

# The Society for Clinical Child and Adolescent Psychology (SCCAP): Initiative for Dissemination of Evidence-based Treatments for Childhood and Adolescent Mental Health Problems

With additional support from Florida International University and The Children's Trust.



# Keynote

## Evidence-based Treatment of Tourette's Syndrome and Tic Disorders

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# Behavior Therapy for Children with Tourette Syndrome

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Professor of Psychology  
Associate Dean of the Graduate School  
University of Wisconsin-Milwaukee

# Disclosures-Woods

## Research Support

- NIMH
- Tourette's Syndrome Association

## Speaking honoraria

- From various academic institutions
- Tourette Syndrome Association

## Royalties

- Guilford Publications
- Context Press
- Oxford University Press
- Springer Press

# What is a Tic?

“... a sudden, rapid, recurrent, nonrhythmic, stereotyped motor movement or vocalization”

# Tics: Phenomenology

- Tics are neurologically based, not learned
- Tics involuntary, though may be suppressed
- Often comes with a premonitory sensation that is reduced temporarily after doing a tic
- From simple to complex tics (examples)
  - Simple motor: eye blinking, shoulder shrugging
  - Simple vocal: throat clearing, grunting
  - Complex motor: touching, squatting, jumping
  - Complex vocal: words and phrases

# What is Tourette Syndrome?

- Motor and Vocal tics
- For 1 year
- ± Impairment

# Common Problems in Persons with TS

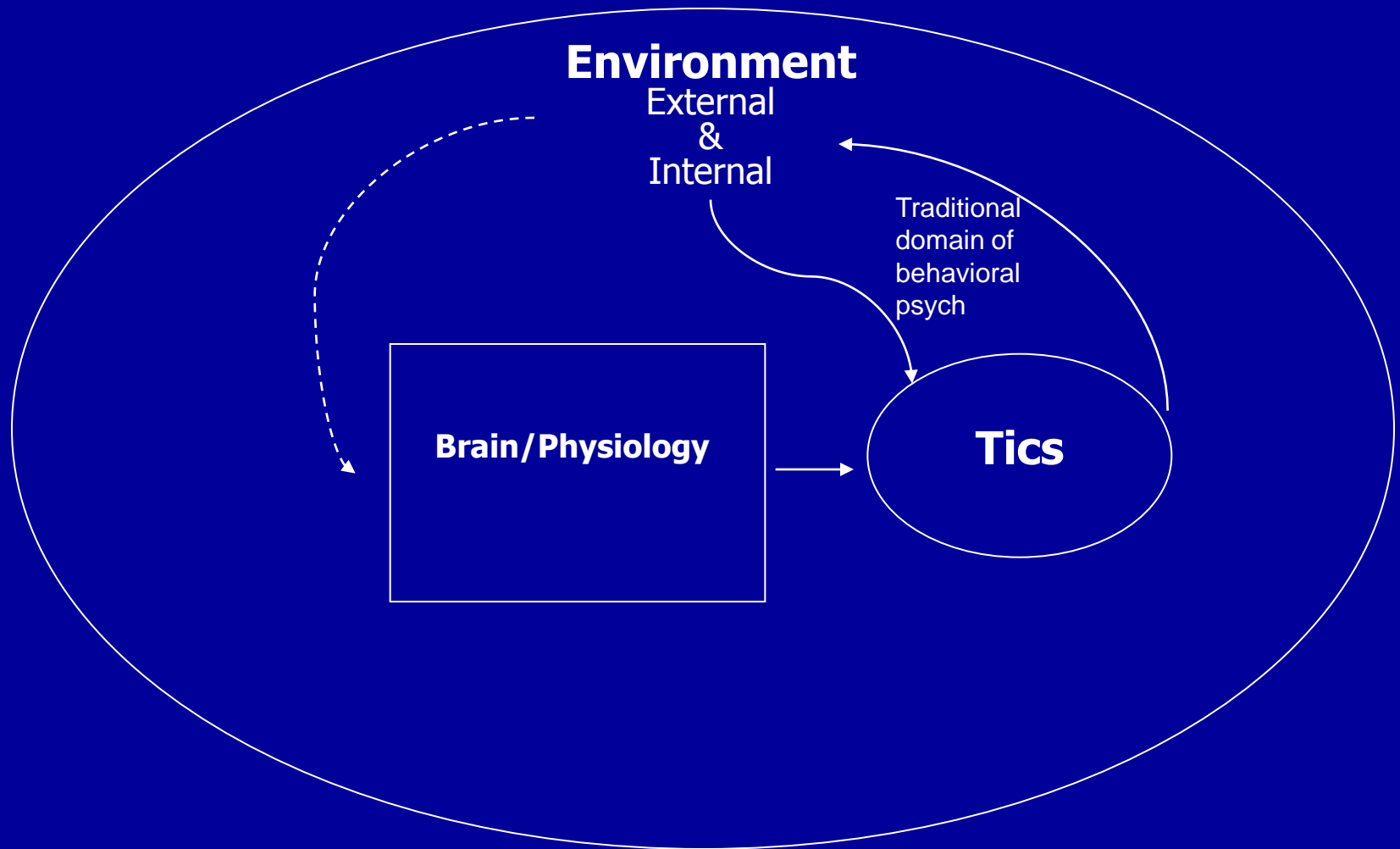
- Disorders
  - Obsessive compulsive disorder
  - ADHD
  - Anxiety
  - Depression
  - Disruptive behavioral disorders
- Difficulties
  - Anxiety
  - Mood
  - Impulse and behavior control
  - Problems with learning



# Course of Tourette Syndrome

- Starts in young children
- More common in males
- Starts with motor tics, then vocal
- Starts in the head and face, then in the body
- Starts with simple tics, then more complex tics
- Peak severity is in early to mid teens
- Symptoms wax and wane throughout disorder
- Development of comorbid conditions is usually later except for ADHD
- Typically treated with medication
- Symptoms are heavily and predictably influenced by surroundings

# Behavioral Model of Tics



# Why Look for Environment-Tic Relationships?

- By understanding how environmental (internal and external) antecedents and consequences impacts tics, the environment can be modified in a targeted way to promote tic reduction

