Executive Functions & ADHD: Evidence-Based Assessment with the BRIEF2

Questions & Answers

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The following are some of the frequently asked questions (and answers) that followed the presentation.

Q: I am wondering about the requirement that teachers know the child for at least 6 months. It really limits our ability to get ratings because of the transient nature of our teachers. Can teachers who have not known the child for six months complete the form?

A: Thank you for pointing out potential confusion between the instructions on the BRIEF2 forms and the requirements for completing the BRIEF2. The BRIEF2 forms say, "We would like to know if the student has had problems with these behaviors over the past 6 months." At the same time, the BRIEF2 Professional Manual states, "To provide valid ratings, the respondent should have had a considerable amount of contact with the child. For example, 1 month of daily contact should be sufficient" (p. 12). The two seemingly contradictory time frames refer to different aspects of knowledge about the student.

The forms ask about the past 6 months to gauge if the child's functioning is relatively stable over time. That is, we are asking more about traits rather than states. It is likely that many teachers who complete the form won't have direct knowledge about the past 6 months, as we know that referrals often start coming in by October of the school year, and teachers have likely only known the student for 4 to 6 weeks at that point. This is sufficient. We want to know if the characteristics that are rated on the BRIEF2 have been going on for a while and not just during the past week or two.

The manual suggests that a rater, whether a parent, teacher, aide, or another person, be very familiar with the student's functioning. It suggests that having the student in class for at least some part of the day most days for a month is usually sufficient for a teacher to get to know the student well enough to offer ratings.

The first timeframe, 6 months, asks if the students' behaviors are stable. The second time frame, 1 month, asks if the teacher knows the student well.

In both cases, there is no hard and fast rule, and your judgement is paramount. The BRIEF2 is intended to capture characteristics of the student's executive functioning,

preferably behaviors that are persistent and not just over the past few weeks in response to a stressor or event. How long the teacher needs to know the student is also a matter of judgement. Some teachers feel that they know a student fairly quickly, particularly students whose self-regulation is either unremarkable or clearly problematic. It is those students who are in between where more time and observation is needed.

Q: Can you speak to the relationship between working memory as measured by self/parent/teacher report on the BRIEF2 and working memory subtests/composites on other tests?

A: This is one of my favorite questions. I hope to put together another webinar that discusses what performance measures (tests) of executive function tell us and what the BRIEF2 tells us. There are several lines of evidence for validity of each that we can examine, including:

1) Are they sensitive to problems with executive functioning in clinical groups?
2) Are they associated with biological markers of executive dysfunction (e.g., brain injury, brain imaging)?
3) Are they associated with real-world functioning (e.g., academics)?
4) Do the measures show improvement with treatment for executive function problems?

In brief, I would answer all of these in the affirmative for both tests and the BRIEF2, though to varying degrees.

To explain the differences between WM tasks (i.e., span tasks) and the BRIEF2 WM scale, it is important to look at what each is measuring. They correlate at about .25, meaning that there is a small but significant correlation between them, but there is a whole lot going on that is not shared between them. Digit span is the most widely used measure of any aspect of executive functioning, largely because it is included in standard cognitive batteries. Digit span is important for many students: Digits forward tells us if the student can capture and hold small amounts of information momentarily, and digits backward tells us if they can then manipulate that information at least briefly. A deficit in either tells us about an important problem. If

a student can't hold a few digits in their head momentarily, then they are not likely capturing lectures/discussions in the classroom and more. If they can't do backward, then I'm very concerned about concentration. Both are important to know: Digits backward is much more working memory vs digits forward which is, well, span.

On the other hand, the Working Memory scale on the BRIEF2 asks about holding information over time and interfacing with real world demands. It does not ask about momentarily holding information in mind or reversing it, but instead asks about forgetfulness, poor concentration, inattention, and so on.

