A SMART Study of Sequencing and Combining Pharmacological and Behavioral Treatments for ADHD:

How We Got There?
Why We Did What We Did?
What Were the Intervention Effects?
What Did They Cost?

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IES Workshop: Getting SMART about Adaptive Interventions in Education
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Disclosures

Past Consultant, scientific advisor, speaker, grant recipient:

McNeil/Alza (Concerta)
Abbott
Shire (Adderall, Adderall XR, guanfacine)
Noven (Daytrana)
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ADHD: Importance to Professionals

Prevalence: 9-12% of population in the U.S.—higher in boys—similar prevalence across many countries

Children dealt with by:
- Health Care Professionals
- Mental Health Professionals
- Allied Health Professionals
- Educators

Most common behavioral referral to health care professionals
Most common referral/diagnosis in special education
Most common behavior problem in regular education classrooms
Most common diagnosis in child mental health facilities

(Barkley, 2006; CDC, 2010, 2011; Pelham, Fabiano & Massetti, 2005)
“All of the ‘experts’ at Jerome Horwitz Elementary School had their opinions about George and Harold. Their guidance counselor, Mr. Rected, thought the boys suffered from A.D.D. The school psychologist, Miss Labler, diagnosed them with A.D.H.D. And their mean old principal, Mr. Krupp, thought they were just plain old B.A.D.!”
A Variety of Names—Same Disorder—Same Children

- Brain Damage (BD)
- Minimal Brain Damage (MBD)
- Minimal Brain Dysfunction (MBD)
- Hyperkinetic-Impulse Disorder
- Hyperkinetic Reaction of Childhood/Hyperkinesia/Hyperactivity—DSM II
- Attention Deficit Disorder (with and without hyperactivity)—DSM III
- Attention Deficit-Hyperactivity Disorder—DSM III-R, DSM-IV, DSM 5

(Barkley, 2006)
ADHD: Core Symptoms--Same Over Past 50 Years

Inattention

Impulsivity

Hyperactivity
Comorbidity with ADHD

- Learning disorders
- Language and communication disorders
- Conduct disorder
- Oppositional defiant disorder
- Anxiety disorder
- Mood disorders
- Tourette’s syndrome; chronic tics
Domains of Functional Impairment in ADHD Children

- Relationships with parents, teachers, and other adults
- Relationships with peers and siblings
- Academic achievement
- Behavioral functioning at school
- Family functioning at home
- Leisure activities

(Barkley, 2006; Fabiano & Pelham, in press)
Why Is it Important to Treat ADHD in Childhood?

ADHD children have severe problems in the key aspects of daily life functioning that predict poor outcomes in later life—parenting, school functioning, and peer relationships. These domains are what should be targets in treatment.
Prognosis for ADHD Children

Chronic disorder (AAP, 2000, 2011) extending into adolescence and adulthood

20%: **Tolerable outcome**; appear to have mild problems but must constantly work to adapt to their difficulties

60%: **Moderately poor outcome**; continue to have a variety of moderate to serious problems, including school difficulties (adolescents) or vocational adjustment and financial difficulties (adults), interpersonal problems, general life underachievement, problems with alcohol, etc.

20%: **Bad outcome**; severe dysfunction and/or psychopathology, including sociopathy, repeated criminal activity and resulting incarceration, alcoholism, drug use disorders

(Barkley, Murphy, & Fisher, 2008; Lee et al, 2011; Molina et al, 2009; Molina & Pelham, 2014)
Common but Not Evidence-Based Treatments

(1) Traditional one-to-one therapy or counseling
(2) Cognitive therapy
(3) Office based "Play therapy"
(4) Elimination diets
(5) Biofeedback/neural therapy/attention (EEG) training
(6) Allergy treatments
(7) Chiropractics
(8) Perceptual or motor training/sensory integration training
(9) Treatment for balance problems
(10) Pet therapy
(11) Dietary supplements (megavitamins, blue-green algae)
(12) Duct tape

What is Effective, Evidence-based Treatment for ADHD in Childhood?
When Did Behavioral and Pharmacological Treatments Begin to be Used for ADHD
SECTION X: CASE STUDIES, TECHNIQUES, AND CLINICAL STRATEGIES

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WITHDRAWAL OF A STIMULANT DRUG AND CONCURRENT BEHAVIORAL INTERVENTION IN THE TREATMENT OF A HYPERACTIVE CHILD

William E. Pelham

State University of New York at Stony Brook

The stimulant (methylphenidate) with which a hyperactive child was being treated was gradually withdrawn and replaced with a behavioral intervention program. The therapeutic program in home and school and the procedure used in withdrawing the drug are described. The results suggest the following: (1) This child was being maintained on a dose of methylphenidate which was twice as high as that necessary to obtain maximal improvement in behavior; (2) the behavioral intervention was at least as effective as the stimulant therapy; and (3) the effects of the behavioral intervention maintained after termination of active therapist involvement.

Reprinted with permission from Behavior Therapy, 8, 473-479, 1977. Copyright 1977 by the Association for Advancement of Behavior Therapy.

The author wishes to thank Sheldon Weintraub and Fredric Levine for helpful supervision in this case.

A 500-word summary of this paper (Behavioral treatment of hyperkinesis) appeared as a Clinical Memorandum in American Journal of Diseases of Children, 1976, 130, 565.
Chapter 9

Hyperactivity and Attention Deficit Disorders

Marc S. Atkins
William E. Pelham
Karen J. White

Figure 9.1. Mean percentage of intervals of on-task behavior for Seth in morning and afternoon academic periods.
Eight hyperactive children were treated with a behavioral intervention focusing on teacher and parent training over a period of 5 months. Three times, before therapy and after 3 weeks and 11 weeks of intervention, children received methylphenidate during 3-week probe periods. Each week in a probe they received either a placebo, 25 mg/kg, or 75 mg/kg methylphenidate. Clumsy observations of on-task behavior suggested that effectiveness of the behavioral intervention was better than that of the two doses of medication before therapy. Both dosages resulted in higher levels of on-task behavior when administered after 13 weeks of behavioral intervention than when administered before therapy. Teacher rating data showed equivalent effects of therapy and the low dosage of methylphenidate alone but a stronger effect of the high dose alone; only the high dose resulted in improved behavior after 15 weeks of behavioral intervention. As a group, only when they received the high dose of methylphenidate did 13 weeks of behavioral intervention did children reach the level of appropriate behavior shown by nonprescrption controls. However, this level was also reached by two children with the low dose and by one child without medication, and it was not reached by one child. The results suggest that the combination of psychostimulant medication and behavior therapy may be more effective in the short-term than either treatment alone for hyperactive children in school settings. In additional, parent ratings and clinic observation of parent-child interactions suggested that children had improved on the home setting, highlighting the importance of behavioral parent training in the treatment of hyperactivity.