# Environment-Tic Relationships that Maintain Tics

## Antecedents

*Places/Situations*

*Other People*

*Activities*

*Internal Experiences*

**Tics**

```
graph LR; AS[Places/Situations] --> T[Tics]; OP[Other People] --> T; A[Activities] --> T; IE[Internal Experiences] --> T; T --> PR[Positive Reinforcement (e.g., others' reactions to tics)]; T --> NR[Negative Reinforcement (e.g., escape from activities, relief from aversive unpleasant internal experiences)];
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## Consequences

*Positive Reinforcement (e.g., others' reactions to tics)*

*Negative Reinforcement (e.g., escape from activities, relief from aversive unpleasant internal experiences)*

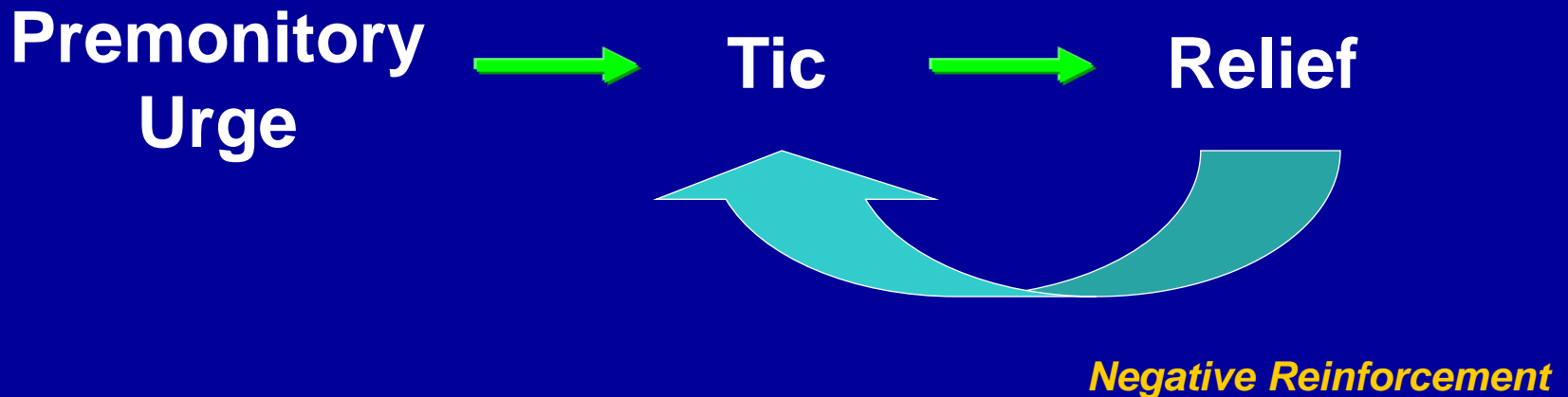
# Antecedent Events that Impact Tics

- Being upset or anxious (Silva et al., 1995)
- Watching TV (Silva et al., 1995)
- Being Alone (Silva et al., 1995)
- Social Gatherings (Silva et al., 1995)
- Stressful Life Events (Surwillo et al., 1978)
- Hearing Others Cough (Commander et al., 1991)
- Talking about tics (Woods et al., 2001)

# Consequence Events That May Impact Tics

- Tics can be made more frequent by...
  - Social reactions (e.g., Watson & Sterling, 1998)
    - Parental attention or comfort
    - Peer attention
  - Escape from an aversive situation
  - Reduction of premonitory urge as a result of a tic
- Tics can be made less frequent by...
  - Reinforcing suppression of tics
    - Potential reinforcers for suppression could include
      - Avoidance of teasing
      - Being able to participate in a social activity or sport
      - Avoidance of embarrassment

# Negative Reinforcement Hypothesis of Tic Maintenance



Tics can be maintained by elimination of premonitory urge. Biological processes underlying the urge and its reduction are not understood.

# Experimental Studies Investigating the Effects of Consequences on Tics

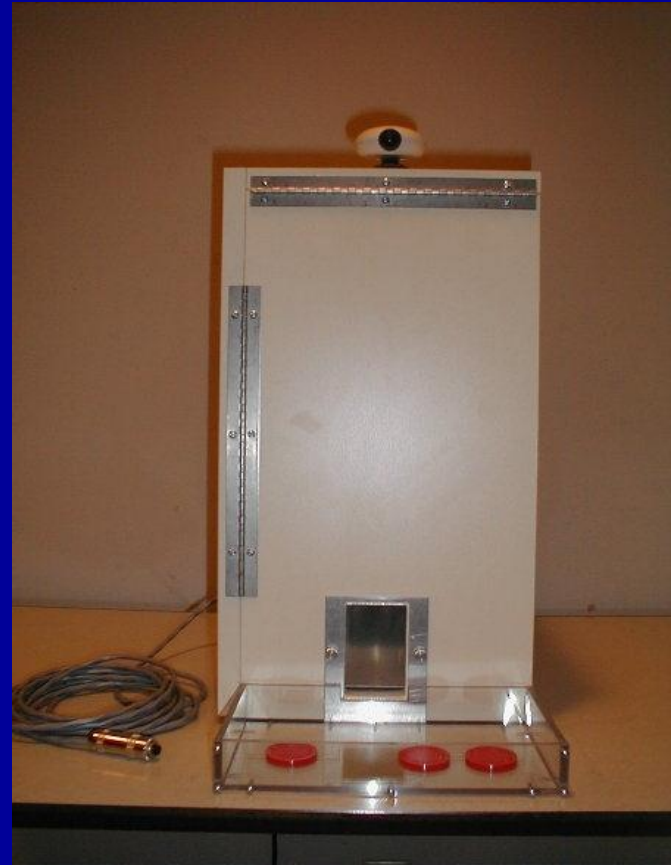
- Study 1: Can reinforcing tic suppression create tic reduction?
- Study 2: Is it reinforcement that creates the reduction?
- Study 3: Can stimulus control over tics develop?
- Study 4: What effect does stress have on tics
- Study 5: Evidence for negative reinforcement hypothesis?



# Analysis of Environmental Variables

## Controlling Tic Reduction

- Tic Detector
  - Remote controlled operant token dispenser
  - Inactive computer camera mounted on top of box
  - Tokens delivered by experimenter who observes from behind an observation mirror
  - Tokens delivered for every 10 sec. tic-free intervals
  - Interval resets if a tic occurs
  - Tokens later exchanged for small amount of money



# Study 1: Can reinforcing tic suppression create tic reduction?

4 children with TS

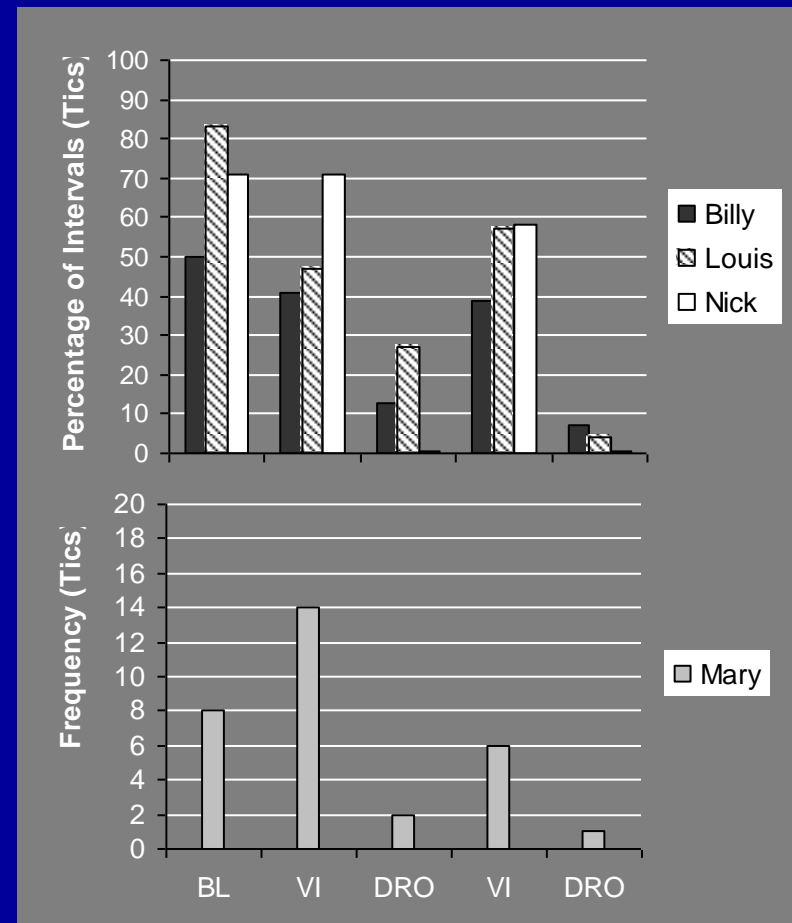
Instructions to suppress produced a 10.3% reduction

Adding reinforcement to instructions produced a 76% reduction

