are a range of different neurological injuries from something like a TBI to dementia and things like

that. Ask Me is our only disease-specific questionnaire system - it's only for adults and that system has to do with the assessment of sickle cell anemia.

John Bellone 59:30
You might have said this and I might have missed it, [but] do you get access to these with your subscription to the Toolbox?

Julie Hook 59:37
You do. In the NIH Toolbox, you get access to select measures. I say that because there are literally hundreds of measures in each of these. And while there are hundreds of measures you gain access to, there could be one particular PROMIS measure that you might be looking for and I would encourage you to look at our website to see if that's accessible through the app. If you're really familiar with PROMIS and you have that key measure you're looking for, I would just want a user to look on our website where you can even download the app for free. You'll be able to see all the measures that are available minus the cognition measures, which you need the access code for. But you could download the app for free and look and see all the measures that are available. There's PROMIS, Neuro-QOL, and there's also some other measurement systems there as well.

John Bellone 1:00:31
Awesome. Well, yeah, we have definitely gotten a much better understanding of the Toolbox and what it encapsulates and incorporates. Are there any upcoming changes or improvements on the horizon other than the translations that you mentioned?

Julie Hook 1:00:46
We are always looking for user feedback. And one of the things that we had heard was users were really interested in adding notes particularly if you think about a large clinical trial. You had a patient who maybe forgot their glasses or something happened and you wanted to note that. There was always a way to add a note, but it was not as apparent as it is now. Now you can add a note per test and you can edit that note. That was a new functionality that was, in part, developed because of some user feedback that we got. Looking forward, I mentioned the ARMADA grant that we have that we're looking to expand some of our tests. I'd mentioned the F-NAME test, the delayed memory and also our ECHO grant, the children's study that I mentioned. We're adding some tests with that as well. There's a visual reasoning test on the horizon. Some other updates, we're looking to re-norm our test. It's been almost 10 years since the original release of the NIH Toolbox so with

the 2020 census, we hope to re-norm a number of our tests to stay current. Looking at a larger time horizon, we're looking for a different administration model using some similar paradigms to what's happening with the NIH Toolbox as it is today. Internally we call it the Mobile Toolbox, a self administered version of it. So if you were running, say, an older adult trial or monitoring the effects of some drug or something like that, you could have a user in your trial download this app and do some self assessment at home. Then you could look at that testing and see whether or not you wanted to perhaps give them the NIH Toolbox examiner or administered version which we have today, or some other type of testing.

Ryan Van Patten 1:02:45
Gotcha. That's very interesting and helpful. Well, from the start of our conversation, Julie, I've been hoping to circle back around to a little bit of professional development and ask you a few questions about your career because I think you're in a unique position for a neuropsychologist. You're the product manager of the NIH Toolbox, which you referenced earlier. I believe also in the past, you had a position for PAR, Psychological Assessment Resources. Is that right?

Julie Hook 1:03:13
Yes.

Ryan Van Patten 1:03:13
Could you talk to us briefly about that position and what that entailed?

Julie Hook 1:03:18
Sure. When I worked at PAR, I worked in two different positions. I was a product director there, and then later, I was also the manager of quality assurance. What that entailed there, the first position was largely test development or test revision. And the second position, the quality assurance, was kind of like what it sounds. Making sure that tests were working as designed and running tests on that, looking at new tests under development and making sure that they were meeting standards and that sort of thing.

Ryan Van Patten 1:03:56
Gotcha. We have a pretty large student listenership and I'm thinking about this through the eyes of a student. We're trained in universities and we work in clinics so it's easy for us to think about jobs that might be in a hospital or the VA or a private practice. But we are not really trained in the world of business and finance and so

thinking about jobs in the private sector in this way, as a product manager, those sorts of things might not come naturally to us. I'm wondering how you initially became involved with these types of positions and if you have any quick advice for students who are looking to broaden their horizons in terms of career options?

Julie Hook 1:04:40

Sure. I was always interested in business. I initially had thought about maybe IO psychology. For a variety of reasons I chose neuropsychology and always, in the background, I was interested in business. I first went to PAR to explore that interest in business and also in getting more involved in test development. Then I went on and I got an MBA to better understand the business processes and to explore that interest of mine even more. So I would say, you know, just keep options open. But I would say, for anyone who's interested in looking at other careers, gosh, I would just even start with APA careers and see what's available. Read a lot of job descriptions. That's one way to really get a sense of what's out there, and what your degree has trained you for, and use it in maybe an "off label" way, and understand how transferable your set of skills are, because I think there is a lot of commonalities in how you're trained as a psychologist and also in assessment in neuropsych and using those skills in other ways.

Ryan Van Patten 1:06:07

Well, we're very glad that you ended up choosing neuropsych over IO.

Julie Hook 1:06:12

[laughs]

John Bellone 1:06:12

[laughs]

Ryan Van Patten 1:06:13

It's also really helpful to hear your perspective, combining business with neuropsychology. I think that's something many of us can use to think about and learn more about.

John Bellone 1:06:24

I'm also curious what the day to day looks like at PAR or as a product manager. You don't see clients clinically, right? I'm assuming you're probably involved in some research, though. Can you give us a sense of your day to day?

