

AQT Cognitive Speed Differentiates Adults with and without ADHD

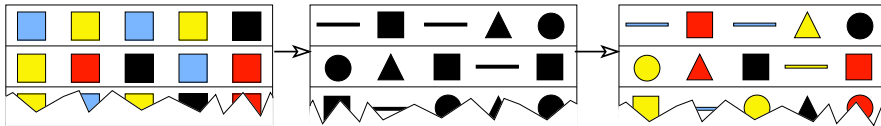
Niels Peter Nielsen, MD¹ and Elisabeth H. Wiig, PhD²

¹ Hvidovre Hospital, Department of Psychiatry, Copenhagen, Denmark;
² Boston University, Communication Disorders, Boston, MA, USA and Knowledge Research Institute, Inc., Arlington, TX, USA

Background

- **A Quick Test of Cognitive Speed (AQT)** – a quantitative timed screening test – investigated potential differentiation of adults with and without ADHD.
- **Objectives:**
 - a. Obtain quantitative processing-speed measures of executive functions known to be impaired in ADHD;
 - b. Compare pre- and post-medication processing-speed measures to controls;
 - c. Evaluate sensitivity and specificity of **AQT** with ADHD adults.
- **AQT was chosen as it:**
 - a. Provides objective, quantitative measures of processing speed (sec.) with rapid naming tasks;
 - b. Requires from 3-5 minutes for administration and scoring;
 - c. Is a proven candidate for screening for executive-function impairments associated with dementia.
- **AQT features:**
 - a. Two single-dimension tests, **color (C)** and **form (F)** naming with 40 stimuli each;
 - b. One dual-dimension test, **color-form combination (CF)** naming with 40 stimuli;
 - c. **C** and **F** measure reaction + retrieval + response times;
 - d. **CF** measures, in addition, 'switch costs' and increased demands on attention, working memory and set shifting;
 - e. rCBF and fMRI of normal adults during **CF** naming show bilateral activation of temporal-parietal and sub-cortical brain regions and hippocampus.

AQT Color-Form Test Plates (40 items each)



Source: A Quick Test of Cognitive Speed (AQT). San Antonio, TX: Pearson/PsychCorp, 2002

Methods

Participants

- 30 adults (18 - 43 yr.) referred to a psychiatric center for evaluation of ADHD symptomatology and possible treatment with Methylphenidate.
- 21 met **ICD-10 F90.0** (hyperkinetic disturbances) and 9 met **F90.9** (hyperkinetic disturbances, unspecified) criteria. None received prescription medication for ADHD at intake.
- 30 age- and sex-matched normal controls, without ADHD symptomatology or other neuro-psychiatric disorders.

Treatment

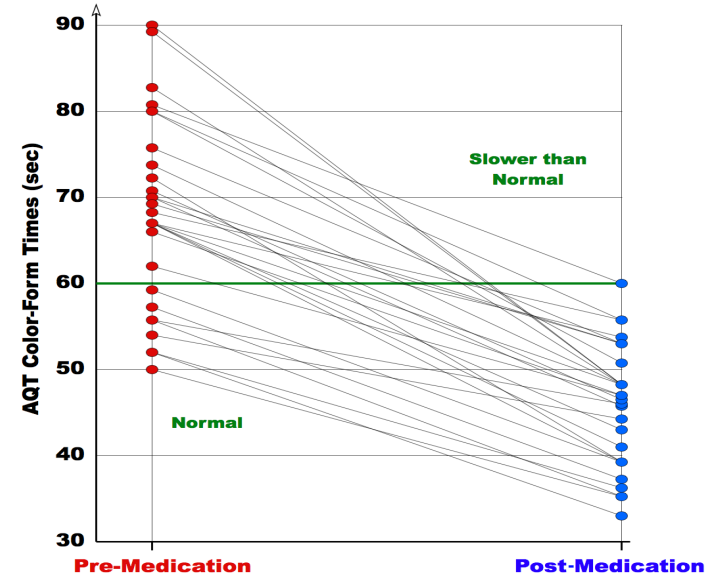
- Treatment concurred with Danish psychiatric practice starting with referral for diagnostic evaluation of possible ADHD based on a psychiatric interview, **ICD-10** and **ASRS-V1.1** criteria.
- After initial responsiveness to Methylphenidate, dosage was increased and stabilization of **ADHD** symptoms was determined with each patient's acceptance, shared evaluation and discussion with the psychiatrist.