Results suggest that consequences to tics can impact tic frequency

Is it really the consequence, though, or just being reminded to suppress?

Woods & Himle (2004). *Journal of Applied Behavior Analysis*



**BL (Baseline)**

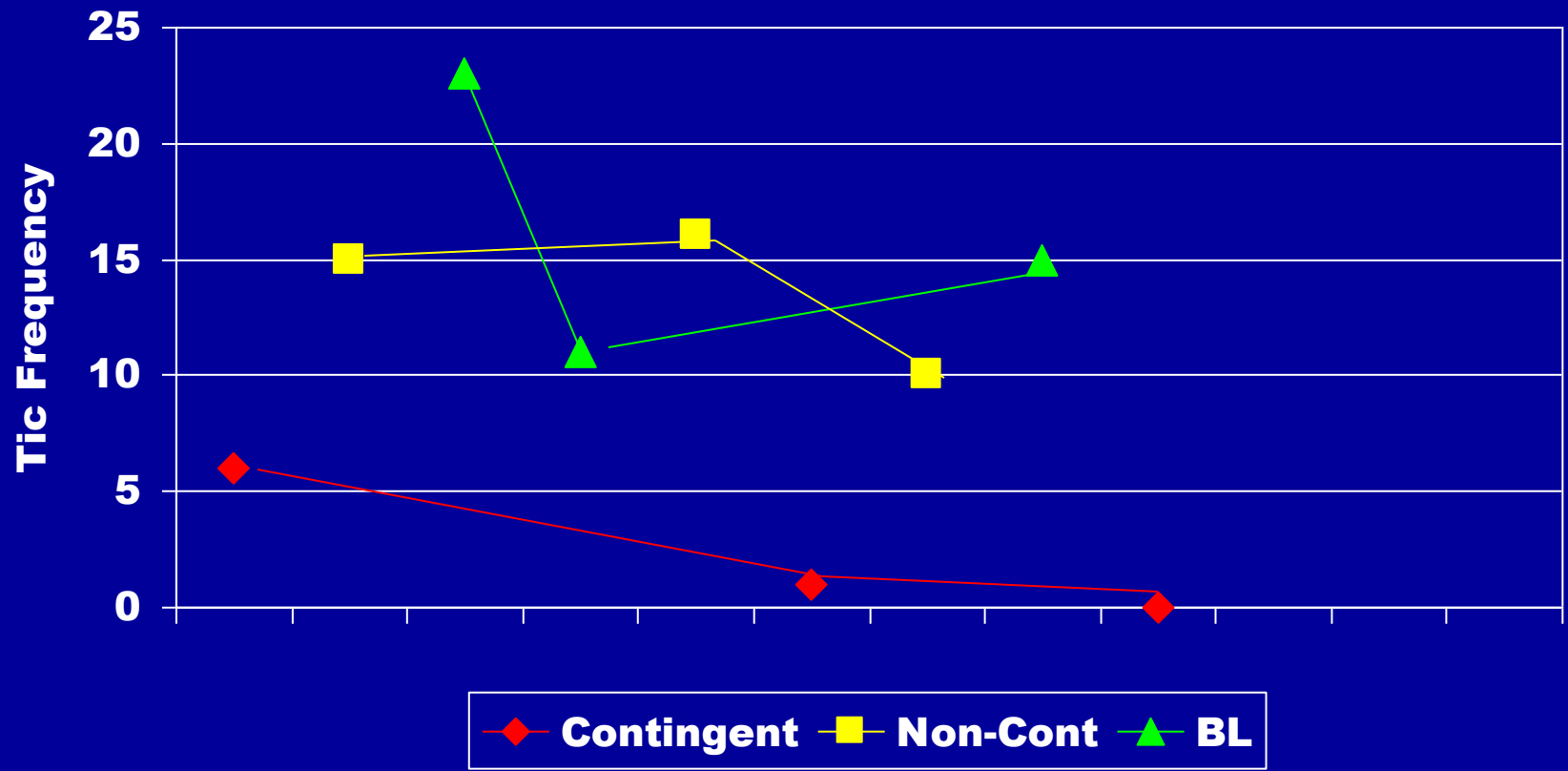
**VI (Verbal Instructions)**

**DRO (Reinforcement for No Tics)**

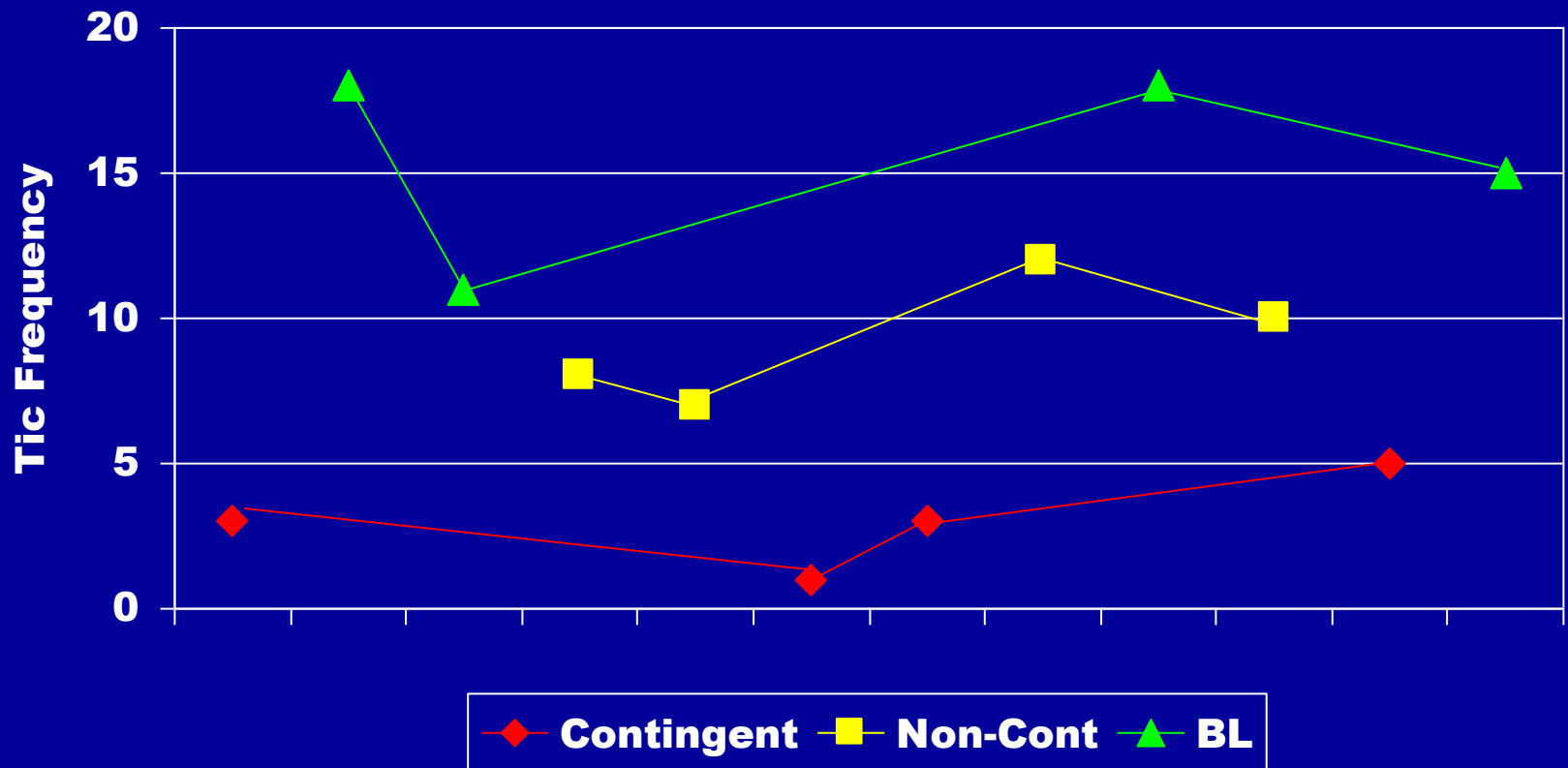
# Study 2: Is it the reinforcement?

- Alternating treatments design comparing 3 conditions
  - Reinforced suppression
  - Suppression + noncontingent reward
  - No suppress (baseline)
- Each condition was 5 minutes
- Each condition occurred 3 times
- Order of conditions was presented randomly
- Four children participated
- Study suggested the contingent delivery of reward was important in successful suppression

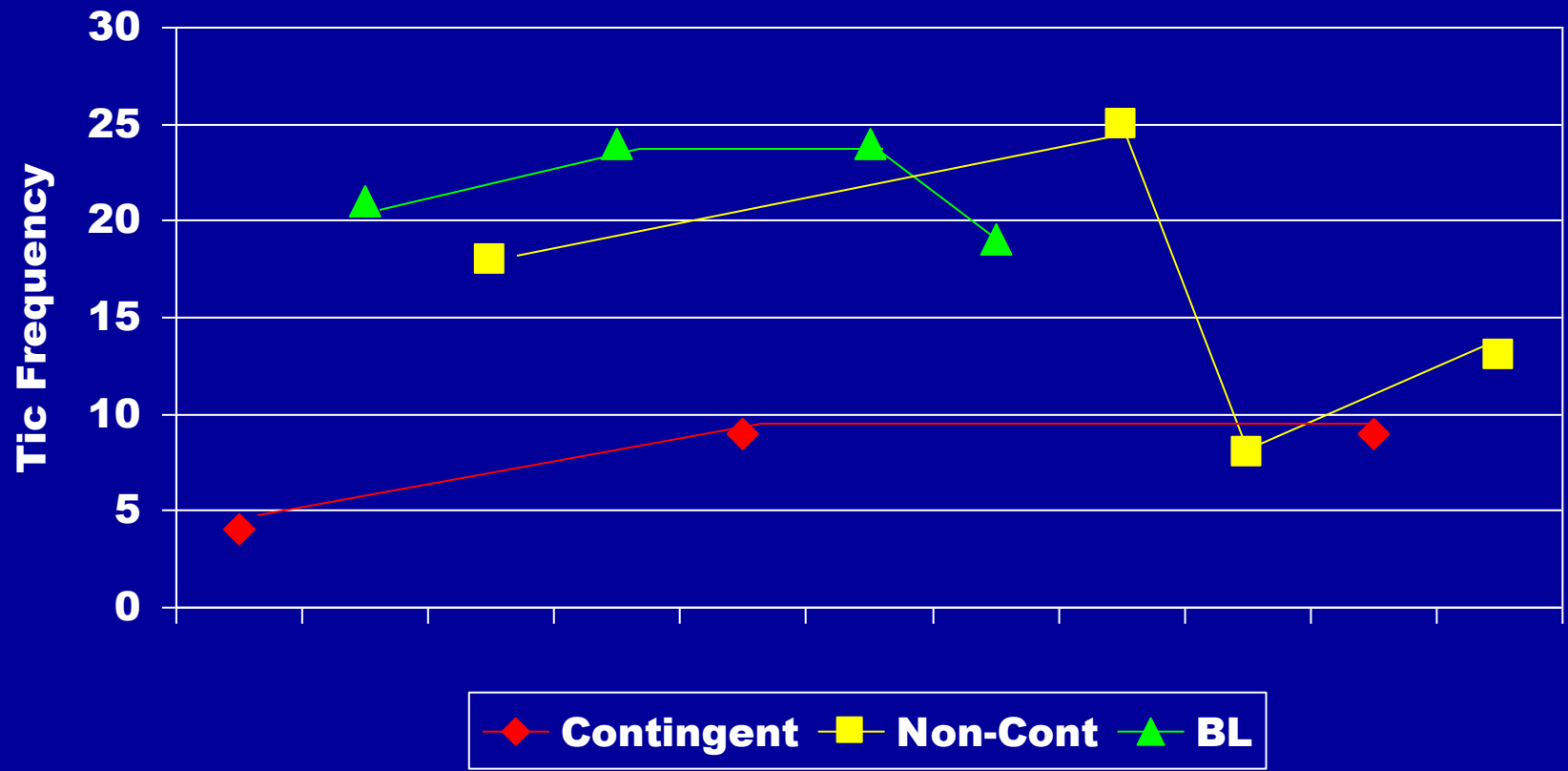
# Subject 1



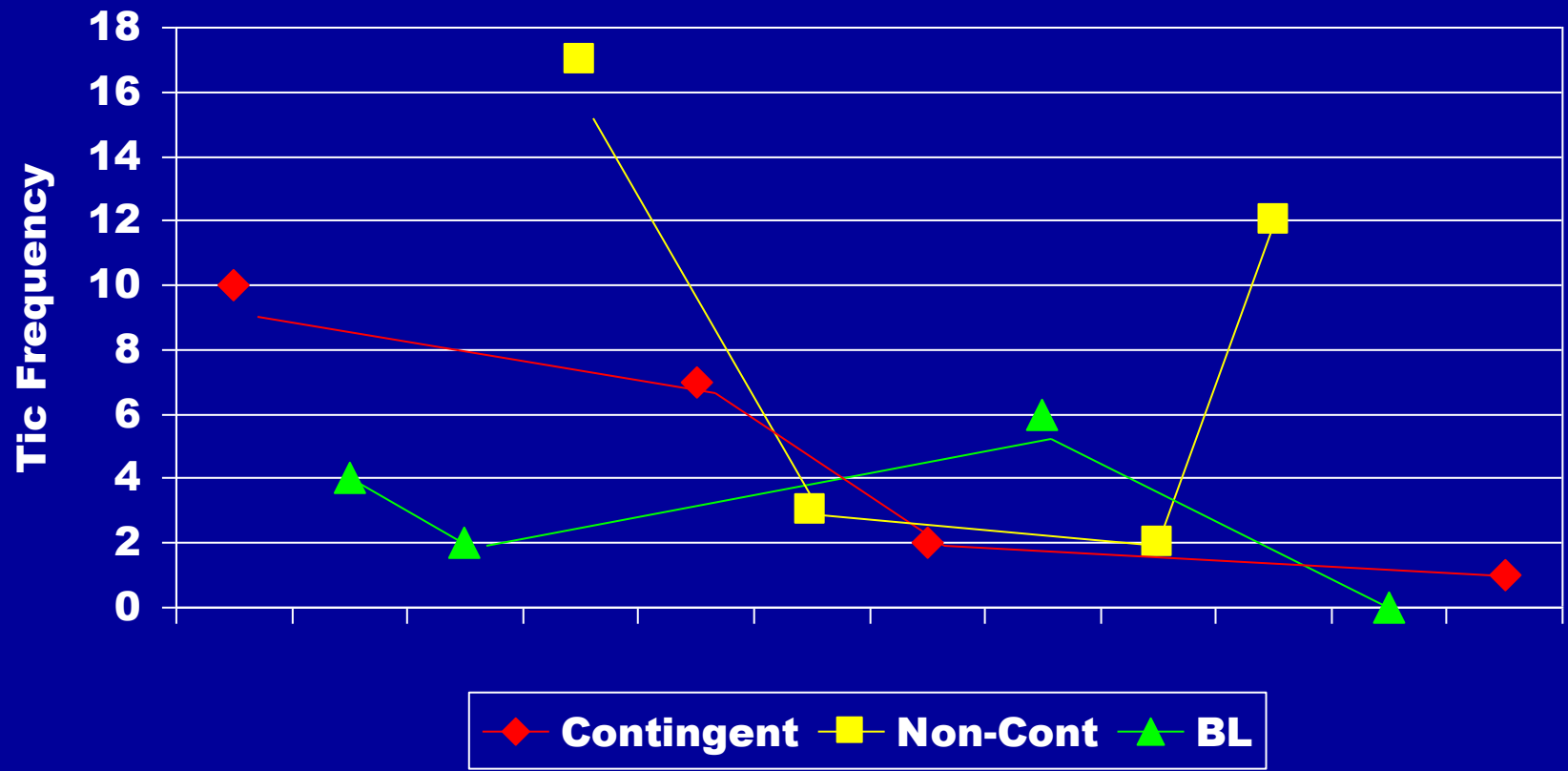
# Subject 2



# Subject 3



# Subject 4

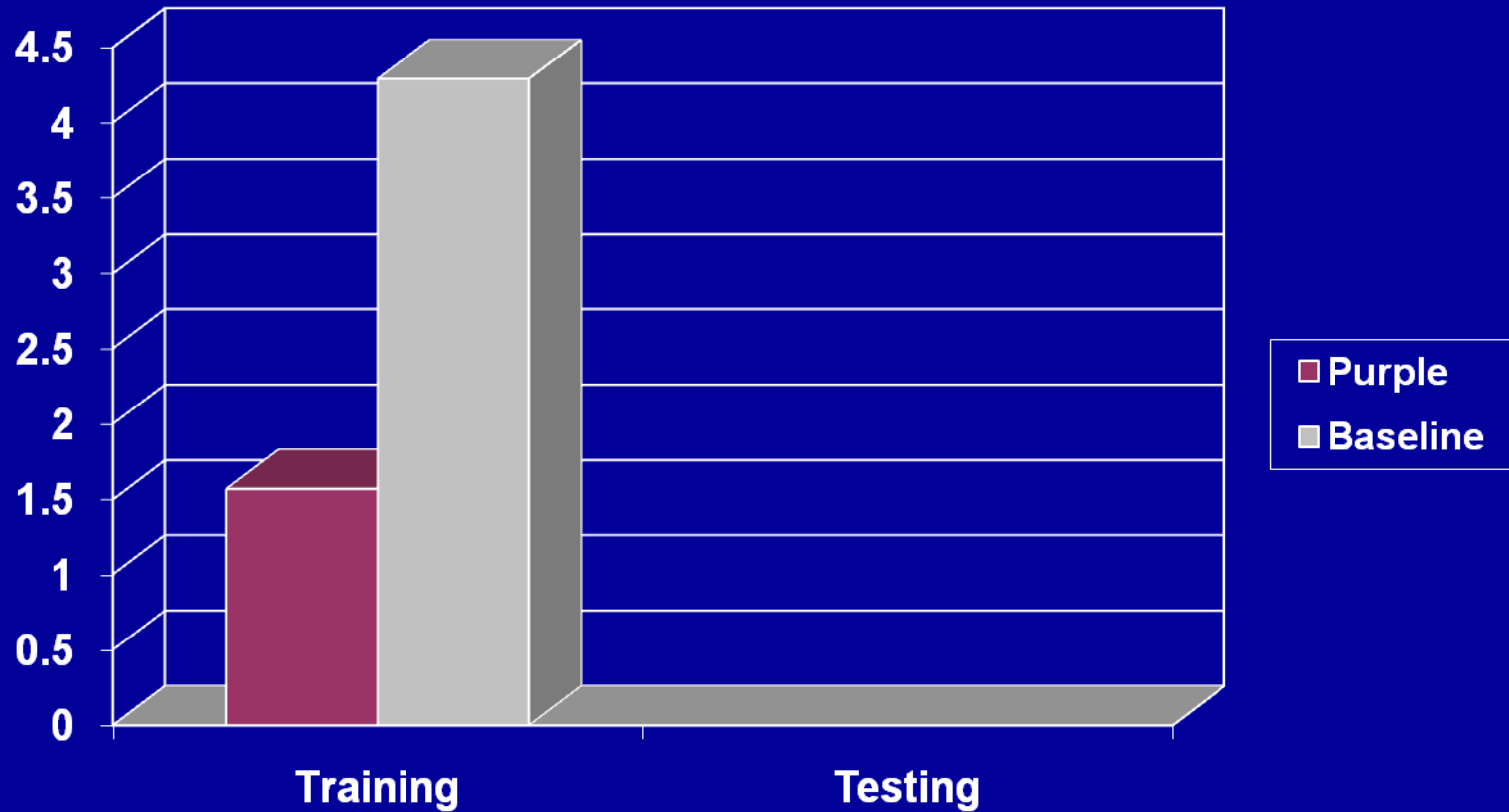


# Study 3: Can the environment develop stimulus control over tics?

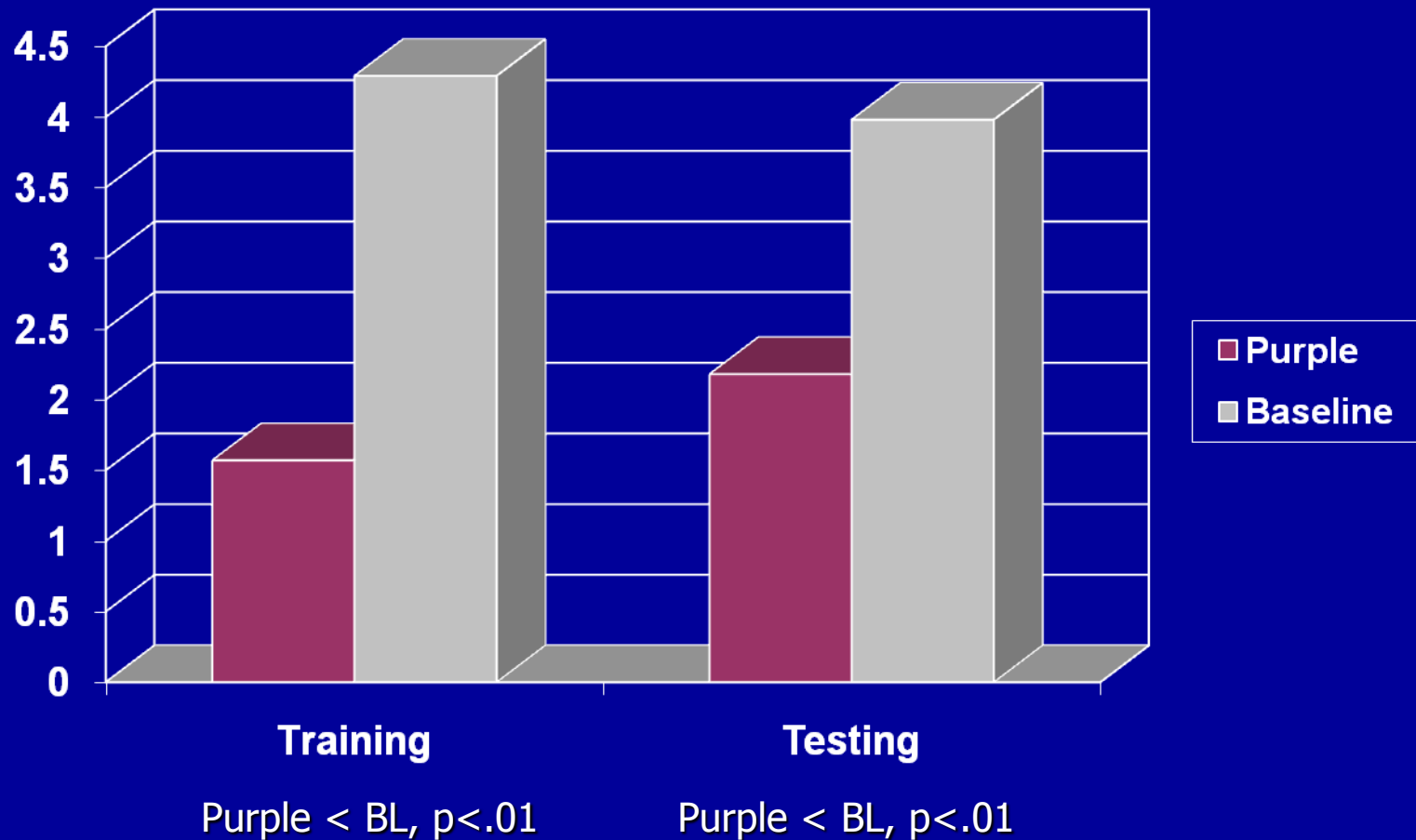
- 10 children with TS/CTDs
- 4 Training sessions, consisting of 2 conditions
  - Purple light (reinforced suppression)
  - No light (baseline, no suppression)
  - Each 5-min condition replicated 3 times in each training session
- 5<sup>th</sup> session was a test of stimulus control
  - No instructions given
  - Light/no light condition presented three times
  - No reinforcers delivered



# Stimulus Control-Means Across Conditions

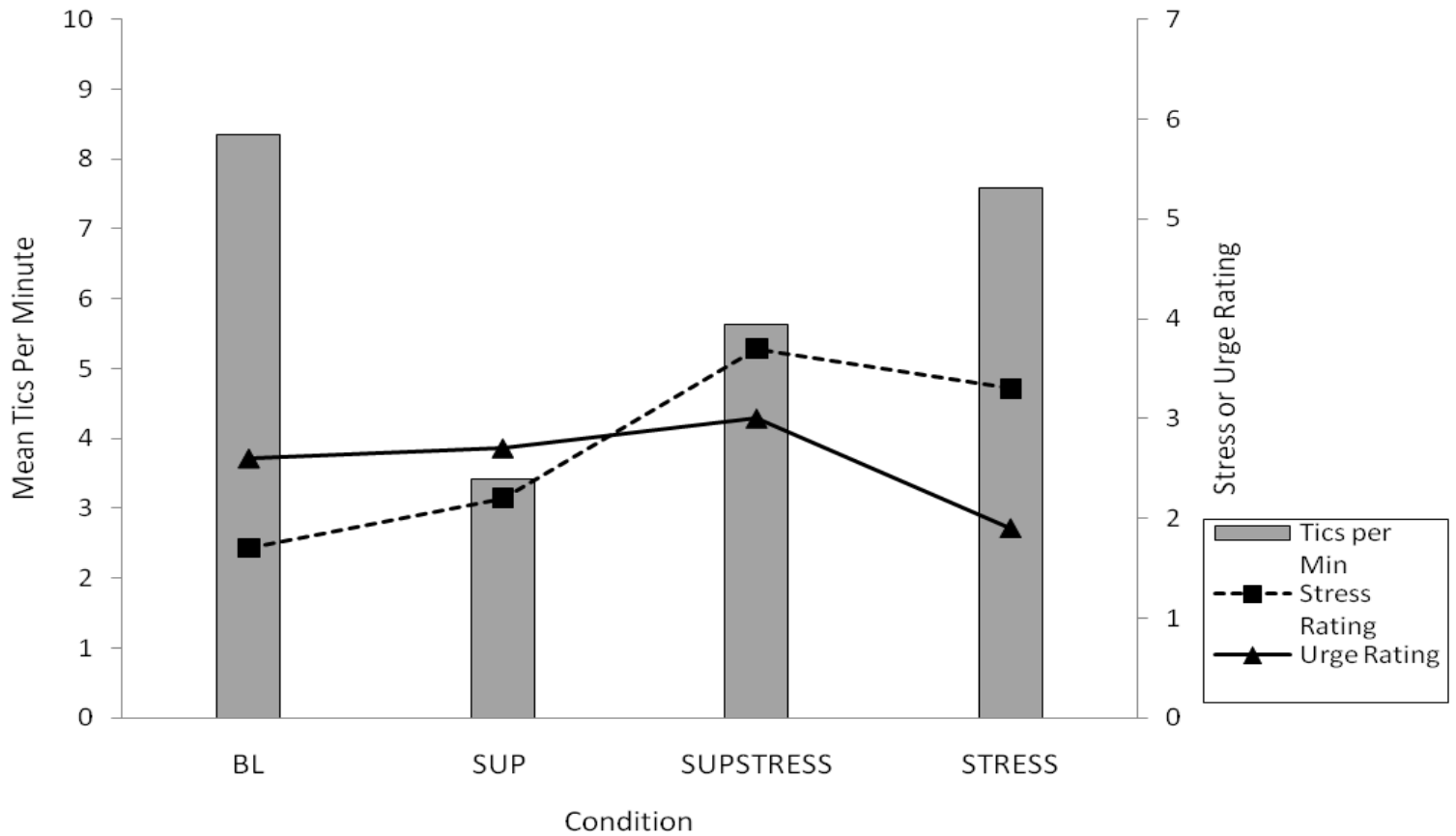


# Stimulus Control-Means Across Conditions



# Study 4: Effects of Stress on Tics

- 10 children with TS/CTD participated
- Mean age of 12.5 (9-17 years)
- Mean YGTSS = 24
- Repeated Measures Design
  - No suppression/No Stress (BASELINE)
  - Reinforced Suppression (SUP)
  - Stress/No Suppression (STRESS)-doing an age appropriate timed math test verbally
  - Suppression + Stress (SUP+STRESS)
  - Each condition was 5 minutes, each replicated twice
- Tics were counted and premonitory urge experience rated on a 0-8 scale



SUP < BL,  $p < .05$

BL = Stress

SUP + STRESS > SUP,  $p < .05$

Stress ratings higher in stress induction conditions

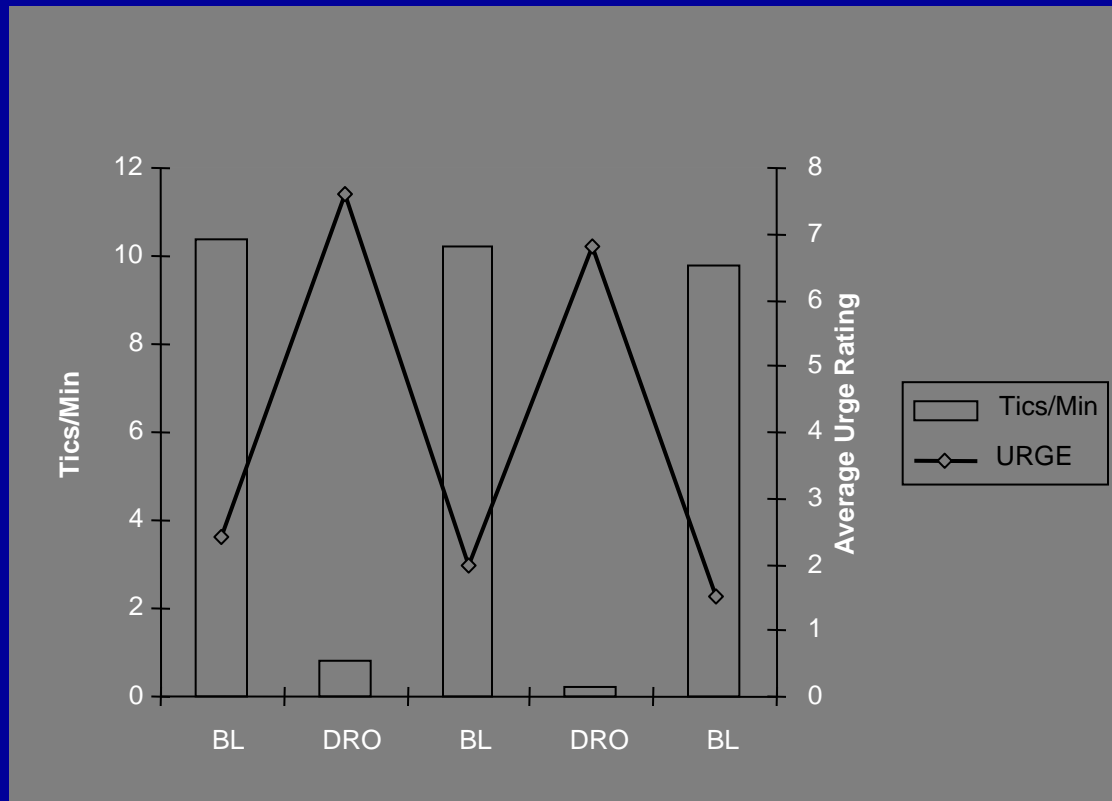
# Effects of Stress on Tics

- Suggested stress alone may not have had a negative effect, but does so through a disrupted ability to suppress tics
- Failed to replicate premonitory urge effects on suppression (may have been methodological)
- Clinically, suggests that stress coping in conjunction with HRT may be helpful

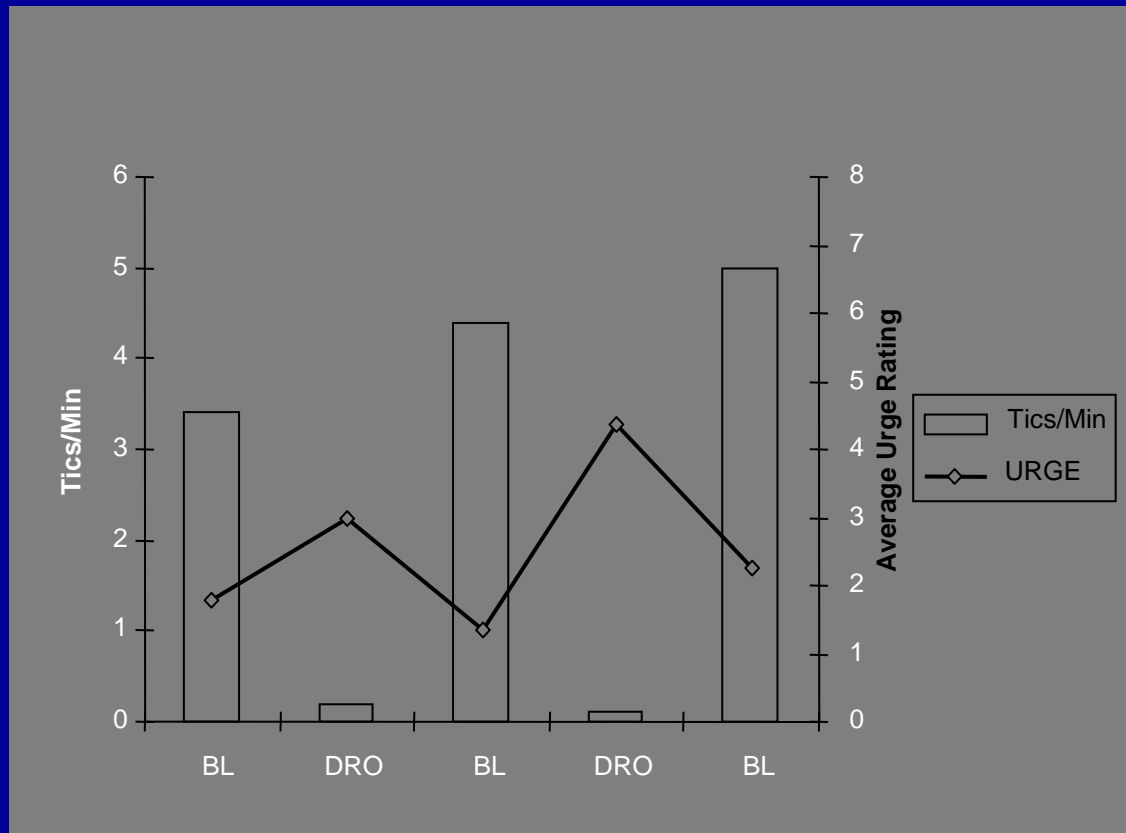
# Study 5: Evidence for Negative Reinforcement Hypothesis

- 5 children with TS participated
- Children ranged in age from 8 to 17
- ABAB Withdrawal Design
  - No suppression ("A" phase)- occurred twice
  - Reinforced Suppression ("B" phase)- occurred twice