DESCRIPTORS: hyperactivity, modifications, medication, behavior therapy, children

**Fig 1.** Mean scores for dependent measures during medication probes. Higher observations and lower Problem scores and Abbreviated Conners' ratings represent improved behavior. Placebo (pl), 25 mg/kg methylphenidate (lo), and 75 mg/kg methylphenidate (hi) weeks are shaded. Comparison children's on-task behavior in striped columns.
Methylphenidate and Children With Attention Deficit Disorder

Dose Effects on Classroom Academic and Social Behavior

William E. Pelham, PhD; Mary E. Bender, MA; Juesta Caddell, MA; Sharon Booth, MA; Samuel H. Moore, MD

The short-term, dose-response effects of methylphenidate hydrochloride were evaluated on academic and social classroom measures in 29 children with attention deficit disorder. In a double-blind, cross-over design with order randomized, children received a placebo for two weeks and three doses of methylphenidate hydrochloride (0.15 mg/kg, 0.3 mg/kg, and 0.6 mg/kg) for one week each. Dependent measures included the output and accuracy of performance in grade-appropriate reading comprehension workbooks and arithmetic problems, spelling word acquisition and word recall, and observations of disruptive and on-task behavior. Beneficial drug effects and linear dose-response curves on all dependent measures were found. The results suggest that beneficial methylphenidate effects on classroom behavior may be accompanied by enhanced academic achievement in some hyperactive children.

Arch Gen Psychiatry 1998;55:948-953

Relative Efficacy of Long-Acting Stimulants on Children With Attention Deficit-Hyperactivity Disorder: A Comparison of Standard Methylphenidate, Sustained-Release Methylphenidate, Sustained-Release Dextroamphetamine, and Pemoline

William E. Pelham, Jr, PhD; Karen E. Greenslade; Mary Yodde-Hamilton; Debra A. Murphy, PhD; Jonathan J. Greenstein, MS; Elizabeth M. Gnagy; Karen J. Guthrie, RN; Michele D. Hoover, MSN; and Ronald E. Dahl, MD

From the Western Psychiatric Institute and Clinic, Pittsburgh, Pennsylvania

A Comparison of Morning-Only and Morning/Late Afternoon Adderall to Morning-Only, Twice-Daily, and Three Times-Daily Methylphenidate in Children With Attention-Deficit/Hyperactivity Disorder

William E. Pelham, PhD*; Elizabeth M. Gnagy, BS*; Andrea M. Chronis, MA*; Lisa Burrows-MacLean, PhD**; Gregory A. Fabiano, BS*; Adia N. Onyango, BS*; David L. Meichenbaum, BS*; Andy Williams, BS*; Helen R. Aronoff, MD†; and Randi L. Steiner, BS*

Once-a-Day Concerta Methylphenidate Versus Three-Times-Daily Methylphenidate in Laboratory and Natural Settings

William E. Pelham, PhD*; Elizabeth M. Gnagy, BS*; Lisa Burrows-MacLean, PhD**; Andy Williams, BS*; Gregory A. Fabiano, BS*; Sean M. Morrissey, BA*; Andrea M. Chronis, MA*; Gregory L. Forehand, BS*; Celeste A. Nguyen, MA*; Martin T. Hoffman, MD†; Thomas M. Lock, MD†; Karl Fieltgebourn, MFA, RPh§; Erika K. Coles, BA; Carlos J. Panahon, BA; Randi L. Steiner, BS; David L. Meichenbaum, BS*; Adia N. Onyango, BS*; and Gene D. Morse, PharmD§
Evidence-Based Short-term Treatments for ADHD 1995-2019

(1) Behavior modification
   - hundreds of studies

(2) CNS stimulant medication
   - hundreds of studies

(3) The combination of (1) and (2).
   > 30+ studies

Moderate to large effect sizes across treatments

Large individual differences in response to all three forms of treatment

Given that Two Modalities of Treatment Work in the Short-term (Medication, and Behavioral Treatment), Which Should be Used as First Line Treatment or Should They Always be Used Together?
Guidelines on Treatments and Sequencing

• Task Force of APA (2007) says psychosocial first
• Guidelines of the AACAP (2007) say medication first (and 2\textsuperscript{nd}, 3\textsuperscript{rd}, 4\textsuperscript{th}, and 5\textsuperscript{th})
• Japanese pediatric guidelines (2008) say behavioral/educational first
• British guidelines (NICE, 2016) say behavioral first in young children and mild cases in older children, otherwise medication
• CHADD says simultaneous Meds and BMOD
• AAP 2011

• For elementary-aged children, the primary care clinician should recommend FDA-approved medication and/or behavior therapy, preferably both, to improve target outcomes in children with ADHD.

• For children under 6, behavior therapy should be the first line treatment, with medication perhaps as ancillary.

• For adolescents, medication should be prescribed with behavior therapy as ancillary.
Psychoactive Medication Business is Booming in America

- Pediatric drugs are typically more expensive than in adults because of lack of generics—dramatic increases in expenditures in past decade
- Insurance plans now spend more money on psychotropics than antibiotics or asthma meds (17% total drug costs)
- 6+% of children in the U.S. took at least one psychotropic in 2005, with 1/5 of those taking 2+meds
- Steady increases in use of antipsychotic medications (10% increase in 2008)—18% of ADHD children in Medicaid
- Steady increases in stimulant usage from 1990 to date
- Stimulants are the most prescribed child psychotropic—4%-7% of U.S. child population are medicated daily with stimulants for ADHD—far more than national CDC studies say BEMOD or combined treatments are used.
Evidence-based Components of Effective, Comprehensive Treatment for ADHD

- Behavioral Intervention
  - Behavioral Parent Training
  - Behavioral School Intervention
  - Behavioral Child Intervention

- (Medication as adjunct)

- (Pelham & Fabiano, 2008; Fabiano et al, 2009)
Components of Evidence-based, Behavioral Treatment for ADHD

Behavioral approach—parents and teachers are trained to implement treatment with the child, modifying interventions as necessary over time using ongoing functional analysis.

Focus on classroom behavior (e.g., rule following), academic performance, and peer relationships at school and behavior (e.g., compliance) and relationships with family at home.

Widely available in schools—less available in MH clinics.

Parent and training: weekly consultation or parent training sessions held for 4 to 12 weeks, then contact faded—Daily Report Card between school and home.