Measurements

- Unmedicated patients completed **ASRS-V1.1** at intake and ratings ranged from 22 to 70 points ($M = 47.4$), indicating likely ADHD (i.e. >20 points).
- **AQT C**, **F**, and **CF** were administered: (a) at intake, without medication, (b) during treatment, and (c) after stabilization of ADHD symptoms with Methylphenidate.

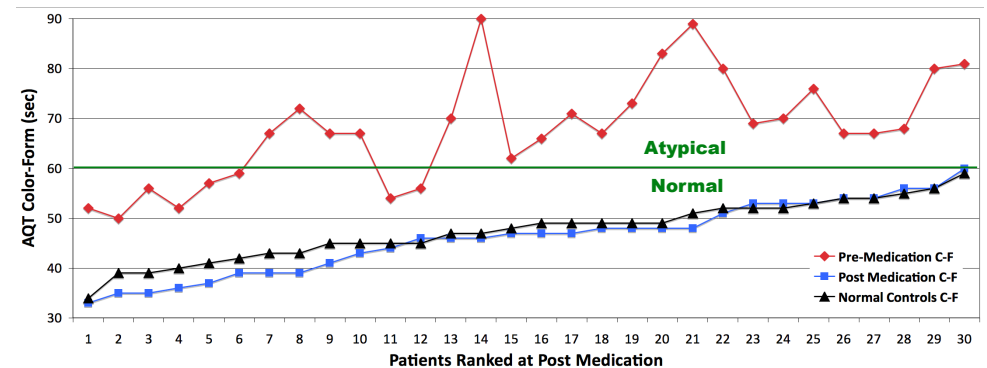
Results - continued

Figure 1. **AQT CF** naming times (sec.) for each adult with ADHD without medication (left) and after stabilization of ADHD symptoms with Methylphenidate (right) ($n = 30$).



- Two-tailed t-tests, assuming unequal variance, tested significance of overhead (O) differences between ADHD pre- and post-medication ($t = 6.80$; $p < 0.0000$, $\eta^2 = 0.61$) and ADHD post-medication and controls ($t = -0.07$; $p = 0.94$).
- Figures 2 and 3 show individual naming times for ADHD adults and controls.

Figure 2. **AQT CF** naming times (sec.) for each of 30 adults with ADHD pre- and post-medication with Methylphenidate and 30 normal controls.



- Sensitivity and specificity evaluated the **AQT additive model** for differentiating patients with ADHD pre-medication from normal controls (See Table 3). Pass/fail decisions used normative naming-time and overhead criteria for the upper limits of normal performance (+ 1 SD).

- Overhead, $O = CF - (C + F)$, measured processing efficiency, as norm-referenced in a study with 270 normal adults (ages 18-70 years).
- C , F , CF and O , were measured before and after treating adults with ADHD with Methylphenidate and compared to performances by normal controls.
- Psychiatric interviews and **AQT** were administered concurrently during treatment.
- **AQT** was administered once to the control group.

Statistical Analysis

- One-way ANOVA with post hoc analyses of log-normal measures evaluated C , F and CF differences between (a) ADHD pre- and post-medication, (b) ADHD pre-medication and controls, and (c) ADHD post-medication and controls.
- T-tests, assuming unequal variances, compared overhead measures $O = CF - (C + F)$.
- Sensitivity and specificity compared individual naming-time measures to criterion-referenced cut-off times (sec.) for normal performance ($< +1 SD$).

Results

Table 1. Descriptive statistics for AQT naming-times (sec.) for the ADHD group pre- and post-medication and for controls. (No outliers were removed.)

AQT	Color		Form		Color-Form		Overhead	
	M	(SD)	M	(SD)	M	(SD)	M	(SD)
ADHD Pre-medication	24.60	(3.98)	30.13	(6.26)	67.93	(10.66)	13.07	(6.92)
ADHD Post-medication	20.23	(3.14)	22.63	(4.23)	46.07	(7.17)	3.20	(3.92)
Non-ADHD Controls	20.73	(2.94)	23.53	(3.50)	47.53	(5.82)	3.27	(3.29)

- Pre-medication, the F and CF means for the ADHD group were in the slower-than-normal range and overhead (O) in the larger-than-normal range.
- Post-medication, ADHD means for C , F , and CF and overhead (O) were in the normal range. (Figure 1 shows changes in CF processing speed).
- Control group means were in the normal range.
- ANOVA main effects were significant for all ln measures. Effect size was small for C ($\eta^2 = 0.24$) and F ($\eta^2 = 0.33$), and medium for CF ($\eta^2 = 0.59$).
- Post-hoc analyses (**Tukey HSD**) showed significant mean differences between ADHD pre- and post-medication and ADHD pre-medication and controls.

