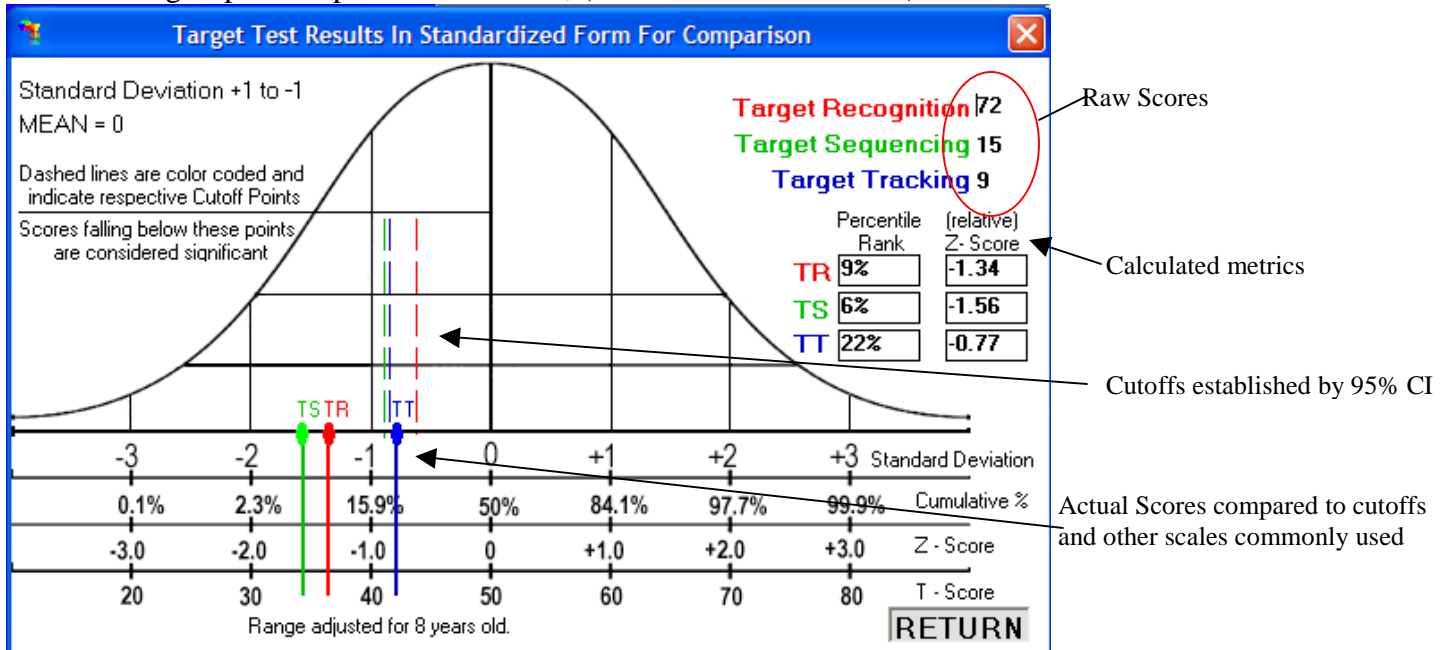


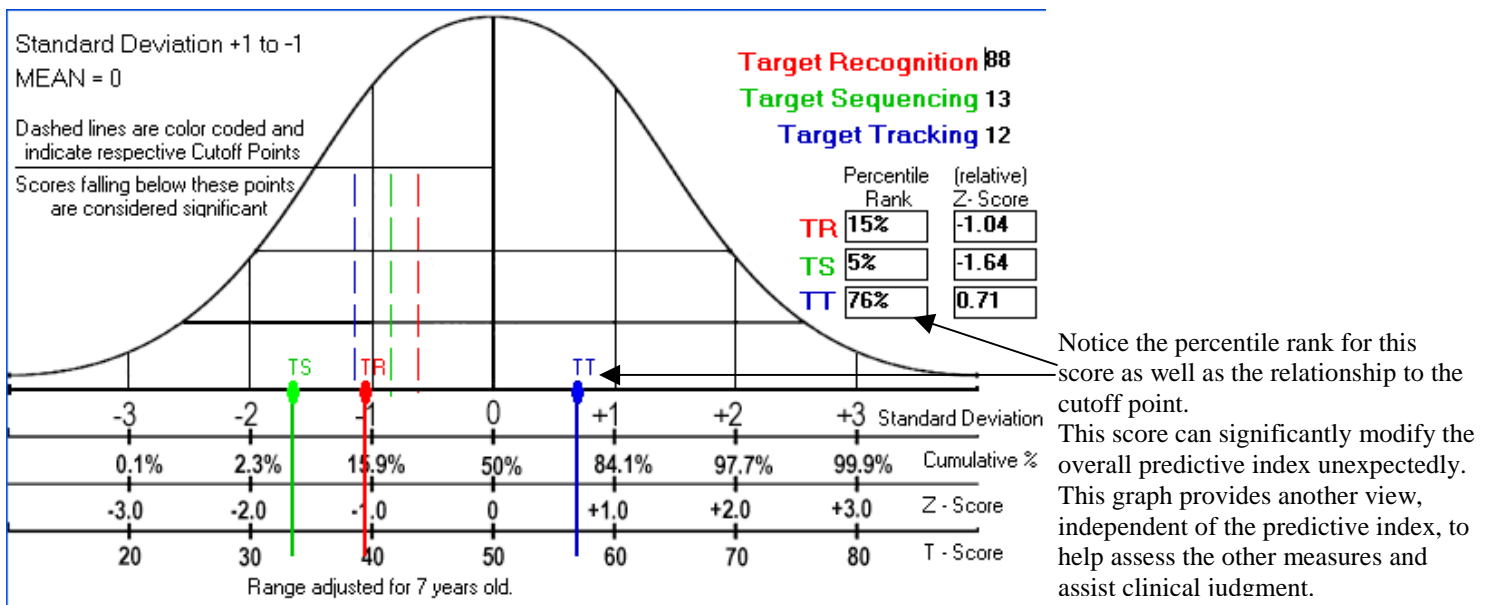
## Interpretation of Target Test scores compared to the non-ADHD group

While the PADDs program automatically calculates the predictive index for the user, at times, it is helpful to review raw score and standard score information. This also helps to illustrate the metrics used in calculating the probability index. The bell curve gives a visual representation of the normalized Relative Z-Scores, percentile rank, and cutoff points shown in the cognitive test report. Table 1 below shows the 95% confidence intervals and the age adjusted cutoff points relative to a given raw score.

This graph is used to visually compare the individual test performances, (color coded indicators), to the non-ADHD group cutoff points for that test, (color coded dashed lines).



Using these age specific cut points, the following decision rule is applied: In order to be considered as a classification hit, two of the three Target Tests of Executive Functioning performances must fall within the expected direction, i.e.,  
 (At least two clinical scores for ADHD classification, or at least two non-clinical scores for classification as non-clinical).



This graphic shows an instance where one of the target test scores,(TT), falls well outside the range of the other scores. Because of the additive and subtractive nature of our predictive index, this one extreme score will affect the overall probability in an unexpected direction, (as well it should). In an instance such as this, the clinician should consider the 2 out of 3 rule described above when making a clinical judgment.

Analysis of the Target Subtests psychometric and clinical support revealed that individuals with a clinical diagnosis of ADHD scored significantly lower on each of the three tests as compared to individuals who had not been diagnosed with ADHD, all  $t_s > 19$ ,  $p < .001$ . It is also important to note that the 95% confidence intervals that are based on standard errors of measurement (SEM) calculated with reliability estimates of .85 supports the selection of the cut scores used for diagnostic purposes with very little error in classification. Table 4.1 presents the 95% confidence intervals for each individual age grouping. As can be seen little to no overlap is evident on the Target subtests between the Typical and Clinical groups.

**Table 1** PADDs cut scores, means, standard deviations, standard errors of measurement, and 95% confidence intervals as a function of sample and age groupings.