Don’t expect instant changes in child—improvement (learning) often gradual.

Continued support and contact for as long as necessary—typically multiple years and/or if deterioration.

Program for maintenance and relapse prevention (e.g., school-wide programs, and train parents to monitor over time).

Reestablish contact for major developmental transitions (e.g., adolescence).

(Pelham & Burrows-MacLean, 2004)
Why is it Important to Include Behavioral Parent Training, School Interventions, and Peer-focused Interventions for ADHD?

• No one is taught how to be a parent and parents of ADHD children have significant stress, psychopathology, and poor parenting skills

• ADHD children have severe academic and behavioral problems in school throughout the grades and teachers are not trained to educate them

• ADHD children have severely disturbed peer relationships that cannot be sufficiently modified by parents or teachers alone

• Used alone, medication does not affect these domains
"Now very slowly........ hand over all your Prozac......."
Main Beneficial Short-term Effects of Behavioral Treatments
(Fabiano et al, 2009)

• Improved functioning in home (e.g., improved compliance and parent ratings), school (e.g., improvement in classroom disruptive behavior and teacher ratings), and peer settings (e.g., improved positive and negative interactions)
• Evidence for benefit throughout the age range (4 to 15) but fewer studies at younger and older ages
• Moderate to large effect sizes across treatments and measures
• Benefits independent of comorbidity
• However, room for improvement even after acute clinic-level treatment for many children
• Less evidence (few studies) for long-term benefits
• How do we maintain benefits from acute treatments and thus emphasis on chronic care model—that is sustained low dose maintenance intervention after acute treatment
Components of Evidence-based Treatment for ADHD

Psychostimulant Medication

Need determined following initiation of behavioral treatments; timing depends on severity and responsiveness

Cycle through methylphenidate and amphetamine-based compounds (other compounds minimally helpful)

Dosing should be based on objective data regarding impairment at home and school independently

Use at minimal effective dose and adjust upward based on response and SE if necessary

Continue for as long as need exists (typically years--evaluate need and dose annually)

Plan for possible emergent iatrogenic effects (e.g., growth suppression)

Lack of evidence for long term benefit (Molina et al, 2009) and lack of evidence of long term safety (Swanson & Volkow, 2008)

(Pelham, 2009)
Main Beneficial Effects of Pharmacological Treatments

1. Decrease in classroom disruption
2. Improvement in teacher and parent ratings of behavior
3. Improvement in rule following and compliance with adult requests and commands
4. Increase in on-task behavior and daily academic productivity and accuracy (but not achievement)
5. Improvement in peer interactions
6. All benefits are acute and immediate but wear off when medication out of system (4-12 hours)
7. BUT…no evidence of long-term benefits

(Greenhill, 2002)
Limitations of Pharmacological Interventions When Used Alone

1) Rarely sufficient to bring a child to the normal range of functioning
2) Works only when and as long as medication taken
3) Not effective for all children
4) Does not affect several important variables (e.g., academic achievement, concurrent family problems, peer relationships)
6) Poor Compliance in long-term use
7) Parents are not satisfied with medication alone
8) Removes incentive for parents and teachers/schools to work on other treatments
9) Uniform lack of evidence for beneficial long-term effects (MTA, 2009)
10) Reduction in growth and ultimate adult height (MTA; Swanson et al, 2017)
11) Lack of information about long-term safety (e.g., later substance use) (Swanson and Volkow, 2008)

(Pelham, 2009)
Summary: Components of Effective, Evidence-based, Treatment for ADHD

- Parent Training--Use always
- School Intervention--Use always
- Child Intervention--Use when indicated because of complexity/expense
- Medication—Use in low doses as adjunct when behavioral treatments insufficient
- How can we best combine and/or sequence treatments to achieve best results with individual children in a cost-effective format?
What About Comparative and Combined Treatment Studies?
Comprehensive Psychosocial and Pharmacological Treatment for ADHD: The NIMH/USOE Multimodal Treatment Study
(MTACG, Archives of General Psychiatry, 1999)

Randomized Clinical Trial of four treatments:
- Community Comparison Control
- Psychosocial Alone
- Pharmacological Alone
- Combined Psychosocial and Pharmacological

576 subjects, recruited from community, entered between January and May of three consecutive years across six sites

144 subjects per group overall; 24 per group per site

Treatment for 14 months; follow-up for 10 months

Extensive manualization and standardization of treatment:
- 1000+ pages of treatment manuals
- Coordinated staff training across sites
- Extensive measures of treatment fidelity for all components
- 10+ hours of weekly conference calls to standardize protocol

All treatments implemented at high dose

Study planned and implemented in 1992-1995
What Did the MTA Study Tell us about Treating ADHD?
Average ADHD Over Time for All Subjects by Treatment Group
Questions the MTA RCT Did Not Answer

What treatments does a given child need? Should behavioral treatment begin before medication (parent preference) or vice versa (physician practice) or should they be implemented simultaneously (as in the MTA).

What are the best “doses” of psychosocial, pharmacological, and combined treatments?

If one or the other modality is begun first, how long should it be conducted and at what dose before adding in the second modality?

What are the impacts of different sequences of treatment benefits and side effects?

These are the questions that families, practitioners, and educators face daily, but they have only recently begun to be studied.
Our Research Program in the Past 15 Years

Five studies funded by NIMH and IES that examine dose effects and sequencing effects of behavioral and pharmacological tx:

1. Controlled examination of 3 levels of behavior modification (none, low intensity, high intensity) crossed with 4 doses of medication in a summer program setting and at home.

2. Follow up to (1): School-year evaluation of effectiveness and need for medication after beginning the year on one of 3 behavior modification levels (none, low intensity, high intensity).

3. Evaluation of effectiveness and need for medication in young ADHD children beginning treatment (home, school, peers, academic) with one of the same behavior modification levels as above (with adaptive components) and continuing without fading for 3 years (to pass peak period for medication use).

4. SMART (sequential, multiple, adaptive, randomized trial) design to examine whether to begin treatment with medication or behavior therapy and, when nonresponse, whether to add the other modality or increase the intensity of initial modality.