  - Each condition was 5 minutes
- Tics were counted and premonitory urge experience rated on a 0-8 scale
- If the removal of the urge reinforces tics, then when tics are stopped, the urge should go up. When tics are allowed to occur, the urge should go down.

# 17 Year Old Male

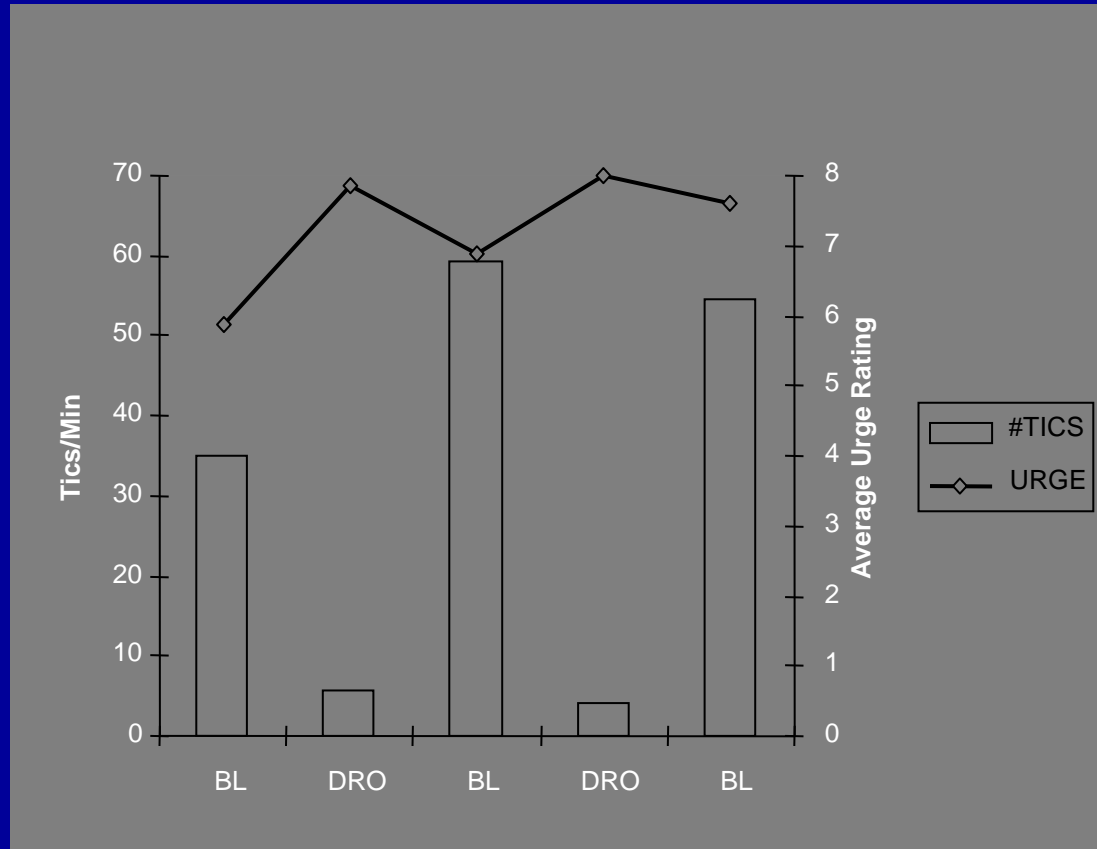


# 14 Year Old Male

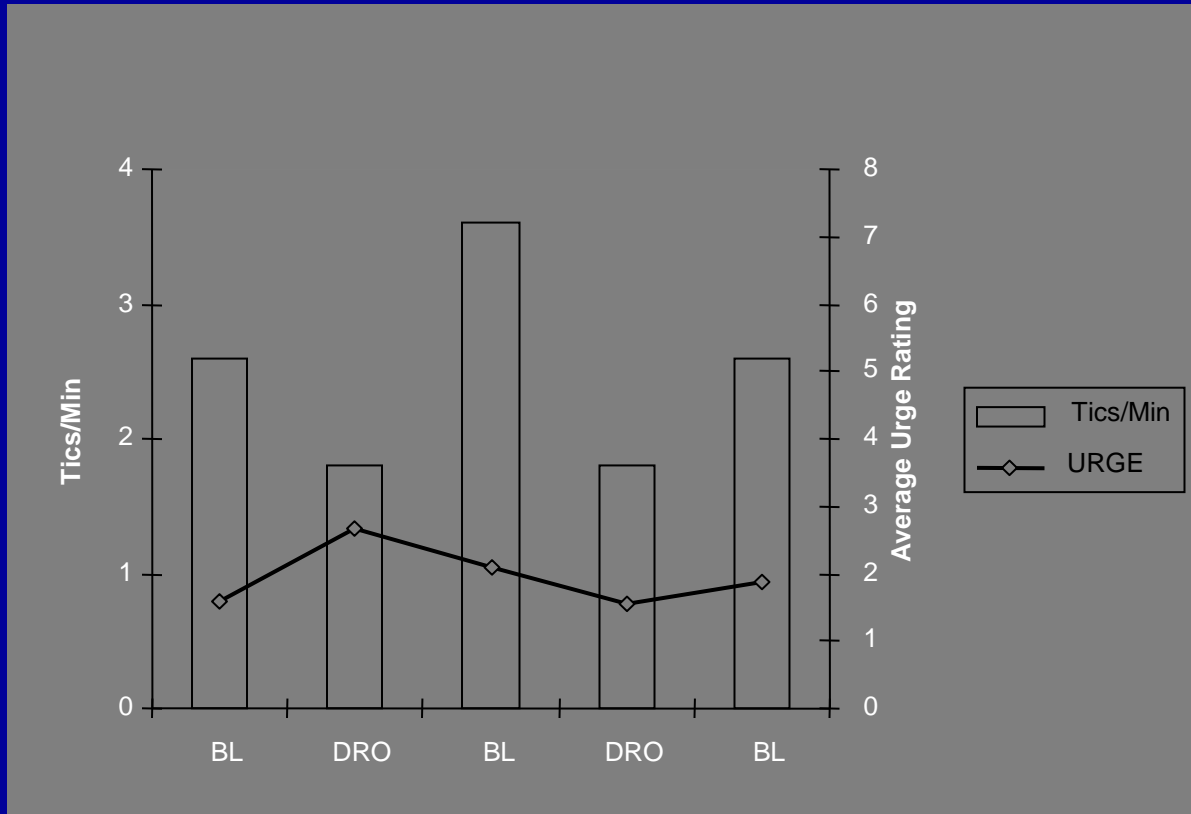




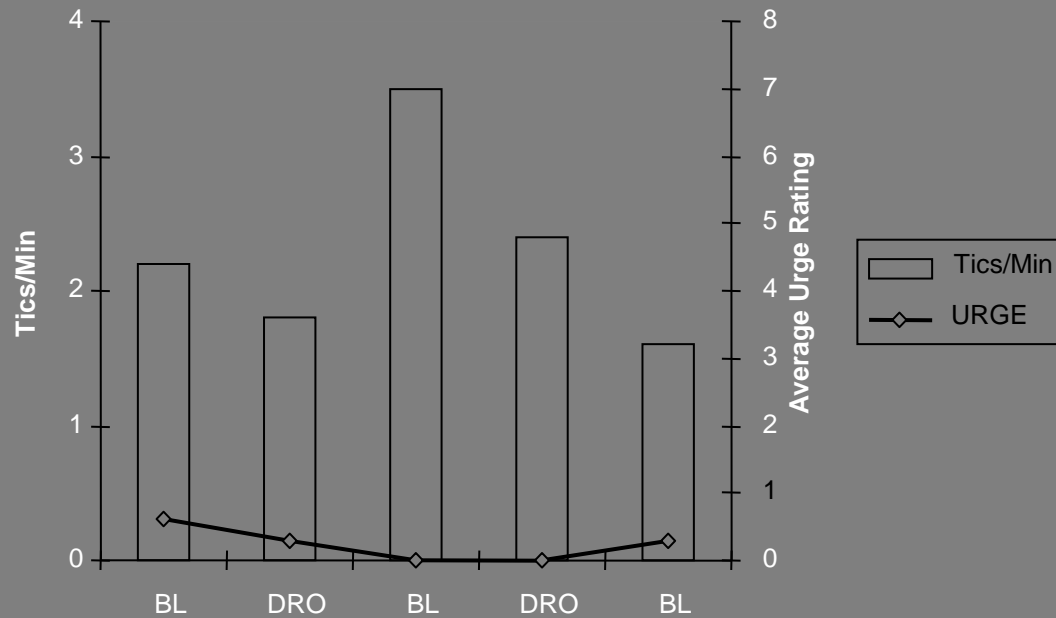
# 13 Year Old Male



# 10 Year Old Female



# 8 Year Old Female



# Evidence for the Negative Reinforcement Hypothesis

- Hypothesis is supported for some children with TS
- Negative reinforcement seems to play a larger role as child becomes older

# Behavioral Treatments are Based on the Following General Principles

- The person's internal and external environment can impact TS symptoms
- The effects of these factors are unique to the individual
- To develop a useful treatment both the external and internal contingencies must be addressed

# Managing External Environment

Managed by functional assessment/intervention

**Example:** *Billy comes home from school stressed out and anxious. He goes to the den where his sister is watching TV and begins ticcing loudly. Billy's Sister gets upset and teases Billy. Billy's mom enters the room, sends his sister out of the room, comforts Billy, and lets him watch TV while he "gets himself together." Now Billy tics a lot right after school, especially when his sister is watching television.*

In doing a functional analysis, we look for antecedents (things that come before the tic) and consequences (things that may be reinforcing the tic).

## Antecedents

- 1) Billy's tics get worse when anxious
- 2) Billy tics more in the den

## Consequences

- 1) Teasing sister is sent to room
  - 2) Billy gets mom's love and attention
  - 3) Billy gets TV to himself
- } Billy's tics are reinforced

# Function-Based Interventions

After specific environmental variables are identified in the functional assessment, interventions are developed to decrease the effect of or contact with that variable

## Antecedents

- 1) Anxiety
- 2) In the den after school



## Functional Intervention

- Teach relaxation strategies
- Change setting

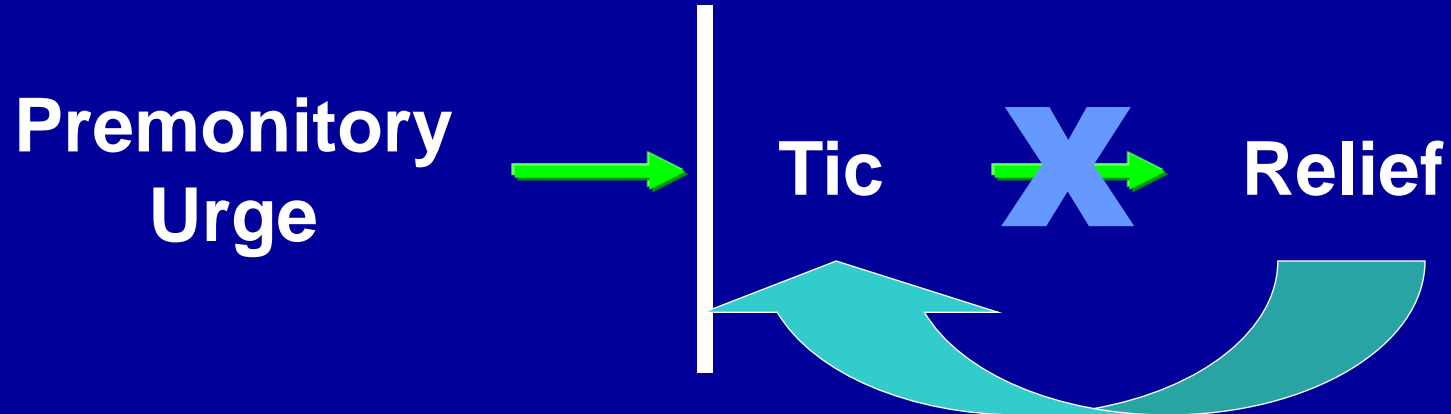
## Consequences

- 1) Teasing sister sent to room
- 2) Mom comforts Billy
- 3) Billy gets TV to himself



- Sister stays in room and is asked to apologize
- Mom no longer comforts Billy
- Mom turns TV off to provide Billy an opportunity practice his tic management strategies (e.g., a quiet place to tic, or habit reversal procedures)

# Managing Internal Environment



*Creates habituation to Premonitory Urge*

*Negative Reinforcement*



# Changing Internal Environment

- Habit reversal training
  - Forces habituation to the premonitory urge
  - Designed to disrupt a habitual motor pattern after it has started