			Typical				Clinical				
AGE	PADDs subtest	Cut score	M	SD	SEM	95% CI	Cut score	M	SD	SEM	95% CI
6 yrs	TR	>94	103.12	34.23	12.81	78 – 128	≤94	65.72	37.31	13.96	38 – 93
	TS	>22	24.12	10.83	4.05	16 – 32	≤22	16.54	9.46	3.54	10 – 23
	TT	>6	8.65	3.46	1.29	6 – 11	≤6	4.98	3.11	1.16	3 – 7
7 yrs	TR	>102	111.75	24.92	9.32	93 – 130	≤102	75.68	33.92	12.69	51 – 100
	TS	>26	30.29	5.2	1.95	26 – 34	≤26	16.15	8.83	3.30	10 – 23
	TT	>6	10.13	3.18	1.18	8 – 12	≤6	4.5	2.43	0.91	3 – 6
8 yrs	TR	>111	118.41	27.36	10.24	98 – 138	≤111	80.91	31.74	11.88	58 – 104
	TS	>26	31.39	6.62	2.48	27 – 36	≤26	18.21	9.14	3.42	11 – 25
	TT	>8	11.6	3.53	1.32	9 – 14	≤8	5.82	3.66	1.37	3 – 9
9 yrs	TR	>113	130.25	14.77	5.53	119 – 141	≤113	83.72	30.93	11.57	61 – 106
	TS	>28	32.23	6.11	2.29	28 – 37	≤28	19.77	8.75	3.27	13 – 26
	TT	>8	11.91	3.97	1.49	9 – 14	≤8	5.78	3.31	1.24	3 – 8
10 yrs	TR	>125	134.32	12.03	4.50	125 – 143	≤125	107.63	18.95	7.09	94 – 122
	TS	>31	34	5.2	1.95	30 – 37	≤31	26.79	6.36	2.38	22 – 31
	TT	>11	13.65	3.54	1.32	11 – 16	≤11	9.13	4.50	1.68	6 – 12
11 yrs	TR	>128	140.49	8.49	3.18	134 – 147	≤128	98.85	34.68	12.98	73 – 124
	TS	>32	34.87	6.52	2.44	30 – 40	≤32	27.1	7.48	2.80	22 – 33
	TT	>12	14.8	3.47	1.30	12 – 17	≤12	8.95	4.43	1.66	6 – 12
12 yrs	TR	>128	137.77	9.77	3.66	131 – 145	≤128	130.07	14.42	5.40	119 – 141
	TS	>34	36.27	2.49	0.93	34 – 38	≤34	29.79	4.08	1.53	27 – 33
	TT	>14	16.05	2.77	1.04	14 – 18	≤14	10.64	4.80	1.80	7 – 14

Note. Within typical sample, age 6  $n = 25$ , age 7  $n = 32$ , age 8  $n = 52$ , age 9  $n = 64$ , age 10  $n = 79$ , age 11  $n = 53$ , age 12  $n = 25$ . Within clinical sample, age 6  $n = 72$ , age 7  $n = 80$ , age 8  $n = 95$ , age 9  $n = 67$ , age 10  $n = 44$ , age 11  $n = 22$ , age 12  $n = 15$ . SEM = Standard error of measurement.

Using interval specific cut points, the following decision rule was applied to 725 subjects: In order to be considered as a classification hit, two of the three Target Test scores must fall within the predicted direction for subjects to remain classified in their initially known group assignment (At least two clinical scores for ADHD classification and at least two non-clinical scores for classification as non-clinical).

Table 2 presents the clinical utility of the Target subtests by individual age. Taken along with the lack of overlap seen in the 95% confidence intervals presented in Table 1, the Target Subtests have demonstrated superior clinical performance in separating typical age peers from their ADHD counterparts.

**Table 2.** Sensitivity, specificity, positive predictive power, and negative predictive power by age grouping.

<b>AGE</b>	<b>SENS</b>	<b>SPEC</b>	<b>PPP</b>	<b>NPP</b>
<b>6 yrs</b>	.89	.84	.94	.72
<b>7 yrs</b>	.90	.88	.95	.78
<b>8 yrs</b>	.87	.87	.92	.79
<b>9 yrs</b>	.91	.92	.92	.91
<b>10 yrs</b>	.86	.91	.84	.92
<b>11 yrs</b>	.86	.92	.83	.94
<b>12 yrs</b>	.80	.84	.75	.88

### **Interpretation of PADDs Results (General Guidelines)**

Despite the highly acceptable clinical performance revealed above, raw scores for each Target subtest were analyzed to determine the specific sensitivity and specificity for each raw score at a given age interval. These sensitivities and specificities were then converted to specific Likelihood ratios, which could be applied incrementally via a nomogram to combine information from behavioral ratings along with the cognitive performances from the TTEF. The incremental inputs from behavioral and cognitive results develop a predictive index for and or against a diagnosis. This analysis when considered against the population base rate constitutes a highly standardized and effective evidence based ADHD screening procedure.