5. Two phase, linked evaluation of tolerance to stimulant medication in the STP and school-year settings, with multiple embedded studies of combined and comparative treatments.
Developing Components of the later SMART Trial

• NIMH-funded study examining the acute effect of multiple doses of behavioral intervention, medication, and their combination

• First in an acute, analogue, summer-time trial

• Then in a school-based trial
Dose-Response Effects of Behavior Modification, Medication, and their Combination in ADHD Children in a Summer Setting


(NIMH 2002-2007)

(Fabiano et al, 2007; Pelham et al, 2014; Pelham et al in preparation)
Design

48-52 ADHD children per summer for 3 summers

4 Medication conditions: placebo and 3 doses of methylphenidate (.15mg/kg, .3 mg/kg, .6 mg/kg, t.i.,d.), with order varying daily within child for 9 weeks

3 Behavioral Modification conditions: No behavioral treatment (NBM), low-intensity (LBM) treatment, and high-intensity (HBM) treatment (BM), varying triweekly in random order by treatment group

3-4 days per medication X Bmod condition.

NonADHD comparison group (24/summer).
Why Treat ADHD in a Summer Setting?

• Work on peer relationships in an ecologically valid setting (e.g., playing common games in peer group settings)
• Teach sports skills and knowledge and team cooperation
• Build friendships with other ADHD children
• Minimize summer learning loss that characterizes low achieving children
• Teach compliance skills to child and parents
• Teach daily report card concept to child and parents
Summer Treatment Research Program Overview

• Children grouped by age into groups of 12-16
• Groups stay together throughout the day
• 4-5 paraprofessional counselors work with each group all day outside of the classroom
• One teacher and an aide staff the classroom for each group
• Treatment implemented in context of recreational and academic activities
• Focus on Impairment and teaching skills—not symptoms
• Parent training incorporated
• Medication is second line treatment
## Typical STP Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30-8:00</td>
<td>Arrivals: Greetings, Daily goals review</td>
</tr>
<tr>
<td>8:00-8:15</td>
<td>Social Skills Training</td>
</tr>
<tr>
<td>8:15-9:00</td>
<td>Soccer Skills Training</td>
</tr>
<tr>
<td>9:15-10:15</td>
<td>Soccer Game</td>
</tr>
<tr>
<td>10:30-11:30</td>
<td>Art Learning Center</td>
</tr>
<tr>
<td>11:45-12:00</td>
<td>Lunch</td>
</tr>
<tr>
<td>12:00-12:15</td>
<td>Recess</td>
</tr>
<tr>
<td>12:15-1:15</td>
<td>Softball Game</td>
</tr>
<tr>
<td>1:30-3:30</td>
<td>Academic Learning Center</td>
</tr>
<tr>
<td>3:30-4:30</td>
<td>Swimming</td>
</tr>
<tr>
<td>4:45-5:00</td>
<td>Recess</td>
</tr>
<tr>
<td>5:00-5:30</td>
<td>Departures: parent-child feedback</td>
</tr>
<tr>
<td>6:30-8:30 (once weekly)</td>
<td>Parent Training/child care</td>
</tr>
</tbody>
</table>
Summer Treatment Program Overview

- Treatment Components:
  - Point System
  - Social Skills Training, Cooperative Tasks, Team Membership, and Close Friendships
  - Group Problem Solving
  - Time out
  - Daily Report Cards
  - Sports Skills Training and Recreation
Summer Treatment Program Overview

• Treatment Components:
  • Positive Reinforcement & Appropriate Commands
  • Classrooms--Regular, Peer Tutoring, Computer, and Art
  • Individualized Programs
  • Parent Training
  • Medication Assessments
  • Adolescent Program
Comparative and Combined Treatments for ADHD

3, 3-week Behavior Modification conditions assigned randomly:

- **High Intensity BMod**
  - Daily Crossover of 4 Med conditions:
    - Placebo
    - .15 mg/kg MPH
    - .3 mg/kg MPH
    - .6 mg/kg MPH

- **Low Intensity BMod**
  - Daily Crossover of 4 Med conditions:
    - Placebo
    - .15 mg/kg MPH
    - .3 mg/kg MPH
    - .6 mg/kg MPH

- **No BMod**
  - Daily Crossover of 4 Med conditions:
    - Placebo
    - .15 mg/kg MPH
    - .3 mg/kg MPH
    - .6 mg/kg MPH
<table>
<thead>
<tr>
<th>NEGATIVE CATEGORIES</th>
<th>POINTS LOST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intentional Aggression</td>
<td>50 points/TO</td>
</tr>
<tr>
<td>2. Unintentional Aggression</td>
<td>50 points</td>
</tr>
<tr>
<td>3. Intentional Destruction of Property</td>
<td>50 points/TO and reparation</td>
</tr>
<tr>
<td>4. Unintentional Destruction of Property</td>
<td>50 points and reparation</td>
</tr>
<tr>
<td>5. Noncompliance/Repeated Noncompliance</td>
<td>20 points; TO for Repeated</td>
</tr>
<tr>
<td>6. Stealing</td>
<td>50 points and reparation</td>
</tr>
<tr>
<td>7. Leaving the Activity Area Without Permission</td>
<td>50 points</td>
</tr>
<tr>
<td>8. Lying</td>
<td>20 points</td>
</tr>
<tr>
<td>9. Verbal Abuse to Staff</td>
<td>20 points</td>
</tr>
<tr>
<td>10. Name Calling/Teasing</td>
<td>20 points</td>
</tr>
<tr>
<td>11. Cursing/Swearing</td>
<td>20 points</td>
</tr>
<tr>
<td>12. Interruption</td>
<td>20 points</td>
</tr>
<tr>
<td>13. Complaining/Whining</td>
<td>20 points</td>
</tr>
</tbody>
</table>
## List of Point System Behaviors

<table>
<thead>
<tr>
<th>Positive Categories</th>
<th>Points Earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interval Categories</td>
<td></td>
</tr>
<tr>
<td>1. Following Activity Rules</td>
<td>25 points</td>
</tr>
<tr>
<td>2. Good Sportsmanship</td>
<td>25 points</td>
</tr>
<tr>
<td>3. Point Check Bonus</td>
<td>25 points</td>
</tr>
<tr>
<td>Frequency Categories</td>
<td></td>
</tr>
<tr>
<td>4. Attention</td>
<td>10 points</td>
</tr>
<tr>
<td>5. Complying with a Command</td>
<td>10 points</td>
</tr>
<tr>
<td>6. Helping a Peer</td>
<td>10 points</td>
</tr>
<tr>
<td>7. Sharing with a Peer</td>
<td>10 points</td>
</tr>
<tr>
<td>8. Contributing to a Group Discussion</td>
<td>10 points</td>
</tr>
<tr>
<td>9. Ignoring a Negative Stimulus</td>
<td>25 points</td>
</tr>
</tbody>
</table>
Dependent Measures

• Counselor-Recorded Daily Behavior
  – Following Activity Rules
  – Noncompliance
  – Interrupting
  – Complaining
  – Conduct problems
  – Negative verbalizations

• Classroom Behavior

• Seatwork productivity and accuracy

• Staff and parent behavior ratings

• Staff and parent ratings of treatment effectiveness and distress
(Fabiano et al, School Psychology Review, 2007)
Noncompliance Daily Frequency as a Function of Behavioral and Pharmacological Treatments
Results Summary

Both medication and behavioral treatment produced significant and generally comparable effects (moderate to large effect sizes) on nearly all measures of functioning in recreational and classroom settings.

