



# ConcussTrack: Advanced Interpretation and Clinical Application of the PCSI-2 and PCEI

## **Questions & Answers**

Presented by Maegan Sady, PhD, and Gerard Gioia, PhD

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## Q: Are there data on learning issues/disabilities and recovery?

**A: Response during webinar:** There is some. Grant Iverson's review (from the earlier slide) lists the studies available as of a couple years ago. The thinking is that some individuals with LD prior to injury may have a more difficult time reintegrating, though it's certainly not universal. On the flip side, some students with LD may actually have a better experience because they already have individualized supports in place.

**Additional response:** There is no clear evidence that students with history of learning disability (LD) recover more slowly from concussion; in the review by Iverson et al. (2017), only one of eight studies found LD to be a predictor of slower recovery. However, individuals with LD are more likely to endorse concussion-like symptoms without concussion (Iverson, et al., 2015), which is where the RAPID score framework on the PCSI-2 and PCEI can be very useful. Removing the preinjury level of each symptom allows the clinician to better understand the effect of the concussion for that individual, rather than conflating with what might be completely normal symptoms for them.

## Q: Is a 504 Plan for a concussion ever appropriate, or is a concussion a temporary event not covered under a 504 Plan?

**A: Response during webinar:** A 504 Plan is often not needed for a standard concussion, as the process would take longer than the recovery would. For a recovery that goes on longer than a few months (which is almost always due to comorbid conditions), it could certainly be appropriate. In practice, some schools will do expedited 504 Plans for concussion, but a much better approach is something like a Student Support Plan that can be implemented more quickly.

**Additional response:** Dr. Karen McAvoy is an expert in this area, and she has a recent paper that nicely outlines the tiers of support for students returning with concussion (McAvoy et al., 2018). One of the key pieces to a smooth recovery



is putting supports in place proactively, which can be accomplished through an Individualized Health Plan or Student Support Plan. These include supports like postponing tests, allowing rest breaks, and reducing overall workload. The majority of students will not need supports beyond this first tier. Tiers 2 and 3 involve 504 Plans and IEPs, respectively, for students who meet the federal criteria in terms of the impact of the condition on their functioning.

The best way to streamline putting tier 1 supports in place for any given student is to have a clear pathway for those supports to be implemented, through a school- or district-wide concussion policy that any one of a host of school personnel (e.g., nurse, guidance counselor, athletic trainer) can activate. Dr. Gioia wrote a nice piece on building a school-based concussion policy and a medical-school partnership for implementing supports (Gioia, 2016). The content of such a policy, with recommended supports, is outlined in the Remove-Reduce/Educate/Adjust-Accommodate/Pace (REAP) concussion management program (Kirelik & McAvoy, 2016) as well as in Halstead et al. (2013). Another recent paper links recommendations for return to school to the CDC guidelines we mentioned in the talk (McAvoy & Haarbauer-Krupa, 2019).

## **Q: Do the authors feel that postconcussion syndrome is becoming a more understood concept and perhaps less controversial?**

**A: Response during webinar:** What a great question. We certainly hope so! There are so many nuances to it, and there is still disagreement on terminology, but I think we're always getting closer. The medical-school partnerships have been instrumental in this process, helping to translate the research to practice.

**Additional response:** I should clarify that I meant to convey I hope there is growing understanding of individuals with persistent symptoms, not necessarily of a "postconcussion syndrome." There continues to be disagreement over the criteria and the term itself, and for good reason. Since prolonged concussion symptoms are thought to almost always involve external, complicating factors, there is concern among clinicians about calling it a "postconcussion syndrome," thereby attributing



all of one's difficulties to concussion. Two consistent predictors of prolonged recovery are initial symptom burden and preinjury psychiatric history, so persistent symptoms are likely directly and indirectly related to concussion. Two of the papers referenced in the slides help delineate the multidisciplinary approach that can be taken for persistent symptoms (Kapadia et al., 2019; McNally et al., 2018).