Julie Hook 1:06:38

Your day to day, I think, would vary depending on the projects that you were working on and what stage of development those were in. I think using a research study as a model to understand the different phases of that and what a day to day would look like isn't a bad analogy. If you're looking to create a new test on some aspect of cognitive functioning, you might do literature reviews, talk with experts in the fields, and that process that you're used to. There's item writing, item development, things that, again, I don't think are out of the norm from what a research study or, depending on what your research looks like, things that you might be tasked to do. I would say the differentiation probably comes more from the business end of it. So at some point, you would be asked to think about what market might this go to. Or how would this test be administered and conceptualize what that looks like in terms of even, you know, what paper type are you going to use, what paperweight, and things that I never had even considered until I started working in commercial test publishing. And then all of a sudden, my consciousness was raised to the fact that it isn't just one type of paper, and, you know, the kind of inks and all these things and all those costs that go into developing tests.

John Bellone 1:08:10

It's all invisible to us as consumers, but there's so many decisions, I'm sure, that you have to make on the business side that we just don't realize.

Julie Hook 1:08:18

I think that's true. I think, too, my first job out of fellowship was at Rush Hospital in Chicago. And when we would buy tests for the clinic, I don't think I was as aware of what company published what. I knew that I wanted more copies of the WAIS, but I don't think 10 or 15 years ago, I wouldn't have been quite as quick to say, "Oh, that's Pearson who publishes that" or something like that. Now, because I've worked in the industry in that way more, I better understand who publishes what and where those relationships are.

Ryan Van Patten 1:08:58

For sure. Well, this conversation has been very helpful, Julie. Thanks for going through some of the nuances of the Toolbox for us as well as some of your business background. We like to end all of our interviews with a few bonus questions. To begin, if there was one thing that you can improve about the field of neuropsychology, what would it be?

Julie Hook 1:09:22

I would look to challenge all of us to streamline our processes. I think looking to fields like manufacturing or software development, they're more apt to use a process called Agile development where they're always stopping and looking to see how far they've gotten in a certain amount of time and what could be improved or changed or what incremental validity is there in adding this new thing. I think for us as neuropsychologists we could take a page from that book and better understand how we could perhaps improve our end product. Who's our consumer? Is it the patient? Is it the professional who referred them? What are they looking for? Do they want a 10 page report? Or would it make more sense to offer them results in a shorter version of report or in a different way? I think raising our consciousness to how we can improve things and being perhaps more agile or streamlined in how we deliver things would be one way that we can improve.

John Bellone 1:10:30

You can't see us, but Ryan and I are both nodding vigorously. [laughs]

Julie Hook 1:10:34

[laughs]

Ryan Van Patten 1:10:34

[laughs]

John Bellone 1:10:37

For the second question, what is one bit of advice that you wish someone had told you or that maybe someone did tell you when you were training that really made a difference, just an actionable step that trainees can take?

Julie Hook 1:10:48

You know, it may sound hackneyed, but I would say always be a student, even when you're graduated. Whether you're learning about some sort of new design theory and user interface design or something specific to the field of neuropsychology, I would really encourage students to always keep learning. You never really know where innovation comes from, or if you're stuck in an idea how do you get to that next step. Oftentimes, those breakthroughs happen when you're doing something else. I remember just working on an arts and crafts project with my daughter and having an "aha moment" where I'm like, "Oh, that would be a good

solution." So that's the advice that I would give. To always be curious and consider yourself a student and a learner.

John Bellone 1:11:42
Yeah, that's what gets us in the field to begin with.

Julie Hook 1:11:45
Right, right. [laughs]

John Bellone 1:11:46
So we keep that in mind to keep that fire.

Ryan Van Patten 1:11:49
Even if you don't want to, there are always CE credits, right?

Julie Hook 1:11:52
That's right. [laughs]

Ryan Van Patten 1:11:53
That forces you to be a student whether you want to be or not. [laughs]

John Bellone 1:11:55
[laughs] That's true. Especially in California, with 36 hours.

Ryan Van Patten 1:11:59
Yeah.

John Bellone 1:12:00
Now that we've covered advice for trainees, we want to finish by asking you for advice for early career professionals. Specifically, the healthcare landscape is changing pretty rapidly, and we want neuropsychology to remain relevant and useful. So once we are established, what steps would you advise we take to ensure that we continue to provide cutting edge scientific and clinical services?

Julie Hook 1:12:24
I think you said it right there - cutting edge. I think staying abreast of new technologies and new trends and looking to see how we could incorporate them and maybe trying to stay a little bit ahead of the curve so we can control how those things are used. So, like eye tracking assessments, I see an emergence of that being used in assessments more and embracing some of those new technologies, thinking about how we could incorporate that. What could that be next? What are the next steps for those types of things? I think it's all coming down the pike. I think it would behoove us to continue doing what we're doing in terms of really looking at the technologies, thinking of ways we can incorporate it, and what are the next steps, and how we want to control how that might look in neuropsychology or how we might use those tools.

John Bellone 1:13:19
Awesome. Well, like we said, we're really appreciative of this conversation. We learned a lot definitely.

Ryan Van Patten 1:13:25
Very much so.

John Bellone 1:13:26
So, thank you. Thank you, Julie, for coming on.

Julie Hook 1:13:29

I thank you both, again, for having me on and letting me talk about the NIH Toolbox. It's something that I know myself and our team at Northwestern, we all feel really strongly about trying to get the word out and letting people know that it's available.

Ryan Van Patten 1:13:43
Yeah, we're happy to be a platform for that.

John Bellone 1:13:45
Yeah. Thanks again.

Julie Hook 1:13:46
Thank you.

John Bellone 1:13:46
Bye.

Ryan Van Patten 1:13:48
Well, that's it for our conversation with Julie. As always, thank you so much for listening, and join us next time as we continue to navigate the brain and behavior.

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