Relatively low doses of both modalities produced benefit with no SE at the lowest medication dose.

On most measures in both classroom and recreational settings, the combination of the lowest dose of medication (a very low dose--.15 mg/kg per dose) and LBM produced as much and sometimes more change than did the four-times-higher doses of medication in the NBM condition, no incremental improvement with higher doses, and more change than LBM and HBM alone.

Parents preferred the behavioral treatments or their combination with low-dose medication.

Thus, combined treatment allows low doses of medication and lower doses of behavior modification.
Conclusions

• We have long argued that a benefit of combining treatment modalities is to produce equivalent improvement using lower doses of medication. The lowest dose used in this study was equivalent to less than 5 mg IR MPH t.i.d. (18 mg Concerta)—a very low dose that is only 40% of that utilized in the MTA study. There were no side effects at this dose and many side effects at the higher doses.

• The highest dose, which was necessary to optimize effects in the absence of BM, was twice that utilized in the MTA combined treatment group and 50% greater than the Medmgt group, suggesting that optimal doses of medication in the absence of all behavioral treatments requires very high doses.

• Notably, at the high dose levels of either condition, there were little incremental benefits of adding the other intervention. High doses of either treatment make the other unnecessary.
Limitation

The study was conducted in an analogue summer program setting, and the treatments were implemented simultaneously. What would have happened in natural settings (e.g., school) and if BM or Medication were implemented first?
School-based Behavioral Interventions for Children with ADHD: Impact of Intensity on Need for Medication


(under review)
Study 2 Design

• 128 participants from the Summer Research Program were randomly assigned to one of two groups for follow-up treatment in School:

  – Behavior modification consultation (BM; N=87)

  – No behavior modification consultation (NBC; N=41)
School Year Follow-Up

Weekly evaluations

Begin on no additional treatment

Begin on Behavioral Intervention

Need for treatment?

No-continue and assess weekly

Yes-medication assessment (separate for home and school) and add medication as recommended

Weekly evaluations
Procedures

• **BC group:**
  – Half of the teachers received three initial consultation visits at the beginning of the school year aimed to improve existing classroom behavior modification programs and to institute a daily report card; the parents of these children also received monthly group booster parent training meetings.
  – The other half of the teachers and parents were eligible to receive up to nine additional individual booster sessions if behavior ratings indicated impairment or as otherwise needed.
  – The half of teachers and parents who were eligible for additional treatment did not seek it and treatment intensity was equivalent across the groups, which were therefore combined for analyses.

• **NBC group:** received no consultation from the study staff.

• **All parents** had participated in 9 sessions of group BPT during the summer.
Procedures

- Teachers and parents in both groups completed weekly ratings on the Impairment Rating Scale (Fabiano et al, 2005).

- If ratings indicated the need for additional treatment or special services for two weeks in a row, and both parents and teachers agreed that medication was indicated, a medication assessment (Pelham, 1993) was conducted to select the optimal dose and children began a medication regimen.

- Medication was introduced in a step-wise manner. Only after a medication regimen was established in school could a medication trial be initiated in the home.
Results

• Survival analyses were conducted separately for school and home settings to evaluate whether continued BMOD reduced the need for medication.

• Previous medication status was a moderator.
School Survival Curves

No Previous School Medication

Previous School Medication
Home Survival Curves

No Previous Home Medication

Previous Home Medication
Summary of School-year Study

- Low dose behavioral consultation with teacher (designed high dose was never received) reduced the probability of being medicated at school by 50% and delayed medication initiation by an average of 13 weeks for children who were medicated; the effect lasted the entire school year.
- Low dose behavioral consultation with parents reduced the probability of being medicated at home by 50% and delayed and prevented medication initiation for the school year for the majority of children.
- Compared to the NBC group, children who received low dose behavioral consultation had lower medication use and received lower doses but had comparable teacher and parent ratings of behavior and comparable normalization rates.
- Costs of the two interventions were the same for the school year because the delay and reduction in medication use offset the additional costs of the behavioral consultation.
- Benefits were dramatically moderated by prior medication—children who had been previously medicated were far more likely to qualify for medication to be added.
Limitations

• All children had participated in the summer study of both medication and behavior modification at different doses of each; the majority of children had been medicated prior to the summer.

• As discussed above, individual behavioral consultations following the initial few were driven (after the first few sessions) by teacher/parent request, rather than therapist-determined, and most parents and teachers used few additional services.

• Could these behavioral strategies prevent need for and use of medication over a longer time period? Is more flexibility needed to adapt the behavioral strategies to the individual child’s need over time? Might some children have done well with medication alone? Would many children have done better with combined low-dose treatment from the beginning?

• What are the implications of the moderating effect of prior medication—permanent changes in parent preferences? Exclusion of prior medicated children in these protocols?
Implications for a SMART, Adaptive Trial

• These two studies provided the treatments for a protocol and study design that could be adapted for individuals across different settings, different treatment modalities, different treatment intensities, in different sequences, and enabling evaluation of a variety of participant characteristics (e.g., age, diagnostic comorbidity, family SES).
General Scientific Question for the SMART Trial:

Given that two modalities of treatment (Medication, and Behavioral Treatment) both have clear acute effects, how can we best sequence and combine them to achieve beneficial effects in a real life setting with individual children.
Adaptive Pharmacological and Behavioral Treatments for Children with ADHD: Sequencing, Combining, and Escalating Doses

William E. Pelham, Jr., Gregory Fabiano, Lisa Burrows-MacLean, James Waxmonsky, Susan Murphy, E. Michael Foster, Elizabeth Gnagy, Andrew Greiner, Timothy Page, William E Pelham, III, Jihnhee Yu, Stefany Coxe

(Pelham et al, JCCAP, 2016; Page et al, JCCAP, 2016)
Recruited in Spring of 3 Consecutive years

- Children recruited from schools pediatricians, newspaper, radio, mental health clinics, and parent referrals
- Baseline assessment in June
- Treatment began in late August/beginning of school
- Treatment implemented for the school year
- Endpoint measures taken at end of school year
Sample Characteristics

- 146 Children with DSM IV ADHD (74 and 72 in M First and B first) based on T ratings and P ratings and structured interview
- 80% Combined type diagnosis
- Mean age: 8.4 years
- IQ: 99
- Comorbid ODD/CD: 72%
- Prior Child Medication Treatment: 29%
- Race: 80% Caucasian
- Parent Marital Status: 9% single mothers
- Parent Education: 26% HS or Technical School; 50% AA or BA
Specific Aims/Questions

1) Is it better to begin treatment for ADHD children with a low dose of Behavior Modification or a low dose of Medication?