**Q: Are there any school districts that you know of who have a health care provider or similar on their staff who are using either of the scales in their baseline data on students?**

**A: Response during webinar:** The design of the scales is such that you don't need to collect baseline (before an injury) data. There's a mismatch between the resources needed to obtain baseline data, particularly in younger students who are less likely to be in organized sports, and the utility for the small proportion who might be injured later.

**Additional response:** The scales are designed for postinjury assessment, taking into account both preinjury and current symptoms/problems, so the "baseline" is built in! Because of this design, the PCSI-2 and PCEI are not intended for use as a baseline measure to be administered prior to injury, and we do not recommend that schools spend their resources on this type of broad administration in uninjured students.

**Q: Realistically, do you recommend, and if so, at what age do you suggest parents/clubs/schools do "preconcussion" baseline assessments? What should be minimum components (e.g., SWAY, ImPact, King-Devick)?**

**A: Response during webinar:** The current international and CDC guidance is that wholesale preseason baseline testing is not recommended, especially if there are not



appropriate trained resources (i.e., personnel) with proper training in administration of cognitive/balance/ocular-motor tests as well as their interpretation. Most youth sports programs do not have these resources and high schools, even with athletic trainers, often are not appropriately resourced. Furthermore, the research has not demonstrated a significant contribution to the recovery management with baseline testing. This may seem counterintuitive, but we need better trained personnel and sensitive tools.

**Additional response:** Concern for lack of “appropriate trained resources” mentioned in the above response comes from empirical studies of baseline testing. For example, one study found scores on computerized baseline testing were on average lower (i.e., worse performance) when students were tested in large groups (Moser et al., 2011). Dr. Gioia’s group did not find this discrepancy between individual and group baseline results (Vaughan et al., 2014), proposing that part of the difference between studies was the training of test proctors, adherence to test administration instructions, and group size.

The bottom line is that a poorly executed baseline test can yield unreliable and even invalid results, which is more harmful than having no baseline (Randolph, 2011). Trained assessment professionals can interpret postinjury results without a baseline test using normative scores (Echemendia et al., 2012) and accurately identify most individuals with diminished cognition. In short, “the available evidence does not justify the financial costs, time and energy associated with its implementation” (Kirkwood et al., 2009, p. 1410).

That said, because individuals with learning disabilities or ADHD may have lower baseline cognitive performance (Zuckerman et al., 2013) and higher concussion incidence (Iverson et al., 2020), it may make sense to conduct baseline evaluations on individuals who are at highest risk (e.g., contact sports athletes who might be expected to perform well above or below average on traditional postconcussion performance tests).

**Q: Do these items correlate with the PCSI-2 and/or PCEI?**



**A:** *Note: The response during the webinar assumed that this question referred to the Related Clinical Questions on the PCSI-2, though it is possible the question referred to the other measures listed on the slide [ACE, CLASS-3, and ChEERS], so both will be addressed.*

**Response during webinar:** [The Related Clinical Questions on the PCSI-2] are not really designed to correlate, since they are flags for related but somewhat separate issues. For example, having trouble falling asleep didn't discriminate as a concussion symptom in our initial analyses, so it isn't on the scale the way it is for the original adult measures. However, it's not uncommon for insomnia-type effects to come later, once someone's sleep schedule is disrupted.

**Additional response:** If the question was meant to refer to the ACE, CLASS-3, and ChEERS, the answer is that they absolutely do! Chapter 5 in both the PCSI-2 and PCEI manuals outlines the finding of significant, positive correlations of the PCSI-2 and PCEI with one another, as well as with the other measures listed. One exception to this is that the PCSI-2 does not correlate strongly with exertional changes in symptoms on the ChEERS, as static symptom level and dynamic symptom response to exertion are independent phenomena. A few peer-reviewed publications further illustrate the complementary nature of the PCSI-2 and PCEI with the CLASS-3 and ChEERS, respectively (Ransom et al., 2016; Sady et al., 2019).