# Habit Reversal-What Is It?

- Multi-component treatment (Azrin & Nunn, 1973)
- Used to treat tics
- 3 main components
  - Awareness Training
  - Competing Response Training
  - Social Support

# Does HRT Work?

- HRT has been studied for over 30 years using small-n and group experimental designs
- Considered an effective treatment for tics according to APA Division 12 Criteria (Cook & Blacher, 2007)
- To date, 6 Randomized Controlled Trials (RCTs) have been conducted
- N's have ranged from 10-42
- Adults and children have been studied
- Controls have either been wait list, supportive therapy, or another behavioral treatment
- Results have all shown separation from waitlist or supportive therapy

# Comprehensive Behavioral Intervention for Tics Study (CBITS)

**Child Study: 126 children (ages 9-17) with TS/CTD**

**Participating Sites (40 at each of 3 sites)**

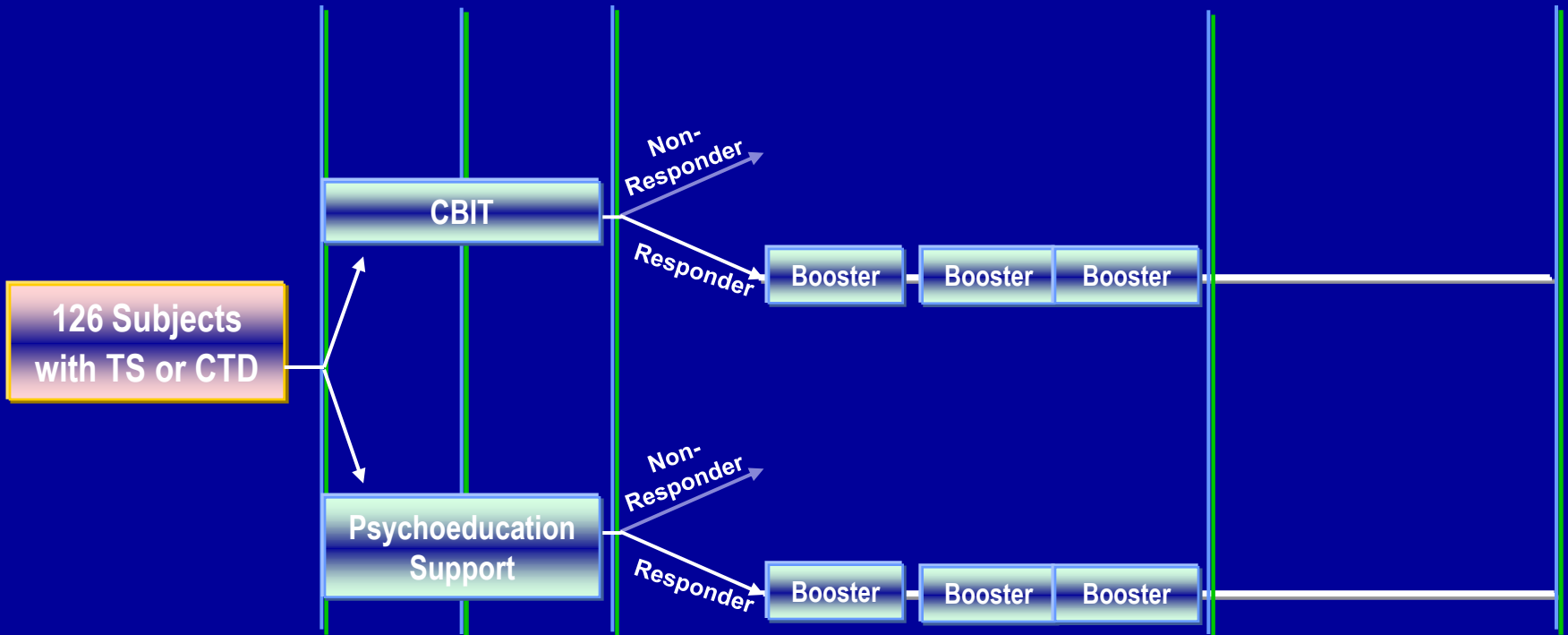
- UCLA (Child: J. Piacentini, PI)
- Johns Hopkins University (Child: J. Walkup, PI)
- U. of Wisconsin–Milwaukee (Child; D. Woods, PI)
- Mass General Hospital/Harvard (Adult: S. Wilhelm, PI)
- Yale Child Study Center (Adult: L. Scahill, PI)
- U. of Texas Health Sciences Center (Adult: A. Peterson, PI)

**Funded by NIMH through two different mechanisms (R01 to TSA)**

# CBITS Study Design

## Assessment Schedule:

Week: 0 5 10 23 36



# Study Treatments

## CBIT Components

- **Psychoeducation**
- **Habit Reversal Therapy**
- **Functional Intervention**
- **Reward System**
- **Relaxation Training**

## Psychoed/Support Components

- **Phenomenology of TS**
- **Prevalence of TS**
- **Natural History of TS**
- **Common Comorbidities**
- **Causes of TS**
- **Psychosocial Impairments**
- **Nonspecific Support**

# CBITS Eligibility Criteria

## Inclusion

- **Age 9 to 17 (child) or  $\geq 16$  (adult)**
- **Primary diagnosis of DSM-IV-TR TS or Chronic Tic Disorder**
- **CGI-Severity > 3**
- **YGTSS Total Score > 14**
- **Unmedicated or stable medication**
- **Patient speaks fluent English**
- **Informed consent**

# CBITS Eligibility Criteria

## Exclusion

- **YGTSS Total Score > 30 (unless approved by caseness panel- 15 child cases of YGTSS >30 were approved: range = 31-42)**
- **IQ < 80**
- **CGI-Severity < 3**
- **Excessive/problematic substance use or CD past 3 months**
- **Lifetime diagnosis of DSM-IV PDD, Mania, Psychotic Disorder**
- **Any serious medical or psychiatric illness requiring immediate treatment other than provided in CBITS protocol**
- **Previous treatment with 4 or more sessions of HRT**



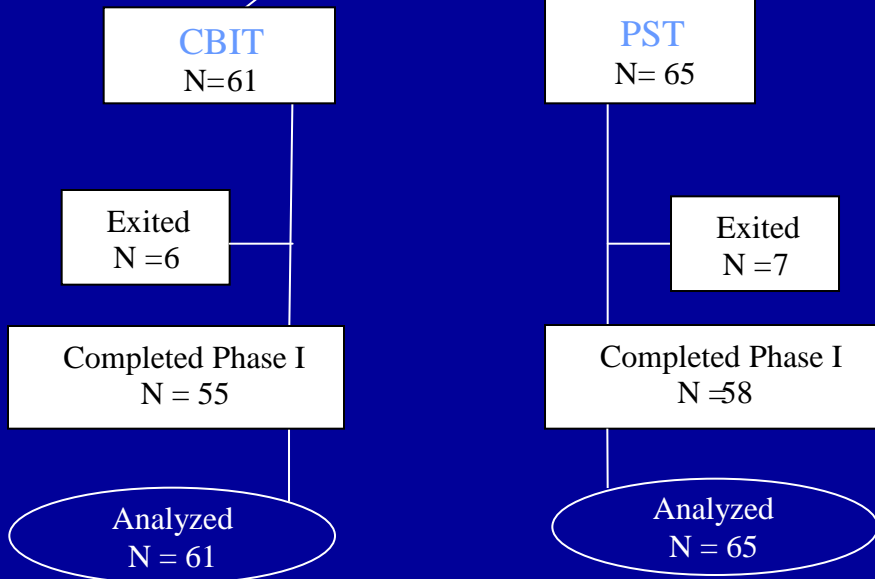
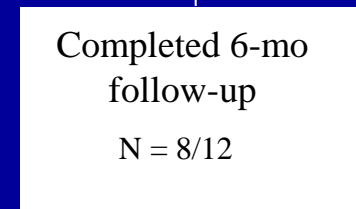
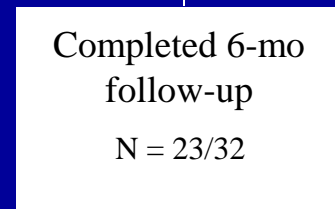
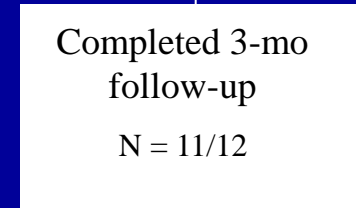
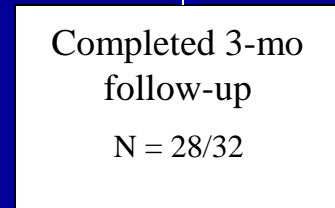
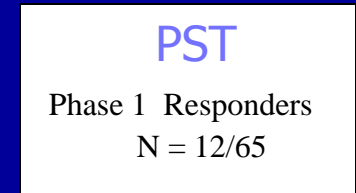
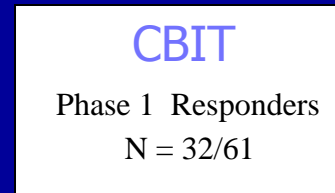
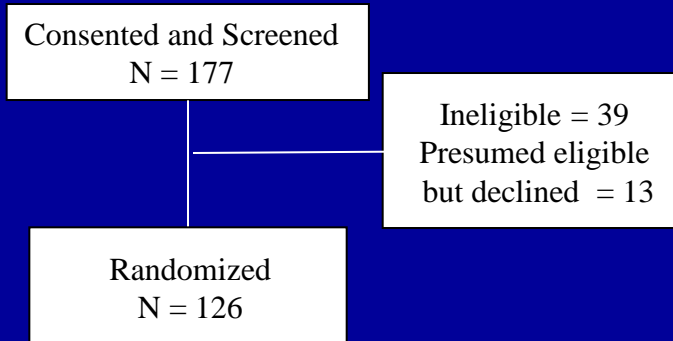