Debbie Waber and colleagues published one of my favorite papers that directly addressed this question. They used the NIH normal brain development study data, with about 350 children who were being followed with multiple measures (e.g., brain imaging, medical tests, neuropsychological evaluations, etc.) over at least a 20-year span. Waber et al. correlated digit span and spatial span scores with multiple brain areas (brain volumes, cortical thickness) and did the same with the BRIEF2 Inhibit (as a foil) and WM scale scores. They found that Inhibit correlated with brain volume in a different area than did WM scale scores, meaning that they are measuring different things (great!). Then they found that digit span and spatial span both correlated with hippocampal volume. First, hold digits or locations is the same thing, essentially. Second, your memory storage unit, the hippocampus, holds small amounts of information at least momentarily, just like it should do.

Importantly, the BRIEF2 WM scale scores correlated with para-hippocampal volume. That is, brain tissue that is right next to the hippocampus. So, holding information is related to the hippocampus, while holding that information over time and interacting with real world demands is right next to the actual holding place. The authors suggest that while digit span reflects the actual holding of information, the BRIEF2 WM scale reflects the momentary binding of what is held with real world demands over time.

I know that is a lot to take in, but think of it this way—you want to know if the student can hold and manipulate information in active working memory, so you do digits forward (holding) and digits backward (manipulating), and maybe some other things, like mental arithmetic. But then you want to know if they are able to do so in the everyday real world, with multiple demands, with distractions, with emotions, with poor nutrition or lack of sleep, or with trauma, and so on. The BRIEF2 is capturing what is really happening in the child's everyday world, while span tasks are looking at the underlying part.

Q: Does the BRIEF2 ADHD Form have different questions than the BRIEF2? Is the ADHD Form something that needs purchased additionally, or is it now automatically available when we score the BRIEF2 on our current PARiConnect account?

A: Great question. The BRIEF2 ADHD Form provides a way to gather and review information already included in the BRIEF2 Parent/Teacher Forms that can help you evaluate the likelihood of an ADHD diagnosis in a student. It is not an additional questionnaire: it's a double-sided form on which you can graph BRIEF2 profiles, review statistics, and look at symptoms in a checklist to help with diagnostic decision-making for students with suspected ADHD. You can use the hand-scored double-sided form, or you can choose to get an ADHD report from PARiConnect once you have scored a BRIEF2 Parent/Teacher Form. There is no additional questionnaire.

We included some of this information in the BRIEF2 Professional Manual. In Chapter 3, Interpretation, we present an argument for identifying students with either presentation of ADHD (ADHD-I and ADHD-C) along with an argument for identifying students with likely ASD, and reference data on the sensitivity and specificity of BRIEF2 scores to support your diagnostic decision-making. We also present the data on sensitivity and specificity in Chapter 6, Reliability and Validity, as part of the body of evidence supporting the accuracy (validity) of the BRIEF2. The BRIEF2 ADHD Form is intended to pull this information together in one simple form while adding further statistical support and a symptom checklist.

Q: Are there differential profiles for ADHD vs. ASD?

Yes, there are different profiles across BRIEF2 scales that we see for students diagnosed with ADHD-I, ADHD-C, and ASD. We first published a paper on profiles in children with developmental disorders in 2002 (Gioia et al., 2002) showing that there were clear, visually and statistically distinguishable patterns of scale elevations on the BRIEF in these groups as well as in children with learning disabilities. Children with ADHD-I were characterized primarily by a substantial elevation on the Working Memory scale followed by Plan/Organize. Children with ADHD-C had the same cognitive regulation

profile but with a substantial elevation on the Inhibit scale. Children with learning disabilities had profiles like those in ADHD-I but at a much lower level. And children with ASD were characterized by a peak on the Shift scale, along with elevations on Working Memory and Plan/Organize.

In developing the BRIEF2, we had a very large clinical data set that allowed us to examine every item to see if it contributed to understanding any clinical group. That allowed us to reduce the length of the BRIEF2 by removing items that weren't helpful in identifying clinical problems with any particular group. We looked at profiles of scale elevations and included a profile analysis, essentially a MANOVA with individual scale T scores as repeated measures, and clinical group (ADHD-I, ADHD-C, LD, ASD, typically developing) as the between-groups factor. We found that all tests were significant, meaning that

1) elevations or scores from scale to scale were not level across diagnostic groups

2) different diagnostic groups had different overall scale elevations, and, most importantly 3) each clinical group had different patterns of scale elevations

Again, ASD was defined by a peak on the Shift scale, while ADHD-I and ADHD-C shared elevations on Working Memory, Initiate, and Plan/Organize but were differentiated by a peak on the Inhibit scale for ADHD-C, and LD was like an ADHD-I profile but milder.