## Q: Why no teacher scales?

**A:** The simple answer is that we did not have the resources to develop a teacher report in tandem with the self- and parent reports. One of the related measures we discussed, the CLASS-3 (Gioia et al., 2020), focuses on the functional impact of concussion at school, and there is a teacher form of the CLASS-3 in development in an ongoing multisite study.

For students experiencing more prolonged recovery, teacher input via a more comprehensive measure such as the BRIEF-2 Teacher Form (Gioia et al., 2015) would certainly be appropriate.



## Q: Can either or both of these measures be used for children suffering post-COVID long-term cognitive impairments?

**A: Response during webinar:** It's certainly possible that many of the symptoms would overlap, but that sounds like a great empirical question to investigate!

**Additional response:** To investigate long-term cognitive impairment from a different medical cause such as COVID-19, we would recommend starting with focus groups and clinical expertise to develop a pool of possible items, rather than using an established questionnaire. The items on the PCSI-2 and PCEI were carefully chosen for their sensitivity to concussion, so you risk missing unique symptoms/problems, and none of the metrics (confidence intervals, severity classification levels, or base rates) would apply to a COVID-19 sample. We would recommend a broader measure such as the BRIEF-2 to begin such an investigation.

## Q: How do you envision this working with or apart from ImPACT testing?

**A: Response during webinar:** We'll address this either in the live session or in the follow-up written Q&A.

**Additional response:** Both sets of consensus guidelines recommend cognitive testing—particularly involving reaction time—as part of a comprehensive postconcussion evaluation (Lumba-Brown et al., 2018; McCrory et al., 2017), so ImPACT or other cognitive testing could be part of a complete evaluation involving the PCSI-2 and PCEI.

## Q: Looks like that website ([cdc.gov/headsup/schools](https://www.cdc.gov/headsup/schools)) is no longer available? Nevermind...Found it.

**A:** We're so glad you found the site! These CDC materials really are a fantastic resource, as they are accessible to so many stakeholders, and they were developed



by clinical and research experts in the field of pediatric concussion.

We also want to highlight the most recent addition to the school resource page, which is a handout on concussion recognition and response for those with intellectual disabilities or developmental disabilities. This specialty guide was designed by Drs. Catherine McGill and Shane Caswell, coleaders of the Virginia Concussion Initiative. We look forward to more resources for special populations from this team in the future!

**Q: To clarify, the PCSI-2 and PCEI are recommended for slow-to-recover postconcussion patients? What is the earliest time postconcussion these should be administered?**

**A:** The PCSI-2 and PCEI are recommended for patients in all stages of recovery from concussion! They can be used as soon as 1 day postconcussion (with the caveat that students who have not yet attempted any schoolwork may find some of the PCEI questions difficult to answer). We recommend using both measures repeatedly over time, for weekly or biweekly monitoring of progress.

**Q: No mention of any input from school staff in terms of functional impairment, nor any observations of the student in context....I'm confused.**

**A:** This webinar was designed to focus on assessment using structured measures, specifically the PCSI-2 and PCEI, so we did not have time to get into the details of all the useful components of concussion management. We completely agree that truly comprehensive care should involve input from additional sources, including performance in school and other settings, as well as input from teachers regarding behavior and participation in the classroom. McAvoy and Haarbauer-Krupa (2019) discuss this in more depth.





## Q: Though we are speaking about children and adolescents, can we use this with adults?

**A:** Analyses for the publication of the PCSI-2 and PCEI included individuals ages 5–18 years, so use in older age groups is not recommended without additional empirical investigation. The experiences of college students may not be too dissimilar to older teens, but the constellation of symptoms and executive functioning problems may be different in adults. We recommend using measures designed for this age range (e.g., Lovell et al., 2006; Potter et al., 2006).

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