# Primary Outcome Measures

- **Clinical Global Impression (CGI) – Improvement Scale (1-7)**
- **YGTSS- Total Tic Score (0-50)**
- **YGTSS- Impairment (0-50)**

# CONSORT: Study Flow-Child

## PHASE 1-ACUTE OUTCOMES

## PHASE 2- LONG-TERM OUTCOMES



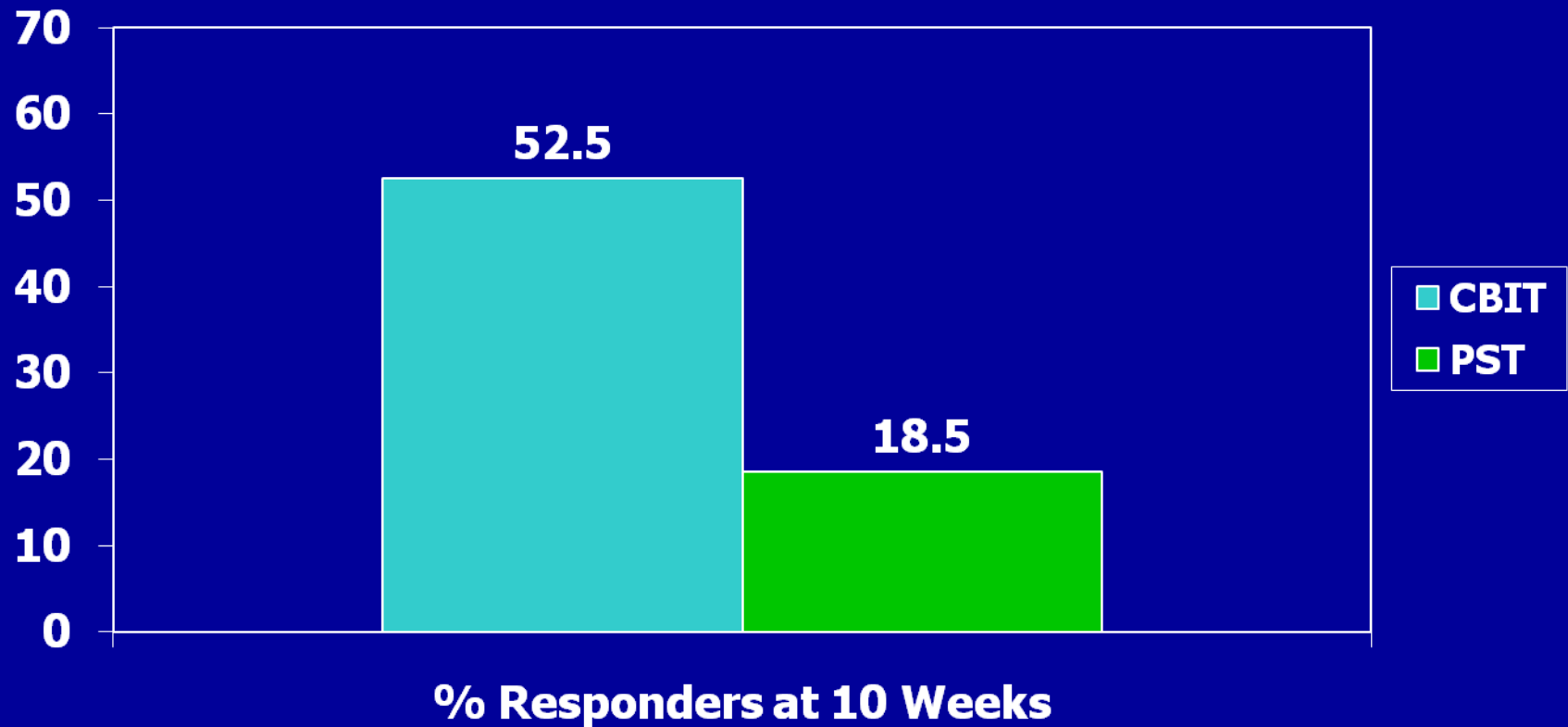
# Sample Characteristics- Child

	<b>CBIT N=61</b>	<b>PST N=65</b>
<b>Mean Age (SD)</b>	<b>11.6 (2.3)</b>	<b>11.7 (2.3)</b>
<b>Gender (% Male)</b>	<b>75.4%</b>	<b>81.5%</b>
<b>WASI IQ (M, SD)</b>	<b>111.7 (13.5)</b>	<b>108.6 (14.0)</b>
<b>Stable Tic Meds at Entry (%)</b>	<b>36.7%</b>	<b>40.3%</b>
<b>Two Parent Family (%)</b>	<b>82.0%</b>	<b>87.7%</b>
<b>Father's Occupation (% Professional)</b>	<b>60.7%</b>	<b>61.5%</b>

# Diagnostic Status

	<u>CBIT</u>	<u>PST</u>
<b>Tic Disorder (%)</b>		
<b>Tourette Disorder</b>	<b>91.8</b>	<b>95.4</b>
<b>Chronic Motor Tic</b>	<b>6.6</b>	<b>4.6</b>
<b>Chronic Vocal Tic</b>	<b>1.6</b>	<b>0.0</b>
<b>Other Diagnoses (%)</b>		
<b>ADHD</b>	<b>32.8</b>	<b>20.0</b>
<b>OCD</b>	<b>13.1</b>	<b>24.6</b>
<b>Generalized Anxiety</b>	<b>16.4</b>	<b>23.1</b>
<b>Separation Anxiety</b>	<b>9.8</b>	<b>7.7</b>
<b>Social Anxiety</b>	<b>21.3</b>	<b>21.5</b>
<b>Other</b>	<b>14.8</b>	<b>12.3</b>

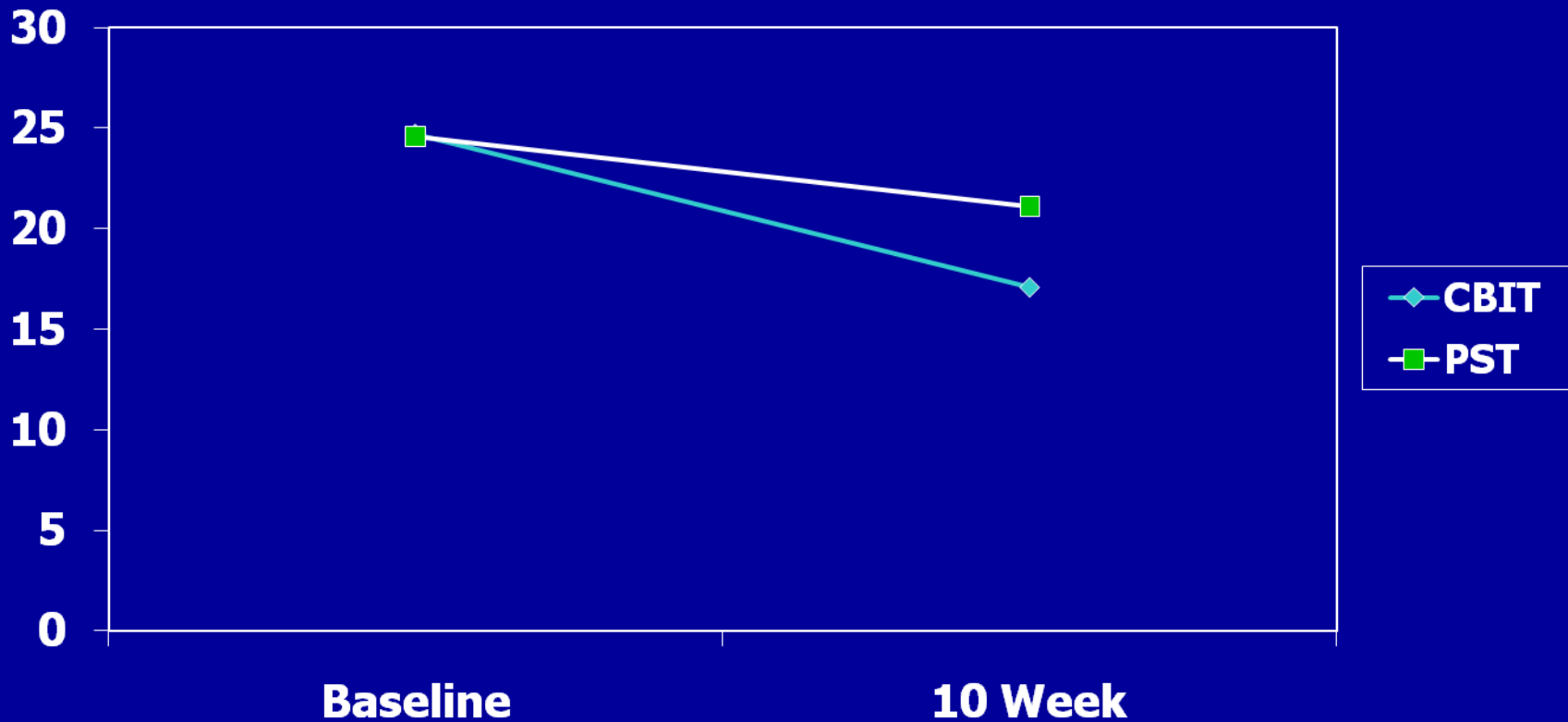
# CGI-Improvement Acute Phase Comparison



\*CBIT>PST,  $p<.0001$

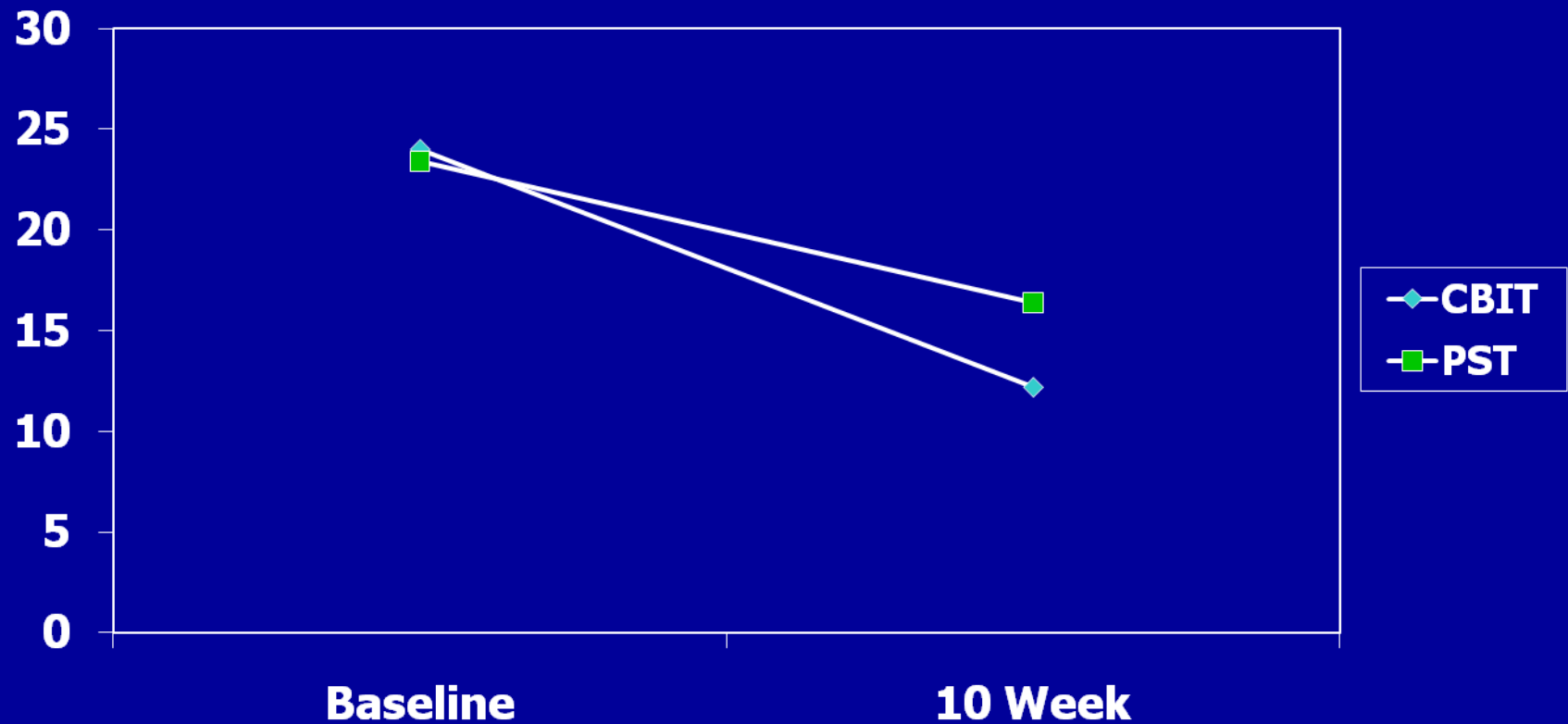
Medication status did not moderate outcome

# YGTSS-Total Tic Score (Adjusted Means) Acute Phase Comparison



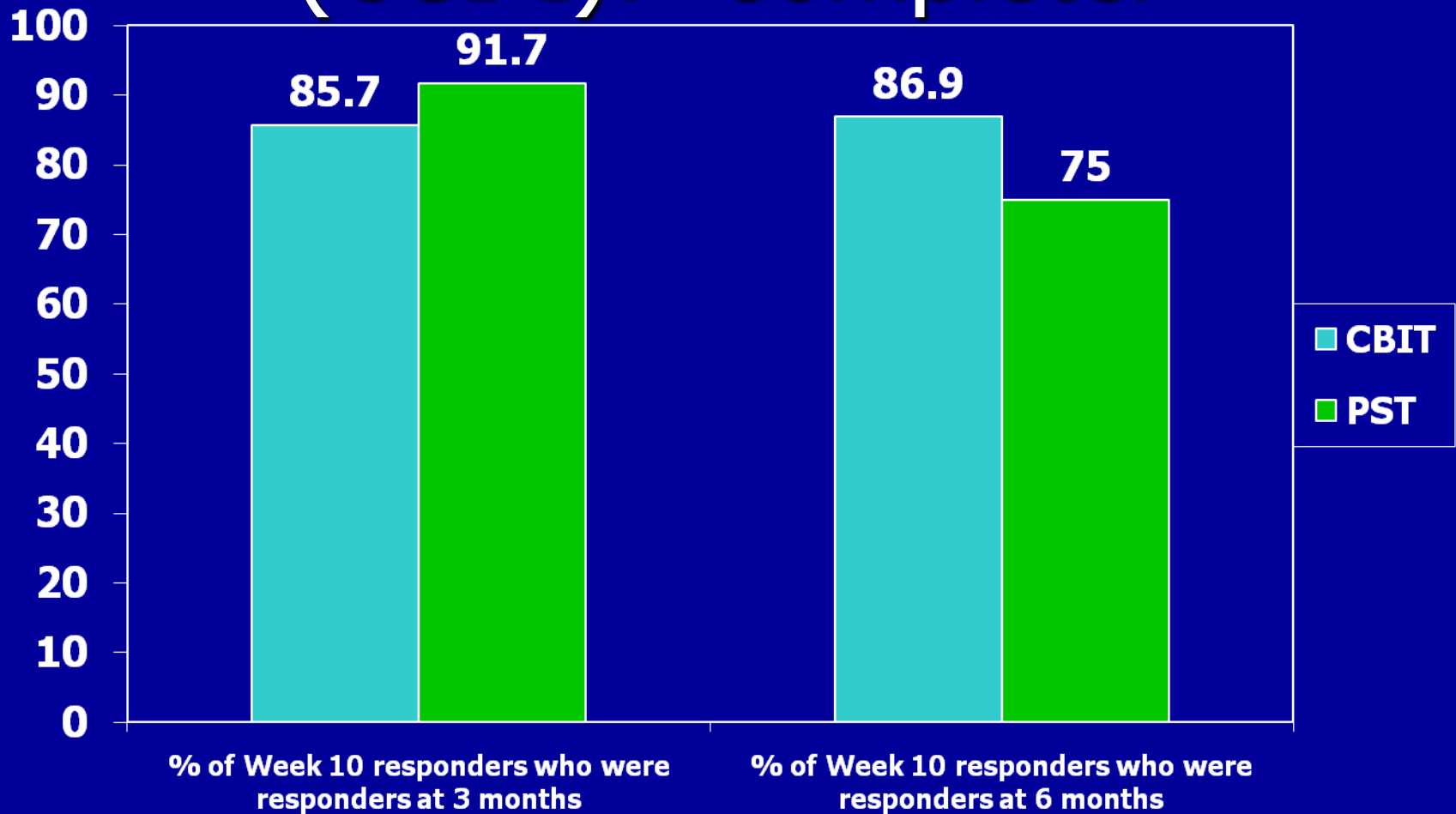
\*CBIT < PST,  $p < .01$ - 10 week Effect Size  $d = .68$   
Medication status did not moderate outcome

# YGTSS-Impairment (Adjusted Means) Acute Phase Comparisons



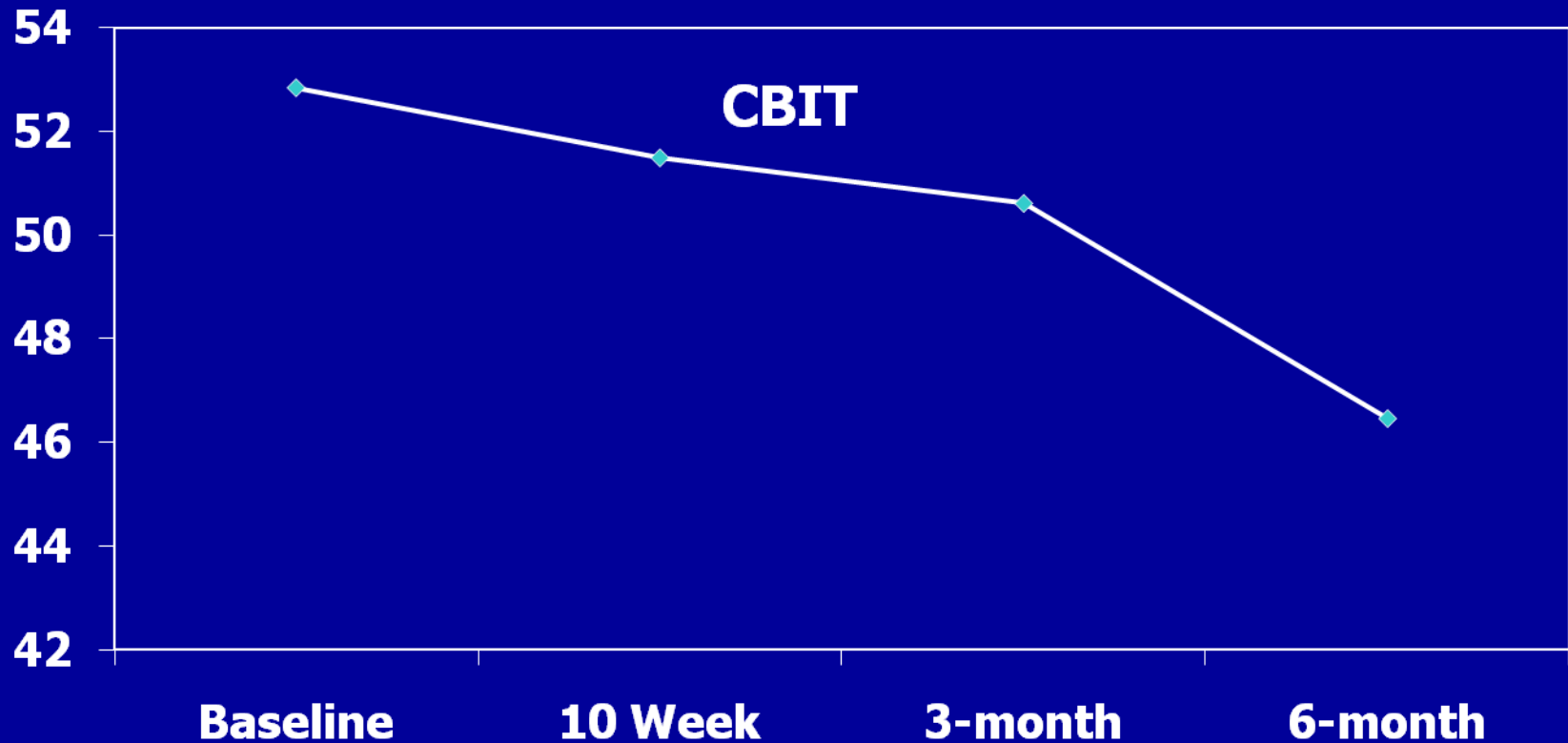
\*CBIT < PST,  $p < .01$ - 10 Week Effect Size  $d = .57$   
Medication status did not moderate outcome

# Maintenance of Responder Status (CGI-I): Completer





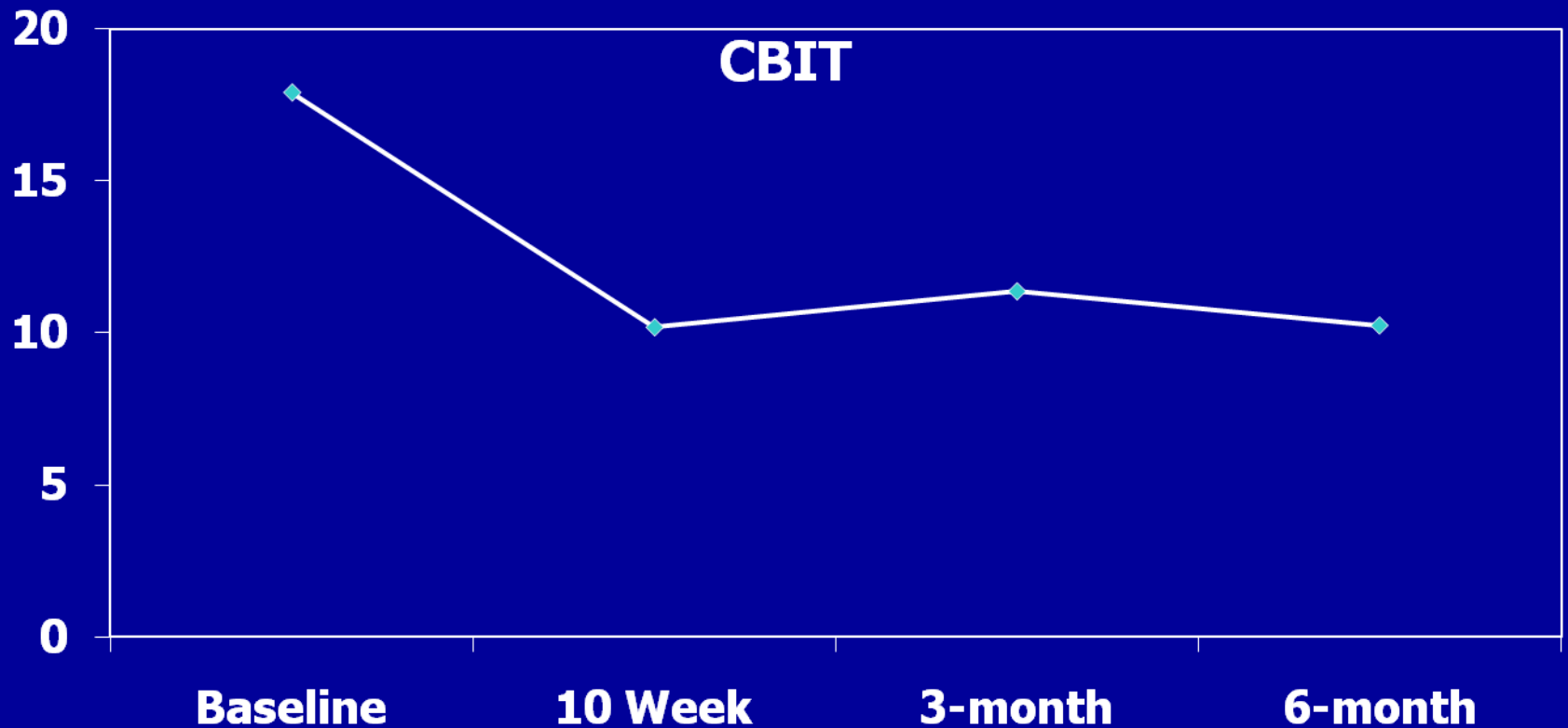
# CBCL-Total Problems T-Scores Week 10 CBIT Responders Through Follow-up



BL > 6-month

10 week > 6-month

# SCARED Total Scores Week 10 CBIT Responders Through Follow-up

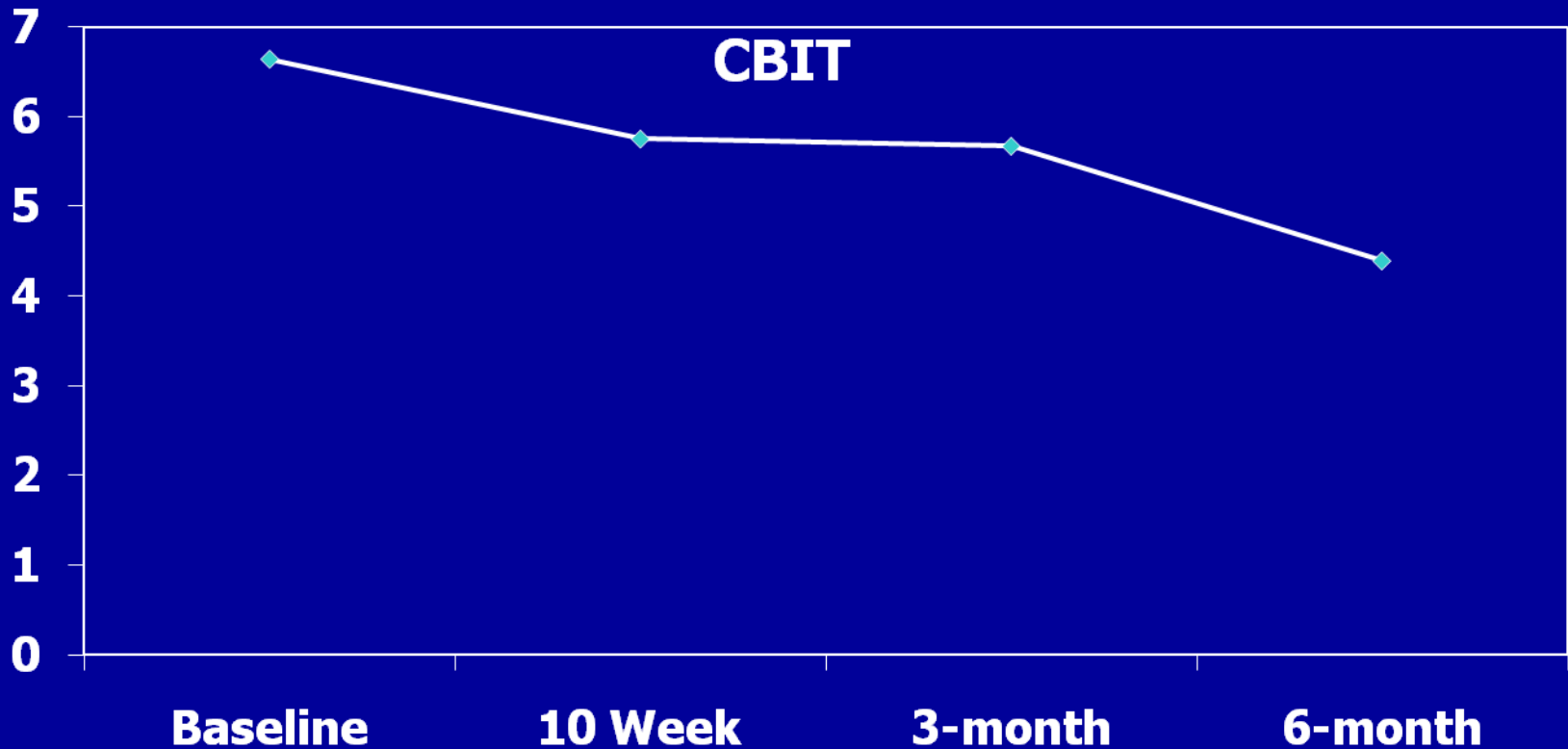


BL > 3-month

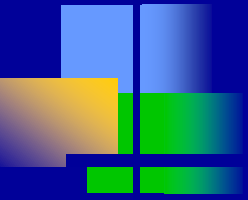
BL > 6-month

# DBRS Scores

## Week 10 CBIT Responders Through Follow-up



BL > 6-month



# Benchmarking CBIT Efficacy



# Benchmarking Acute Phase CBIT Efficacy

Comparison RCT	N	Group	YGTSS Total Score (%↓)		Effect Size ( <i>d</i> )
			<u>Active</u>	<u>Comp</u>	
CBIT (Piacentini et al., 2010)	126	PST	31%	14%	0.7
Risperidone (Scahill et al., 2003)	34	PBO	36%	9%	1.0
Ziprasidone (Sallee et al., 2000)	28	PBO	35%	7%	0.9

# Adverse Events by Treatment Group

	CBIT		Control		P-value
	N	(%)	N	(%)	
Upper Respiratory Infection	21	34.4	27	41.5	NS
Irritability, explosive behavior	10	16.4	10	15.4	NS
Headache	10	16.4	14	21.5	NS
Muscle or joint pain	9	14.8	13	20.0	NS