2) What is the most effective treatment protocol among the four embedded treatment protocols (BB, BM, MB, MM)?

3) In the event of insufficient response to each initial treatment is it more effective to increase the dose of that treatment or add the other modality?

4) What are the relative costs of these treatment strategies?
**Study Design**

1. **1st Random Assignment**
   - **“BehFirst”** Begin low-intensity behavior modification
   - **“MedFirst”** Begin low-dose medication

2. **At 8 weeks...**
   - Assess: Adequate response?
     - Yes
       - 2nd Random Assignment
     - No
       - 2nd Random Assignment

3. **“B-then-M” group**
   - Add medication

4. **“B-then-B” group**
   - Intensify behavior modification

5. **“M-then-B” group**
   - Add behavior modification

6. **“M-then-M” group**
   - Increase medication dose

7. **Continue, reassess monthly; randomize if deteriorate**
## Treatment Components

<table>
<thead>
<tr>
<th>Modality</th>
<th>Initial Treatment</th>
<th>Secondary/Adaptive Treatment</th>
</tr>
</thead>
</table>
| **Medication**            | • 8-hour stimulant equivalent to 0.15 mg/kg methylphenidate b.i.d.                                                                                                                                              | • Increased school dose  
• Added evening/weekend doses                                                                 |
| **Behavioral Treatment**  | • 8 weekly sessions of group behavioral parent training (concurrent group social skills training for children)  
• Monthly booster parent training sessions  
• 3 consultation meetings with primary teacher to establish a school-home daily report card  
• One individual parent training session to establish home rewards for daily report card | • Individual PT sessions  
• School-based rewards  
• Group or individual classroom contingency management systems  
• Time-out in school  
• Tutoring  
• Organizational skills training  
• Weekly Saturday social skills sessions  
• Homework skills training  
• Paraprofessional-implemented school rewards programs  
• Home-based daily report card |
Indicator of Need for Additional Treatment at 8-week and Subsequent Assessments:

(1) Average performance on the ITB is less than 75% AND
(2) Rating by parents or teachers as impaired (i.e., greater than 3) on the IRS in at least one domain.

Treatment decisions and content are tailored to the specific domains of impairment rated on the IRS.
Primary and Secondary Outcomes

• Primary
  – Direct observations of negative behavior in the children’s regular classrooms (Main paper)
  – Total Direct Treatment Costs (Costs paper)

• Secondary
  – Teacher Ratings of ADHD and ODD behavior
  – Parent Ratings of ADHD and ODD behavior
  – Frequency of Out-of-Class Disciplinary events
  – Parent/Teacher Ratings of Social Skills
  – Treatment Cost including implicit parental costs
First Aim/Question

• Is it better to begin treatment for ADHD children with a low dose of Behavior Modification or a low dose of Medication?
## Response to Initial Treatment

<table>
<thead>
<tr>
<th></th>
<th>SCHOOL SETTING</th>
<th>HOME SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medication First</td>
<td>Behavioral First</td>
</tr>
<tr>
<td>Responder—never rerandomized from initial treatment</td>
<td>53%</td>
<td>33%</td>
</tr>
<tr>
<td>Insufficient responder—rerandomized to a second-stage treatment</td>
<td>47%</td>
<td>67%</td>
</tr>
</tbody>
</table>
Outcomes on Objective Measures by Treatment Group

- Classroom Rules Violations Per Hour:
  - MedFirst: 12
  - BehFirst: 8
  - BB protocol: 10
  - BM protocol: 12
  - MB protocol: 14
  - MM protocol: 16

- Out-of-Class Disciplinary Events Per School Year:
  - MedFirst: 4
  - BehFirst: 2
  - BB protocol: 2
  - BM protocol: 1
  - MB protocol: 6
  - MM protocol: 4
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Medication First</th>
<th>Behavioral First</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom rules violations per hour**</td>
<td>12.7 [10.5, 15.4]</td>
<td>8.4 [6.8, 10.3]</td>
<td>IRR = 0.66</td>
</tr>
<tr>
<td>Out-of-class disciplinary events per school year†</td>
<td>3.0 [1.8, 5.0]</td>
<td>1.6 [0.9, 2.8]</td>
<td>IRR = 0.53</td>
</tr>
<tr>
<td>Teacher DBD—ADHD</td>
<td>0.98 (.67)</td>
<td>1.00 (.64)</td>
<td>d = -0.02</td>
</tr>
<tr>
<td>Teacher DBD—ODD</td>
<td>0.59 (.66)</td>
<td>0.45 (.51)</td>
<td>d = 0.24</td>
</tr>
<tr>
<td>Teacher SSRS</td>
<td>33.9 (9.5)</td>
<td>36.0 (10.5)</td>
<td>d = 0.21</td>
</tr>
<tr>
<td>Parent DBD—ADHD</td>
<td>1.49 (.63)</td>
<td>1.45 (.63)</td>
<td>d = 0.06</td>
</tr>
<tr>
<td>Parent DBD—ODD</td>
<td>1.13 (.72)</td>
<td>0.99 (.66)</td>
<td>d = 0.21</td>
</tr>
<tr>
<td>Parent SSRS</td>
<td>44.0 (11.0)</td>
<td>44.7 (10.8)</td>
<td>d = 0.07</td>
</tr>
</tbody>
</table>
Normalization

• Using MTA Criteria—Mean ratings of 1.0 or less on ratings of ADHD, ODD, and CD Sx on DSM Sx Rating Scale

• Teacher Ratings
  – 78% of BehFirst and 69% of MedFirst
  – 92% of responders to init Beh Tx and 84% of responders to init Med Tx

• Parent Ratings
  – 39% of BehFirst and 31% of MedFirst
  – 54% of responders to init Beh Tx and 66% of responders to init Med Tx
First Aim/Question and Answer

• Is it better to begin treatment for ADHD children with a low dose of Behavior Modification or a low dose of Medication?

