AQT Cognitive Speed Differentiates Adults with and without ADHD

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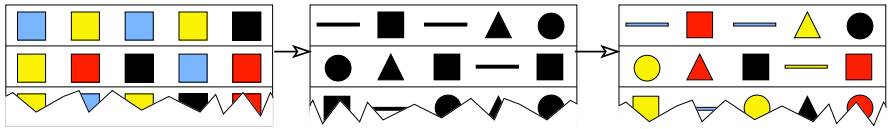
Background

- ***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

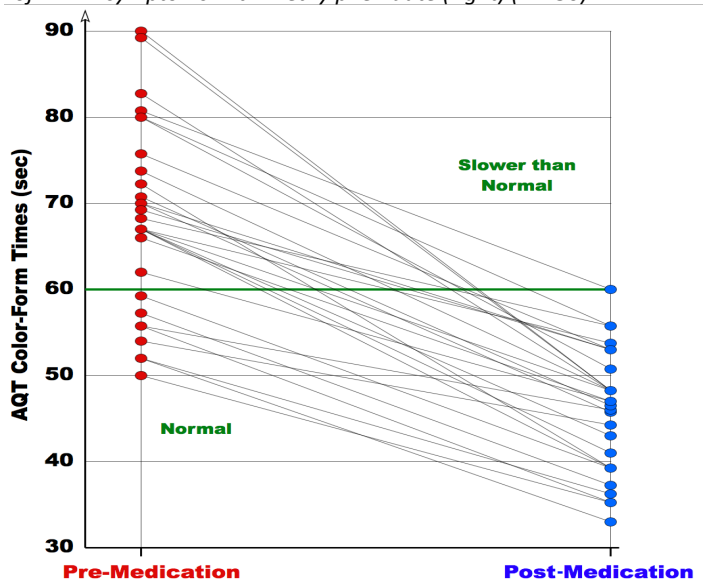
- Treatment concurred with Danish psychiatric practice starting with referral for diagnostic evaluation of possible ADHD based on a psychiatric interview, **ICD-10** and **ASRS-V1.1** criteria.
- After initial responsiveness to Methylphenidate, dosage was increased and stabilization of ***ADHD*** symptoms 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.

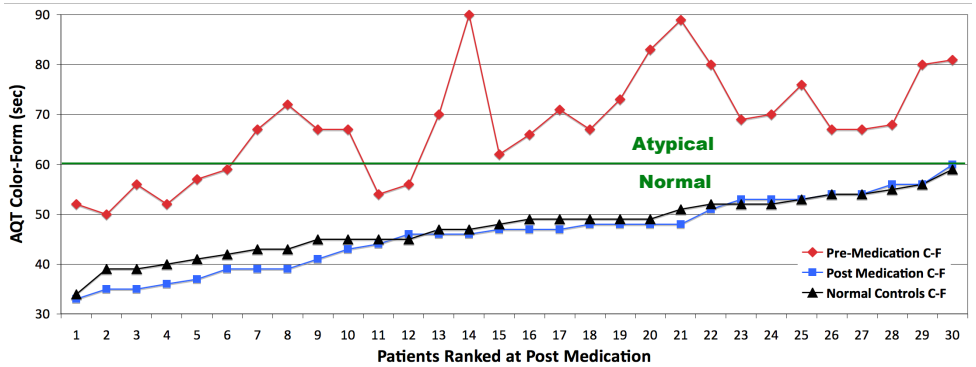
Results - continued

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 ADHD pre vs controls ADHD post vs controls	4.84* 4.18* 0.67
F	2 87	1.3749 2.8204	0.6875 0.0324	21.21	0.0028	ADHD pre vs post ADHD pre vs controls ADHD post vs controls	8.57* 7.22* 1.35
CF	2 87	2.7668 1.928	1.3834 0.0222	62.42	0.002	ADHD pre vs post ADHD pre vs controls ADHD post vs controls	14.30* 12.97* 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.*

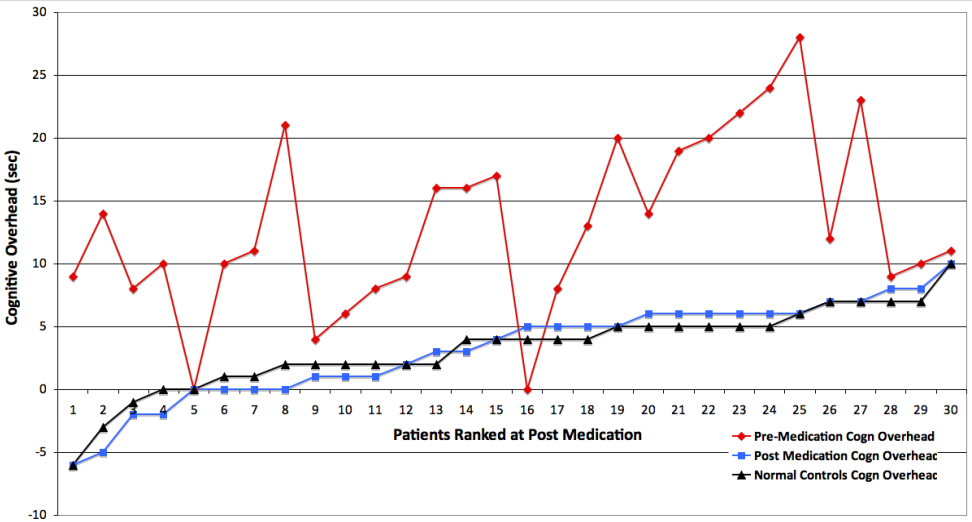


*Table 3. **AQT** Sensitivity and specificity at pre-medication for 30 adults with ADHD and 30 controls.*

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., Minthon, L., & Warkentin, S. *A Quick Test of Cognitive Speed (AQT).* San Antonio, TX: Pearson/PsychCorp, 2002.
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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.