<b>Accidental injury</b>	<b>7</b>	<b>11.5</b>	<b>19</b>	<b>29.2</b>	<b>0.02</b>
Anxiety and nervousness	4	6.6	3	4.6	NS
Disruptive behavior	4	6.6	4	6.2	NS
Sore Throat	4	6.6	7	10.8	NS
Nausea, vomiting	2	3.3	5	7.7	NS
<b>Stomach Discomfort</b>	<b>2</b>	<b>3.3</b>	<b>9</b>	<b>13.8</b>	<b>0.06</b>
Dermatological problems	1	1.6	5	7.7	NS
Tic worsening	1	1.6	4	6.2	NS
Tiredness, fatigue	1	1.6	4	6.2	NS

# Adverse Events by Treatment Group

	CBIT		Control		P-value
	N	(%)	N	(%)	
Upper Respiratory Infection	21	34.4	27	41.5	NS
Irritability, explosive behavior	10	16.4	10	15.4	NS
Headache	10	16.4	14	21.5	NS
Muscle or joint pain	9	14.8	13	20.0	NS
Accidental injury	7	11.5	19	29.2	0.02
Anxiety and nervousness	4	6.6	3	4.6	NS
Disruptive behavior	4	6.6	4	6.2	NS
Sore Throat	4	6.6	7	10.8	NS
Nausea, vomiting	2	3.3	5	7.7	NS
Stomach Discomfort	2	3.3	9	13.8	0.06
Dermatological problems	1	1.6	5	7.7	NS
Tic worsening	1	1.6	4	6.2	NS
Tiredness, fatigue	1	1.6	4	6.2	NS

# Summary of CBIT Findings

## **CBIT is more efficacious than PST for**

- Reducing tic severity
- Reducing tic-related impairment

## **CBIT efficacy similar to meds for tics**

- Roughly similar symptom reduction rates
- Lower Effect Size (use of active comparison group)
- More favorably safety profile

## **CBIT responders maintain their gains and improve in other areas of functioning 6-mo after treatment**



# If Behavior Therapy for Tics is So Promising....

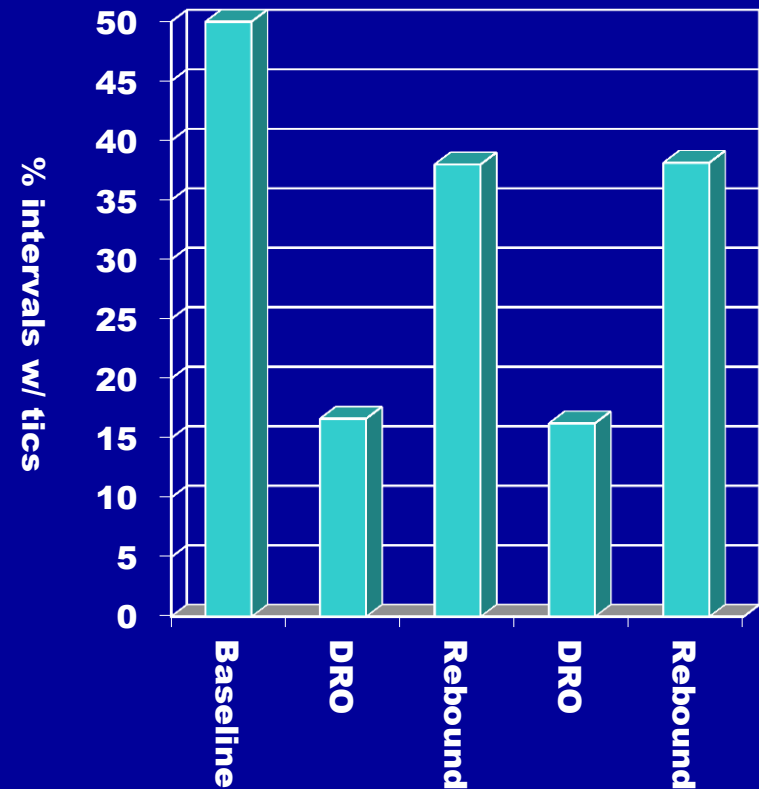
- Dissemination
  - How do we teach therapists to do this?
- Referral problem
  - Neurologists/pediatricians usually get referral
- Beliefs about negative effects of behavior therapy

# Beliefs Inhibiting Use of Behavior Therapy for Tics

- Rebound effects
  - Trying to stop tics makes you tic more
- Symptom substitution
  - Stopping one tic makes others worse, or are replaced by new ones
- Ability to attend to other things will be greatly diminished because of focus on tics

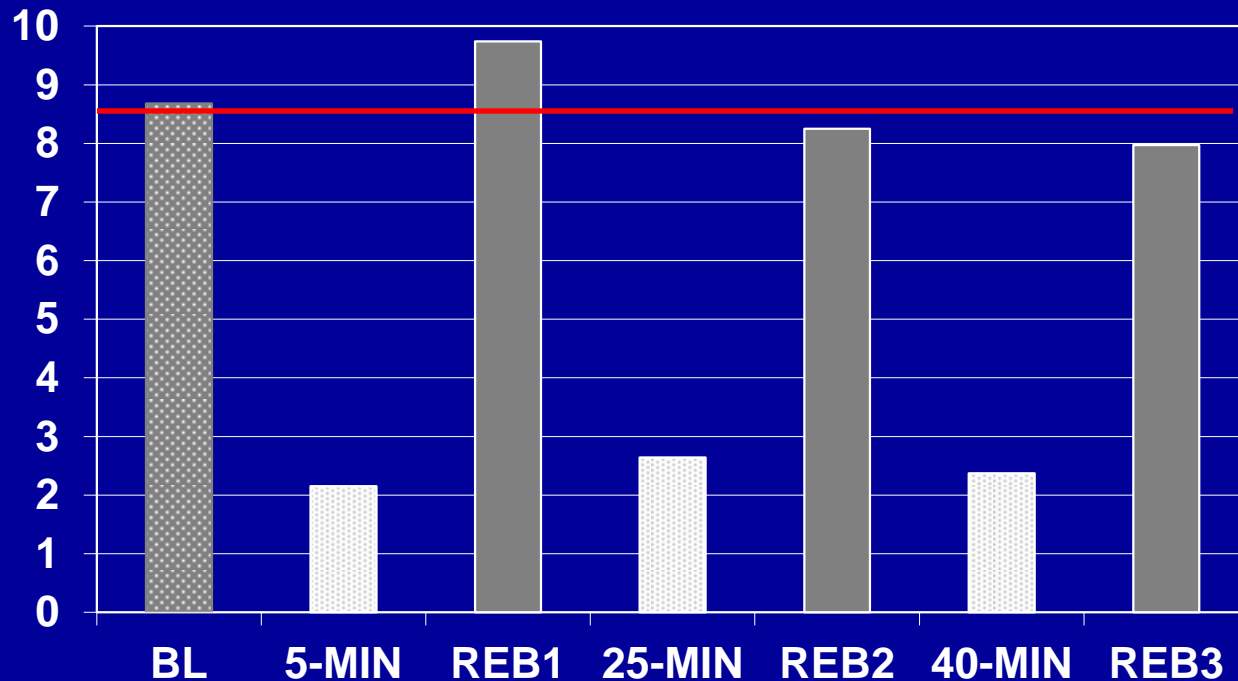
# Is there a Rebound Effect? Study 1

- 7 children with TS
- Three conditions
  - Baseline
  - Reinforced suppression
  - Rebound evaluation
- All conditions were 5 min
- Tics were reduced in suppression condition
- Rebound did not occur



Himle & Woods (2006)  
*Behaviour Research and Therapy*

# Is there a Rebound Effect? Study 2



13 children with TS or CTD

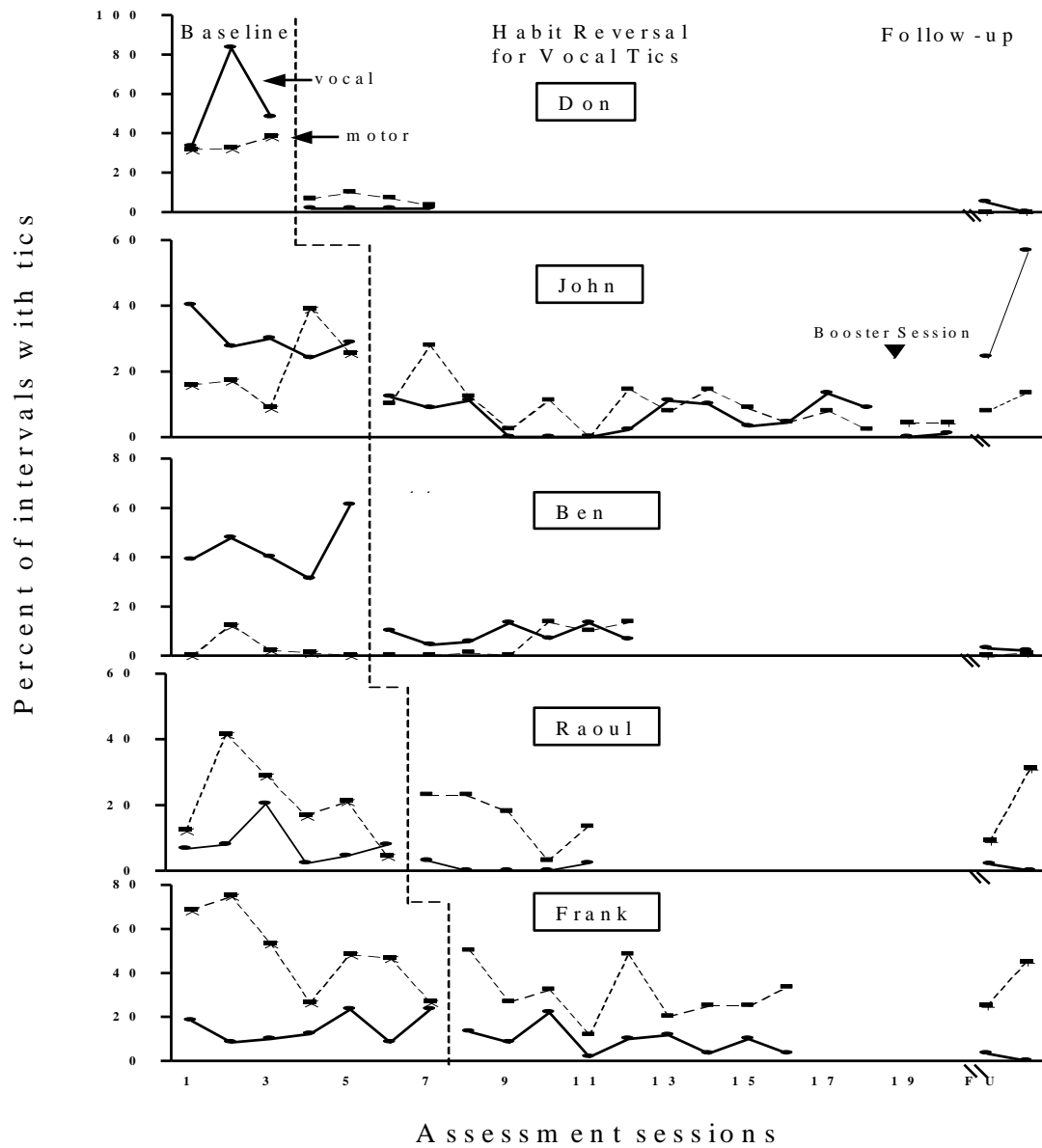
Mean YGTSS = 28.2

Woods et al. (2008). *Journal of Abnormal Child Psychology*

Funded by TSA

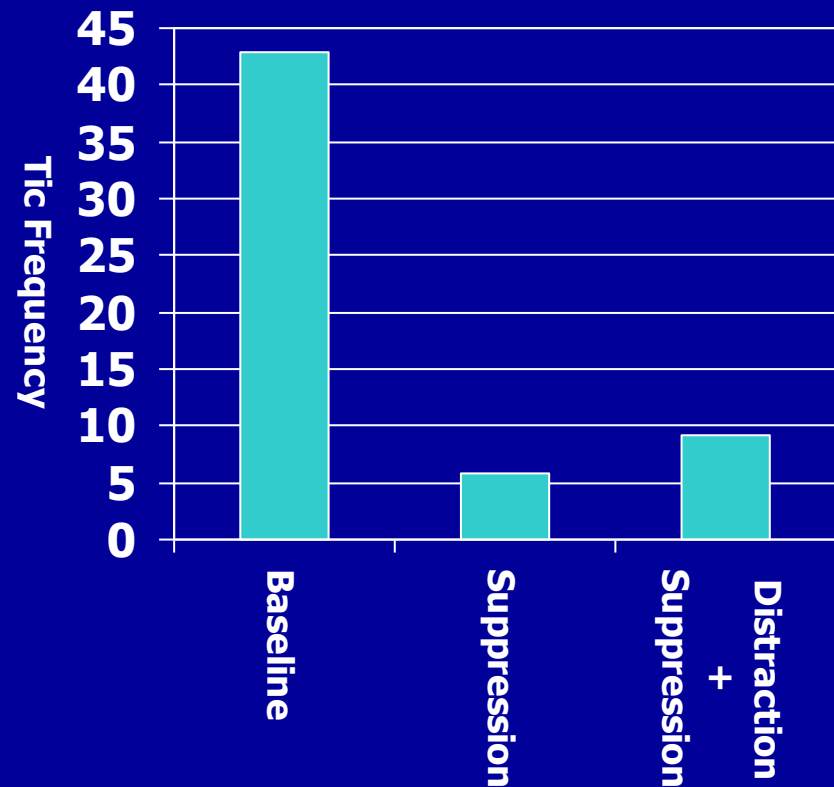
# Does Symptom Substitution Occur?

- Multiple BL Across 5 Subjects with TS
- Initial assessment followed by in home recordings
- Habit Reversal (Woods, 2001)
  - 1, 1 hr session; 2, 1/2 hour booster sessions
  - 1 session per week for 3 consecutive weeks
  - Awareness training, competing response training, social support training



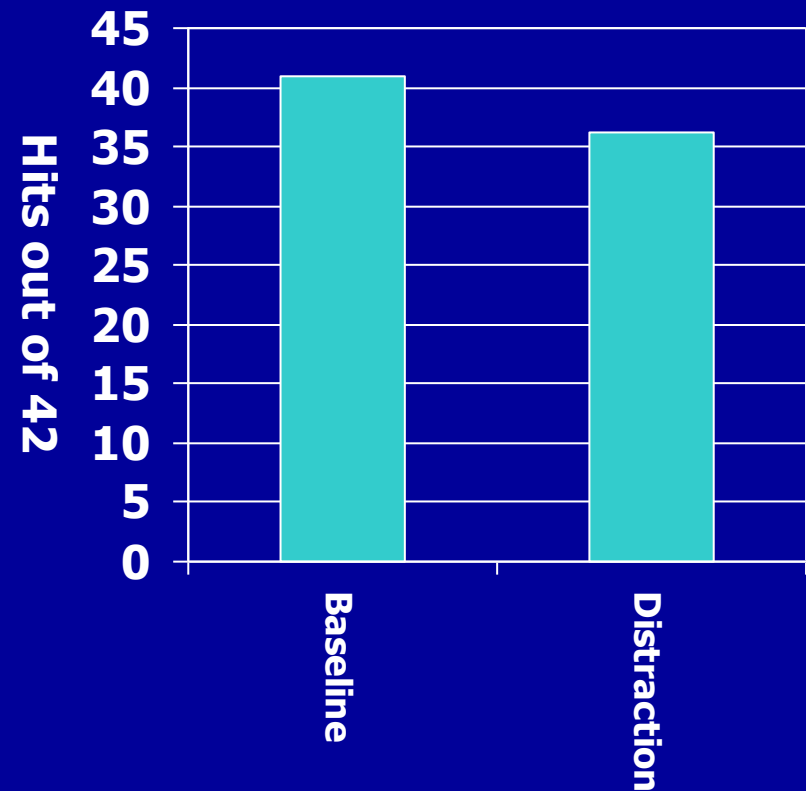