• It is better to begin with Behavior Modification
Second Aim/Question

• What is the most effective treatment protocol among the four embedded treatment protocols (BB, BM, MB, MM)—that is best pattern of initial treatment and conditional second stage treatment (both for responders and non-responders)?
Outcomes on Objective Measures by Treatment Group
### Outcomes by Treatment Protocol

<table>
<thead>
<tr>
<th>Outcome</th>
<th>BB protocol</th>
<th>BM protocol</th>
<th>MB protocol</th>
<th>MM protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classroom rules violations per hour</strong></td>
<td>7.2† [5.8, 8.9]</td>
<td>9.3a† [7.6, 11.3]</td>
<td>14.4b [11.1, 18.6]</td>
<td>12.7ab [9.0, 18.0]</td>
</tr>
<tr>
<td><strong>Out-of-class disciplinary events per school year</strong></td>
<td>2.6ab [1.1, 6.1]</td>
<td>0.9c [0.5, 1.7]</td>
<td>5.6a [2.4, 12.9]</td>
<td>1.7bc [1.0, 2.9]</td>
</tr>
<tr>
<td><strong>Teacher DBD—ADHD</strong></td>
<td>1.09 (.65)a</td>
<td>0.91 (.61)a</td>
<td>1.03 (.71)a</td>
<td>0.95 (.63)a</td>
</tr>
<tr>
<td><strong>Teacher DBD—ODD</strong></td>
<td>0.48 (.55)ab</td>
<td>0.42 (.46)at</td>
<td>0.69 (.79)bt</td>
<td>0.50 (.50)ab</td>
</tr>
<tr>
<td><strong>Teacher SSRS</strong></td>
<td>35.0 (10.8)ab</td>
<td>36.8 (10.0)at</td>
<td>33.2 (10.7)bt</td>
<td>34.5 (8.2)ab</td>
</tr>
<tr>
<td><strong>Parent DBD—ADHD</strong></td>
<td>1.51 (.63)a</td>
<td>1.39 (.61)a</td>
<td>1.56 (.65)a</td>
<td>1.42 (.61)a</td>
</tr>
<tr>
<td><strong>Parent DBD—ODD</strong></td>
<td>1.10 (.70)ab</td>
<td>0.89 (.60)a</td>
<td>1.23 (.76)b</td>
<td>1.04 (.67)ab</td>
</tr>
<tr>
<td><strong>Parent SSRS</strong></td>
<td>44.5 (10.0)a</td>
<td>45.0 (11.6)a</td>
<td>43.6 (9.7)a</td>
<td>44.4 (12.0)a</td>
</tr>
</tbody>
</table>

Within each row, means that have no superscript in common are significantly different from each other, \( p < .05 \). Cross next to superscripts indicates difference was only marginal, \( p < .10 \).
Second Aim/Question and Answer

• What is the most effective treatment protocol among the four embedded treatment protocols (BB, BM, MB, MM)—that is best pattern of initial treatment and conditional second stage treatment?

• The best protocol was BM; the worse was MB. BB was close to BM (and better on classroom obs.) and MM was only slightly better than MB.
Third Aim/Question

• In the event of insufficient response to each initial treatment is it more effective to increase the dose of that treatment or add the other modality?
<table>
<thead>
<tr>
<th>Outcome</th>
<th>B-then-B</th>
<th>B-then-M</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom rule violations per hour*</td>
<td>6.6 [5.1, 8.6]</td>
<td>9.4 [7.5, 11.7]</td>
<td>IRR = 1.41</td>
</tr>
<tr>
<td>Out-of-class disciplinary events per school year†</td>
<td>3.2 [1.2, 8.3]</td>
<td>1.0 [0.4, 2.7]</td>
<td>IRR = 0.30</td>
</tr>
<tr>
<td>Teacher DBD—ADHD</td>
<td>1.28 (.65)</td>
<td>1.00 (.65)</td>
<td>d = 0.44</td>
</tr>
<tr>
<td>Teacher DBD—ODD</td>
<td>0.63 (.60)</td>
<td>0.52 (.49)</td>
<td>d = 0.19</td>
</tr>
<tr>
<td>Teacher SSRS</td>
<td>32.0 (9.6)</td>
<td>35.0 (9.1)</td>
<td>d = 0.31</td>
</tr>
<tr>
<td>Parent DBD—ADHD</td>
<td>1.58 (.66)</td>
<td>1.44 (.65)</td>
<td>d = 0.21</td>
</tr>
<tr>
<td>Parent DBD—ODD</td>
<td>1.19 (.70)</td>
<td>0.94 (.62)</td>
<td>d = 0.38</td>
</tr>
<tr>
<td>Parent SSRS</td>
<td>42.3 (9.1)</td>
<td>42.7 (11.4)</td>
<td>d = 0.04</td>
</tr>
</tbody>
</table>
Normalization for Those Needing more Treatment after Initial Behavioral

- Using MTA Criteria—Mean ratings of 1.0 or less on ratings of ADHD, ODD, and CD Sx on DSM Sx Rating Scale
- Teacher Ratings
  - 61% of B then B and 80% of B then M
- Parent Ratings
  - 30% of B then B and 40% of B then M
<table>
<thead>
<tr>
<th>Outcome</th>
<th>M-then-M</th>
<th>M-then-B</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom rule violations per hour</td>
<td>14.5 [9.5, 22.1]</td>
<td>17.1 [10.9, 26.9]</td>
<td>IRR = 1.18</td>
</tr>
<tr>
<td>Out-of-class disciplinary events per school year*</td>
<td>1.9 [0.8, 4.7]</td>
<td>8.2 [3.5, 19.1]</td>
<td>IRR = 4.35</td>
</tr>
<tr>
<td>Teacher DBD—ADHD</td>
<td>1.21 (.63)</td>
<td>1.43 (.71)</td>
<td>d = -0.34</td>
</tr>
<tr>
<td>Teacher DBD—ODD †</td>
<td>0.70 (.52)</td>
<td>1.15 (.91)</td>
<td>d = -0.61</td>
</tr>
<tr>
<td>Teacher SSRS</td>
<td>32.2 (6.2)</td>
<td>28.8 (11.0)</td>
<td>d = -0.39</td>
</tr>
<tr>
<td>Parent DBD—ADHD</td>
<td>1.47 (.60)</td>
<td>1.63 (.63)</td>
<td>d = -0.26</td>
</tr>
<tr>
<td>Parent DBD—ODD</td>
<td>1.12 (.67)</td>
<td>1.33 (.75)</td>
<td>d = -0.30</td>
</tr>
<tr>
<td>Parent SSRS</td>
<td>43.4 (11.9)</td>
<td>42.5 (8.9)</td>
<td>d = -0.09</td>
</tr>
</tbody>
</table>
Normalization for Those Needing more Treatment after Initial Medication

• Using MTA Criteria—Mean ratings of 1.0 or less on ratings of ADHD, ODD, and CD Sx on DSM Sx Rating Scale

• Teacher Ratings
  – 63% of M then M and 38% of M then B

• Parent Ratings
  – 34% of M then M and 18% of M then B
Third Aim/Question and Answer

• In the event of insufficient response to each initial treatment is it more effective to increase the dose of that treatment or add the other modality?