### **PADDs Interpretation Guidelines For Unusual or Unexpected Results**

Despite the outstanding classification potential demonstrated by the Target Tests of Executive Functioning with known groups (see Table 4.2), these metrics, when applied against a base rate of 4% (as with ADHD) will result in significantly lower predictive power than is implied from their ability to separate groups with 100% known assignment (for a graphic depiction see case studies section of manual). Thus, each potential raw score from the Target Tests of Executive Functioning was analyzed to determine the exact percentile rank for both the ADHD and Typical groups that corresponded to that given raw score. This was done so as to determine the sensitivity and specificity of every possible score for each of the three Target Tests. These sensitivities and specificities were used to develop likelihood ratios from every potential score for all three subtests. These ratios could then be applied incrementally with other data, as judged clinically appropriate, to a Fagan nomogram. Given that the PADDs program collects data for and against diagnosis it is possible to get unusual results and while these should not be routine we have listed below several profiles that we have encountered on occasion.

## Profile 1

**Positive parent and teacher ratings for ADHD produces probability index of 74% and two of the three Target subtests fall within the non-clinical range (see 95% confidence intervals *table 4.1*) reducing the predictive index away from supporting a diagnosis.**

Discussion:

This profile suggests that at least under some circumstances the subject can display adequate attention and executive control and therefore points to the risk of over reliance on behavioral ratings or test measures alone. The most common outcomes found with this profile have been:

**A.** A bright hyperactive subject who was challenged and engaged by the Target Tests. This child often presents as making solid grades but is a frequent disruption to the learning environment. Often complaints show that the child easily irritates peers, teachers, parents and relatives. They may play video games for hours on end and may like risk taking activities. These children typically have a difficult time with slow paced activities, such as the classroom or waiting in line and listening to instructions during sporting activities. These subjects also often show difficulty modifying their activity patterns to better fit with others at church, movies, when dining out, and in most other instances when confronted with tasks and environments that lack frequent, clear and meaningful rewards. As always the final determination of a clinical diagnosis rests with the clinician weighing all the available information. The clinician must determine the extent to which these difficulties impair the social and emotional development of the subject and the likelihood that behavioral and/or medical intervention will help.

**B.** Consideration that an academic and/or performance problem is creating behaviors similar to ADHD.

Below we have listed some of the most frequently cited precautions given when routinely using rating scales.

Subjectivity can be skewed

Demand characteristics may enhance personal leanings

Can be inconsistent even between parents and multiple teachers

Multiple ratings may be considered as redundant information in some cases

Bias may reflect more about the relationship of the child & rater than about the organic functioning of the child.

When the hyperactive profile described above is not evident, we have found many instances of reading disabilities or reading delay especially when the child is being identified for the first time as a rising 3<sup>rd</sup> or 4<sup>th</sup> grader.

**C.** The behavioral rating scales are picking up primarily on an adjustment or emotional disorder.

Clinical judgment, the CADI and other multi-level ratings can help rule in or out such conditions. In some cases they occur co morbidly with ADHD but this is usually seen with combined poor performance on the Target Subtests.

## Profile 2.

### One extreme outlier significantly modifies the predictive model

Discussion: As can be seen in the descriptive statistics present for group classification in Table 4.1, the 95 percent confidence intervals show little to no overlap for the cut scores. However, at times a given score may fall well above or below that found in the confidence bands. The following recommendations are offered to assist in deciding the weight to give such scores.

**A Very Low Score:** will not modify the predictive model. This would be a score that was not encountered by either reference group as with a score of 2 for the Target Tracking subtest. In general, this type of score is so infrequent that it should not be interpreted.

**A Very High Score:** When found between two low scores can substantially alter the predictive model as with a Target Tracking score of 17. A review of the confidence intervals shows that this score falls above the 95<sup>th</sup> confidence interval for the non-clinical group. Thus, such a score should not be given more weight than the combined input of all other sources of data.