# Can Tics be Stopped While Doing Other Things?

- 9 children with TS were studied
- Tics were lower when children were asked to suppress, regardless of whether or not they were distracted while suppressing
- Reduction during suppression was 86% from BL
- Reduction during distraction was 76% from BL



# Does Stopping Tics Impact Ability to Do Other Things?

- Accuracy was reduced 11% on CPT when in the suppression+distraction condition





# Summary/Future Directions

- HRT/Behavior Therapy is a promising treatment for TS
- Still need...
  - Predictors of response to treatment
  - Mechanism of change data
  - Overcoming barriers to implementation
    - Telehealth service delivery
    - Computerized therapist training packages
    - Educating appropriate care providers about availability of BT

**“Evaluating Dissemination Strategies for Habit Reversal Training: Initial Development and Testing of a Telehealth Approach”**

M. Himle

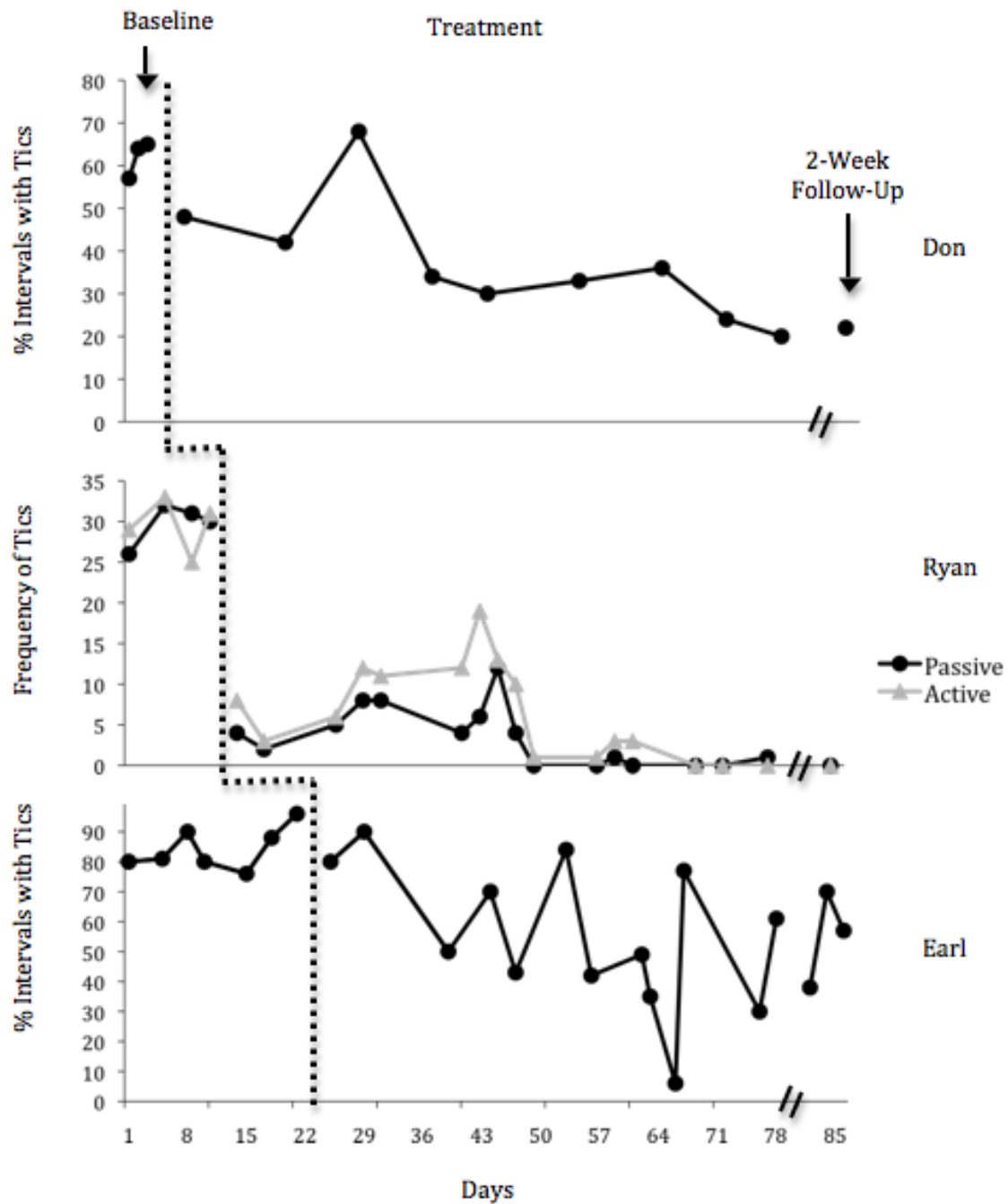
University of North Dakota

University of Utah

D. Woods

University of Wisconsin-Milwaukee

Project funded by the TSA



For more information, please go to the main website and browse for workshops on this topic or check out our additional resources.

## Additional Resources

### Online resources:

1. National Tourette Syndrome Association website: <http://www.tsa-usa.org/>
2. Society of Clinical Child and Adolescent Psychology website: <http://effectivechildtherapy.com>

### Selected Peer-reviewed Journal Articles:

1. Cook, C. R. & Blacher, J. (2007). Evidence-based psychosocial treatments for tic disorders. *Clinical Psychology: Science and Practice*, 14, 252–267.
2. Piacentini, J., Woods, D.W., Scahill, L., Wilhelm, S., Peterson, A.L., Chang, S., & Walkup, J.T. (2010). Behavior therapy for children with Tourette disorder: A randomized controlled trial. *Journal of the American Medical Association*, 303(19), 1929-1937.
3. Sallee, F.R., Kurlan, R., Goetz, C.G., Singer, H., Scahill, L., Law, G., & Chappell, P.B. (2000). Ziprasidone treatment of children and adolescents with tourette's syndrome: A pilot study. *Journal of the American Academy of Child & Adolescent Psychiatry*, 39(3), 292-299.
4. Scahill, L., Leckman, J.F., Schultz, R.T., Katsovich, L., Peterson, B.S. (2003). A placebo-controlled trial of risperidone in Tourette syndrome. *Neurology*, 60 (7), 1130-1135.
5. Silva, R.R., Munoz, D.M., Barickman, J. & Friedhoff, A.J. (1995). Environmental factors and related fluctuation of symptoms in children and adolescents with Tourette's disorder. *Journal of Child Psychology Psychiatry*, 36, 305–312.
6. Woods, D.W., Himle, M.B., Miltenberger, R.G., Carr, J.E., Osmon, D.C., Karsten, A.M., & Bosch A. (2008). Durability, negative impact, and neuropsychological predictors of tic suppression in children with chronic tic disorder. *Journal of Abnormal Child Psychology*, 36(2), 237-245,