You can see these profiles graphically in the BRIEF2 manual in Figures 3.1, 3.2, and 3.3 (pp. 40-41). We discuss how this adds to the body of evidence for valid interpretation later in the manual (beginning on p. 161). The Profile Analysis section ends a larger discussion of BRIEF2 findings in students with developmental disorders (e.g., ADHD, ASD, LD) and those with medical disorders including NF1, ALL, tumors, other cancers, epilepsy, and brain injury.

You can also find sensitivity and specificity as well as predictive values for using the Shift scale to help identify students with ASD in the BRIEF2 Professional Manual (beginning on p. 41). It turns out that elevated scores on the Shift scale are very predictive of an ASD diagnosis if that is a question and if there are other appropriate measures that suggest an ASD diagnosis as well.

If you are specifically interested in how the BRIEF2 works in the context of an ASD evaluation, my coauthor Lauren Kenworthy has been studying ASD for the past 20 plus years and is one of the developers of the "Unstuck and On Target!" intervention for increasing flexibility in students who get "stuck." See Yers, et al (2009), Rosenthal, et al (2013), and Granader, et al (2014).

Q: What resources do you recommend that help develop interventions and supports for students with executive functioning deficits, with or without ADHD?

Now that we are pretty clear on how best to evaluate executive functioning, research and clinical attention has turned toward figuring out what to do about problems with executive functions. We have learned much in the last decade. Most of the research points to an executive function coaching model as the effective ingredient in interventions for executive difficulties in students and adults, including older adults.

Executive coaching as we understand it comes from the work of Mark Ylvisaker and Tim Feeney and has formed the foundation of effective interventions, including our own work on the BRIEF2 Interpretive Report and upcoming intervention handouts, and Dawson and Guare's intervention model (e.g., "Executive Skills Coaching with Children & Adolescents"). This kind of intervention is really a series of scripts for asking a student, or adult, about what they want to accomplish (goal), why that is important (why), how they will approach their goal (plan), following the plan (do), then looking back to see what worked and what didn't work (review), and thinking about what they might do differently the next time. It applies to managing a bunch of school or work tasks (e.g., a backlog of reports that are due), one work task (e.g., writing a difficult report), home chores (e.g., cleaning a room, making a meal), and social activities (e.g., playing successfully with peers).

A model for how we might create evidence-based interventions using this coaching model is Kenworthy et al.'s *Unstuck and On Target!* This is the first "cookbook" coaching intervention that has been through a randomized clinical trial and found good support for efficacy. It is specifically designed to help students be more flexible but is a great model for how we can develop and test such interventions in the future.

Coaching can be particularly useful for students with attention, planning, organizing, and monitoring problems. In fact, it is probably best for these students and less effective for students with impulsivity. Within a coaching model, there are many commonly used accommodations and interventions for students with ADHD-I, such as placing the student more in the middle of things and in the teacher's sight path, giving them a preview of what is to be learned, providing an outline, keeping things brief, and offering repetition. Many teachers know that they need to give the class instructions and then stop by the

student with ADHD's desk and provide a summary of instructions and guidance. I like teacher "check-ins," where the student is asked to do one or two problems or parts of an assignment then bring the work to the teacher for review and positive feedback, then asked to do a few more problems, and so on.

We discuss lots of interventions for executive function problems in our BRIEF2 Interpretive Report, which is available when a protocol is scored on PARiConnect. CHADD is a good clearing house for what works and what doesn't for ADHD symptoms. Also, books like Late, Lost and Unprepared by Cooper Kahn and Dietzel, Smart but Scattered by Dawson and Guare, and Taking Charge of ADHD by Barkley are all great resources.

For a good review of interventions for executive function problems, see Diamond & Lee (2011) and Diamond & Ling (2016).

Q: Can we utilize self-reports to help in determining if a student has ADHD, or is the research only focused on parent and teacher reports?