Table 2. One-way ANOVA with post hoc analyses of ln values for AQT measures for 30 adults with ADHD pre- and post- medication and 30 controls.

	df	SS	MS	F	P	Tukey HSD
C	2 87	0.6648 2.1005	0.3324 0.0241	13.77	0.0075	ADHD pre vs post 4.84*
						ADHD pre vs controls 4.18*
						ADHD post vs controls 0.67
F	2 87	1.3749 2.8204	0.6875 0.0324	21.21	0.0028	ADHD pre vs post 8.57*
						ADHD pre vs controls 7.22*
						ADHD post vs controls 1.35
CF	2 87	2.7668 1.928	1.3834 0.0222	62.42	0.002	ADHD pre vs post 14.30*
						ADHD pre vs controls 12.97*
						ADHD post vs controls 1.32

* Tukey HSD accepted. Abbreviations: C = color, F = form, CF = color-form. Pre = pre-medication; Post = post-medication.

Figure 3. AQT overhead (O) for 30 adults with ADHD pre- and post-medication with Methylphenidate and 30 normal controls.

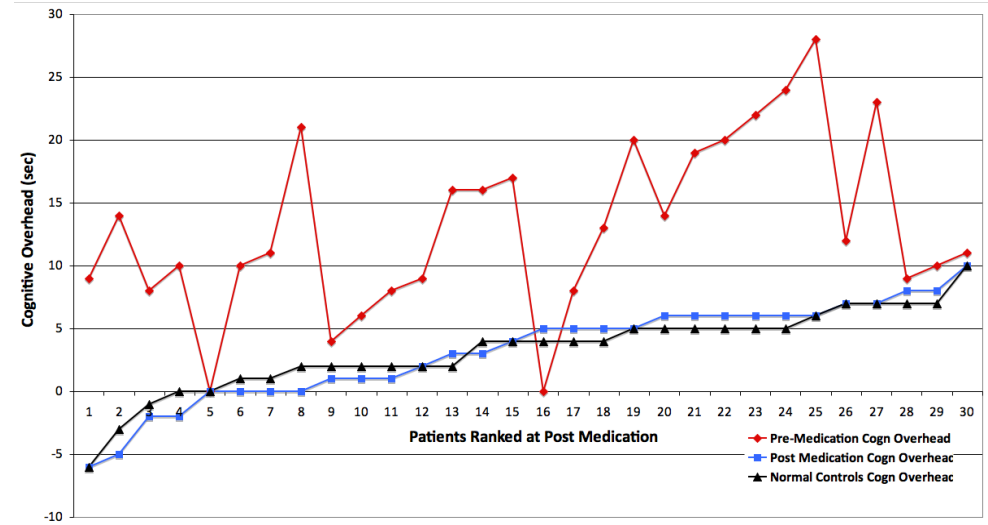


Table 3. AQT Sensitivity and specificity at pre-medication for 30 adults with ADHD and 30 controls.

AQT	Color	Form	Color-Form	Overhead	Color-Form or Overhead
Sensitivity	43%	43%	73%	87%	93%
Specificity	97%	100%	100%	87%	100%

Conclusions

- Findings suggest that the **AQT additive model** may provide a sensitive quantitative measure for screening for ADHD and monitoring pharmacological treatment effects.
- **AQT** measurements can indicate when subjects have reached stabilization and normal processing speeds
- **AQT** single- and dual-dimension processing speed and efficiency were significantly reduced in adults with ADHD before medication, but restored to normal levels after treatment with Methylphenidate.
- A combination of pass/fail for either the **AQT** dual-dimension or overhead measures or both resulted in high sensitivity (93%) and specificity (100%).
- Findings are preliminary, as data were collected in an outpatient psychiatric practice, without external funding, and procedures were limited by requirements to follow Danish psychiatric practice in a social-medicine environment.

References

1. Wiig, E.H., Nielsen, N.P., Mintho, L., & Warkentin, S. *A Quick Test of Cognitive Speed (AQT)*. San Antonio, TX: Pearson/PsychCorp, 2002.
2. Wiig EH, Nielsen NP, Mintho L, Warkentin S. *AQT: Assessment of Parietal Function*. Svensk Version & Norsk Versjon. Stockholm, Sweden: Pearson/PsychCorp, 2003.
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4. Nielsen NP, Wiig EH. An additive model for relations between AQT single- and dual-dimension naming speed. *Percept & Mot Skills* 2011; 112:1-10.