An expert in self-regulation in students with ADHD once said at a conference in 2001 that the last person to ask about their own executive functioning was an adolescent with ADHD. We had just published the original BRIEF and heard this statement, prompting us to study the question of whether an adolescent could tell us accurately about their own executive functions, particularly when those very functions were problematic (e.g., they were diagnosed with ADHD). We created a self-report form for the BRIEF, collected a lot of clinical and normative data, and examined the evidence for precision and accuracy of this new measure. This eventually became the BRIEF Self-Report Form, now incorporated within the BRIEF2.

We learned that adolescents can and do tell us important things about their own self-regulation, but that their ratings are often not as clear (e.g., as elevated) as are parents' and teachers' ratings. In the BRIEF2, parent and teacher ratings on the Working Memory scale, the most predictive of ADHD presence, are two standard deviations away from the normative mean. That is, Working Memory T scores of 70 and up are not unusual for students with ADHD. Adolescents with ADHD rate themselves on average as approximately 1 standard deviation above the mean, or about a T score of 60.

Given the differences in ratings between adolescents and their parents and teachers, we found that predicting the likelihood of an ADHD diagnosis was much more accurate with parent and teacher ratings than with adolescent ratings. That said, adolescents can and do tell us important things about how they perceive their own self-regulation. Typically, they report a similar pattern of ups and downs across scales but to a lesser degree. This allows us to show them their ratings along with parent and teacher ratings and note that everyone is on the same page in terms of areas of strength (i.e., valleys in the profile) and weakness (i.e., peaks in the profile). Sometimes, adolescent ratings suggest that there are no problems while parents and teachers suggest that there are problems, and our first task is then to get the adolescent on board with recognizing the problems. Occasionally an adolescent will rate themselves much higher (more problematic) than parents and/or teachers, and this deserves a follow-up interview. It often reflects a student who is distressed and feels they need help but that others are not seeing the problem.

In sum, I rely on parent and teacher reports for helping understand the student's everyday self-regulation, but I want the student's input to gauge their awareness of any problems.

Q: How do you adapt to online school during COVID with regard to teacher input?

This is a practice question that we have been struggling with this year and there are no hard and fast rules. We can use rating scales with teachers who have known the student in class recently and reasonably well. For example, I've been able to gather rating scale data from teachers who had the student in the previous year (before schools went remote) and knew the student well and remember them well now. I make sure that I'm clear in my reports to note that the ratings were from the previous year and things may have changed, also noting if the pattern is the same as reports of current functioning from parent and/or teacher. Many of the students I've seen this fall are in school 2 to 5 days per week, so that is useable data in the typical fashion.

When students are entirely remote and the current teachers don't have prior in-class experience with them, we can still collect rating scale data but likely need to interpret and report the data with caution and caveat. That is, we can say that the student is

exhibiting difficulties with X, Y, and Z under conditions of remote learning relative to most students during more typical in-school learning. For example, I saw a student who has been remote since March. Her teachers know her well, the problematic behaviors have long been clear, and the problems persist and are observable on camera. The same profile was reported by the student's parent and in-home provider. Thus, I felt it was appropriate to report the data, noting that it was collected under the atypical circumstances of remote schooling, but also noting that it was consistent with multiple previous evaluation findings, with parent and observer reports, and with everyday functioning by observation.

Indeed, this is not far from my typical evaluation of the precision and accuracy, or reliability and validity, of evaluation data. I look at my current test /rating scale scores, compare with previous findings, compare with reports of everyday functioning, and evaluate any factors that might have influenced scores. I can then say something like,

"Given Suzie's good cooperation and effort, the consistency with previous evaluation findings, and the consistency between observations and parent and teacher reports, the present findings are likely an adequately valid and reliable indication of Suzie's current functioning."

Q: You addressed how this can be used to guide a diagnosis and how to address this in write-ups about the BRIEF2. I work in a setting where I do not provide diagnoses but instead specifically address the skills involved in EF and utilize the BRIEF2 to guide interventions. Are the phrase guides provided in this presentation and the manual acceptable for non-diagnosing professionals, or does the phrasing need to be adjusted?

As you note, many psychologists do not offer an ICD or DSM diagnosis depending on the setting. For example, I work in many Vermont schools where I am expected to offer mental health diagnoses when appropriate, including a diagnosis of ADHD, but I also work in New Hampshire schools where I'm not supposed to offer such diagnoses.

Further, I work in a teaching hospital setting where I'm required to make a diagnosis every time I write a note in the record.

Depending on your setting, you may need to adjust statements. As I discussed in this presentation, we examine function (e.g., working memory, inhibitory control, etc.) and may make a clinical diagnosis (e.g., ADHD-I) and/or may suggest an educational disability (e.g., OHI). We can craft our language to fit those needs. I often try to transition from function (executive functions) to clinical diagnosis (e.g., ADHD) to educational diagnosis (e.g., OHI). Much of the time, I state that:

"Parent and teacher ratings of Johnny's everyday self-regulation revealed a pattern of problems with sustained working memory (attention and concentration) and inhibitory control (impulsivity). This pattern is like that seen in students diagnosed with ADHD-Combined presentation. Johnny's profile reflects limited alertness, or inattention, and heightened awareness, or distractibility, that characterize an educationally handicapping condition of Other Health Impairment."

Indeed, the BRIEF2 ADHD Form report on PARiConnect offers statements with this phrasing:

In this case, parent ratings of John's working memory (T = 77, %ile = 99) and inhibitory control (T = 85, %ile = > 99) are clinically elevated. This suggests that, in the home environment, John exhibits clinically significant difficulties with sustained attention and working memory as well as impulsivity and/or hyperactivity. **This pattern is like that seen in adolescents diagnosed with ADHD, combined presentation**.

You should feel free to adapt the language to your needs. We never intend to tell evaluators what to say but try to offer suggestions to make your job easier.

Q: In addition to behavior rating scales, background history, family, and medical information, I administer direct measures to assess executive functioning such as a trail making test, attention/executive function subtests, and an intelligence test. Many times, direct measure results are inconsistent with BRIEF2 results. For example, a teacher or parent will often endorse difficulties in the area of working memory when direct measures fall within the average or higher range. I tend to rely on direct measures and direct observations. How do you reconcile the differences?

It sounds as though you do a very comprehensive assessment with plenty of focus on executive functioning. The relationships between our performance measures (i.e., tests) of executive function and ratings on the BRIEF instruments is one of my favorite topics, and I hope to do another webinar on this soon.

As I discussed earlier, there are multiple lines of evidence supporting the accuracy (e.g., validity) of both the BRIEF instruments and performance measures. But if both have evidence of validity, why don't they correlate more directly? This question has been raised in numerous articles including by us (Gioia & Isquith, 2004) and others (e.g., McAuley et al., 2010; Toplak et al., 2008), entire books (e.g., Sbordone, 2008), and one of my favorite articles by Cheryl Silver (2000), generally reaching the conclusion that these two types of measures are assessing different aspects of executive functioning. Further, evidence is clear that ratings on the BRIEF instruments are much more sensitive to problems and predictive of real-world functioning than are performance measures (Chevignard et al., 2012, Toplak et al., 2008), leading some to suggest use of the BRIEF as a practice standard when executive function deficits are suspected (Turkstra et al., 2005).

We first developed the BRIEF in response to our own clinical observations that how students performed on our performance tests was often at odds with parent and teacher reports of how they were functioning in the everyday home and school environments. Students would do great on tests but were described as dysregulated in school and at

home, and vice-versa. That led us to start writing down what parents and teachers said, turning them into statements, and collecting data to examine the question of why our tests don't often match real-world behavior.

What we, and many others, have learned over the past 20 years is that tests and the BRIEF are likely tapping different aspects of executive functioning. In a paper that summarized 50 years of executive function research, Don Stuss and Paul Burgess (2017) noted that we cannot measure all cognitive abilities using the same approach (i.e., tests alone), and that measures that mimic naturalistic situations are more likely to capture problems with executive functions than are tests.

Debbie Waber and colleagues offered an elegant way of understanding how these two types of measures work together. In an analysis of the NIH Normal Brain Development data, they showed that span tasks (e.g., digit span, spatial span) were associated with brain anatomy in the hippocampus while the BRIEF2 Working Memory scale was related to anatomy next to the hippocampus. They suggested that span tasks reflect the actual brain process of holding information in working memory while the BRIEF2 Working Memory scale reflected the implementation of that holding in the everyday real-world environment where there are multiple factors other than just "holding" at play.

Our colleagues at University of Houston in Jack Fletcher's lab did a nice study that speaks to the contribution of both tests and the BRIEF instruments to understanding students' executive functions. They looked at correlations between the BRIEF2 scales and reading and math performance, and between tests of executive functions and the same reading and math measures. They found that both the BRIEF2 scales and corresponding EF performance measures correlated with academic scores between .3 and .5. That is, each of the types of EF measures contributed moderately to scores on reading and math tasks. However, the two types of EF measures only correlated modestly, about .20 to .25, with each other. This means that they both contribute different information to understanding students' academic functioning.

There was once a conference where a few authors of different executive function measures gave presentations. The author of some performance measures suggested that tests were the best approach and that ratings were like taking a vote. The author of a rating scale said that tests of executive function were not reasonably related to everyday functioning and were not useful in assessing conditions like ADHD. While I was not asked my thoughts at the time, my BRIEF colleagues and I have often said and written that both performance tests and the BRIEF scales are important and useful in developing a full understanding of a students' executive functioning. They offer different,

but complementary, views of the conductor. See Chevignard, et al., (2012), Gerst et al., (2017), Gioia & Isquith, (2004), Faridi et al, (2015), McAuley, et al., (2010), Silver (2000), Toplak et al., (2009), and Turkstra et al., (2005)

Q: I find students with language deficits have working memory deficits. Is this sensitive to this?

An excellent observation! Yes. As adherents to Vygotsky's theory of self-regulation, we have always been interested in the relationships between language and executive function. In Vygotsky's view, thought, and thus self-regulation, is speech to the self. We have a running internal monologue that we use to think through problems and to self-regulate. Very young children can hold information in working memory (e.g. repeating "so big!" or imitating patty cake movements). They learn to use their internal speech, first out loud through narrating their own play and later to themselves to talk through problem-solving scenarios, practicing using their executive functions. For example, "Tools of the Mind," a Vygotskian early childhood intervention for developing better executive functions, teaches adults to encourage children's problem-solving narratives through play and has been shown to be effective in supporting executive functions in children at risk.

When we first wrote the BRIEF manual in 2000, we included mention of working memory problems in children with language delays or deficits. We added this as a comment in the BRIEF and BRIEF2 Interpretive reports, noting that mild elevations on the Working Memory scale may be associated with language difficulties.

One of my favorite cases over the past 30 years involved an assessment of an adolescent boy who was identified as intellectually disabled and emotionally disturbed and placed in a separate school for students with emotional and behavioral problems. He was breaking the rules there and was headed for a locked residential program. I met him in the waiting room and noticed that he was pleasant, socially engaging, and polite, but struggling for words and could not formulate verbal output. On testing he demonstrated above average visual/nonverbal problem solving but very low verbal functioning across the evaluation. I asked him about his behavior problems, and he was able to explain that he would get so frustrated at his inability to express his feelings that he would explode (e.g., smashing a television into a car windshield). When asked about his behavior problems and defiance at his current school, he explained that he

was asked to sit at a desk all day and fill out worksheets that he couldn't read. He would try to tell the teacher but was told to do his work. He would become so angry that he needed to leave the room and sit outside for a while to think and calm down. We agreed that this was a good step toward regulating his emotions. We also agreed that he was smart and not intellectually disabled but instead had a marked language impairment. We changed his placement to a program for students with language-based learning disabilities and got him through high school graduation.

Q: I work with Spanish speaking parents. Do you recommend translating the BRIEF2 and administering to Spanish-speaking parents?

BRIEF2 Parent and Self-Report Forms are currently available in Spanish from PAR.

When the original BRIEF came out, we had several colleagues in Spanish-speaking countries who translated and collected data, and there is a body of literature on how it performs.

There are many translations and adaptations of the BRIEF instruments that are used in clinical and research settings around the world. If you find yourself wanting to capture parent ratings from parents who read another language, the BRIEF instruments are available in many languages, including most languages used in Europe to many Asian languages and several African languages from Afrikaans to Xhosa. Contact PAR for permission to use a translated or adapted version of the BRIEF instruments.

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