• Additional Bmod was more effective on rule violations than adding Med for BehFirst; additional Med was slightly better than adding Bmod for MedFirst.

• Rule violation rates were nearly twice as high for the two medication conditions as for the two behavioral conditions.
Rules Violations & Disciplinary Events

Classroom Rules Violations per hour:
- MedFirst: 12.7
- BehFirst: 8.4
- BB protocol: 7.2
- BM protocol: 9.3
- MB protocol: 14.4
- MM protocol: 12.7

Out-of-Class Disciplinary Events per school year:
- MedFirst: 3.0
- BehFirst: 1.6
- BB protocol: 2.6
- BM protocol: 0.9
- MB protocol: 5.6
- MM protocol: 1.7
Why Is BMOD-MED Sequence Superior to MED-BMOD Sequence?

- Treatment uptake? Post hoc analysis of parent engagement in BPT—session attendance
Parent Training Attendance—Treatment Engagement

![Bar chart showing the percentage of groups attended and families attending sessions.](chart.png)

- **Percentage of All Group Sessions Attended**
  - Medication First: 25%
  - Behavioral First: 75%

- **Percentage of Families Attending at Least 6 of 8 Group Sessions**
  - Medication First: 30%
  - Behavioral First: 60%

- **Percentage of Families Attending at Least 1 Booster Session**
  - Medication First: 10%
  - Behavioral First: 30%
Parent Engagement in Treatment is Better for those Who Received BMOD First

- Dramatically better attendance at BPT sessions
- Dramatically more families reached the threshold for good adherence
- More parents who began with BMOD first attended booster sessions
Conclusions from Effectiveness Analyses

• Sequence of treatment impacts outcomes
  • Behavioral treatment THEN medication if necessary resulted in better outcomes in school on direct observations and teacher ratings
  • Medication THEN behavioral treatment yielded inferior outcomes and reduced attendance at PT.
  • Results are arguably mediated by parent training attendance/participation

• Thus, improvement in parental skills at home and parental involvement with the children’s schools (e.g., backing up the DRC, communicating with teachers) were limited dramatically when medication was begun first—medication undermines parental involvement in treatment

• 8 sessions of group PT and a teacher implemented DRC is sufficient for 36% of ADHD children; 64% need either more group or individual sessions or combined treatment with medication at a low dose, both of which were effective.

• 54% of children responded well to a very low dose of medication, but increases in medication dose were ineffective for the remainder; nothing predicts who will respond to that dose; physicians who start treatment with medication will produce poor outcomes in half of their patients.

• Prior experience with medication moderated these effects
Fourth Aim/Question

• What are the relative costs of these treatment strategies?
Costs of Combined and Unimodal Treatments and Sequences
(Page et al., 2016)

• Only previous comparison of treatment costs is MTA (Jensen et al., 2005)

• Limitations of MTA cost study:
  – Expensive, intensive behavioral treatment used
  – All children received fixed treatment regardless of need
  – At the time of the MTA, inexpensive, generic immediate-release methylphenidate was standard
  – Now, children are medicated with new, extended-release formulations that are much more costly—$7.50 daily vs. 30 cents
Analyzing Cost of Treatments

- **Goal:** determine cost of treatment for each child over the 10-month (school-year) duration of study
- Detailed logs contained information on every instance of treatment each child received, including type, date, location, persons present, and duration
- For each child we compute the amount of
  - physician time (valued at $86/hour)
  - clinician time ($21 or $36/hour)
  - paraprofessional time ($12/hour)
  - teacher time ($41/hour)
  - parent time ($23/hour)
  - medication ($.30-$2 for IR, $4-8 for ER)
  - gasoline ($3.14/gallon)
- **Wages taken from the U.S. Bureau of Labor Statistics**
- Average treatment cost is then simply the sum of enumerated cost categories described above divided by the number of children
Payer vs. Societal Perspectives

- **Primary estimates included only direct costs attributable to the interventions**
  - Payer perspective
  - Explicit costs only

- **Secondary estimates included the implicit time costs to parents, who spent time in parent training and physician visits**
  - Societal perspective
  - Explicit costs + implicit costs
Costs Based on Initial Assignment

- **Direct Cost**
  - Medication First
  - Behavior First

- **Including Parent Cost and Gas**
  - Medication First
  - Behavior First
Costs of Combined Treatments

Costs:
- Direct Cost
- Including Parent Cost and Gas

Comparisons:
- Med + Med
- BMod + BMod
Costs of Combined Treatments

Direct Cost
- Med + BMod
- BMod + Med

Including Parent Cost and Gas
- Med + BMod
- BMod + Med
Cost Summary

- Behavioral First was significantly less expensive than Medication First
- Behavioral plus Behavioral if necessary was less expensive than Medication plus medication if necessary
- Behavioral plus medication if necessary was less expensive than Medication plus behavioral if necessary
- The incremental costs of behavioral treatment were offset by reductions in medication cost when behavioral treatment was implemented first.
- $4 billion could be saved in US healthcare economy if medication were NOT the first-line treatment for childhood ADHD.
Fourth Aim/Question and Answer

- What are the relative costs of these treatment strategies?
- Conditions that started with or included behavioral treatment are always less expensive than those that included medication alone or medication as the initial intervention.
Some Issues of Implementation in this SMART Trial: Lessons Learned

• Doing intervention in parallel in home and school
  – Prior meds in kid or family—problem (dropout, time course) and solution
  – PT groups for second stage Beh conditions—slight diffs in composition and major differences in uptake (unknown until data analysis)

• Teacher views of meds/CM—preferences, own child’s tx, prior treated kids in teacher’s classroom

• Tailoring variables
  – P and T IRS, DRC/ITBE-dual criteria (why?) why ITBE vs direct obs.?
  – Confirmed in clinical decisions by senior investigators—group consensus
    • Practical issue—must spread these meetings out if have 150 Ss
    • Joint presence of the MDs and PhDs overseeing the treatment if two sets of expertise are needed
  – Cross site meetings/decisions if necessary

• How often do Tx adjustments (e.g., gather required data--prior study example—planned biweekly—infeasible—moved to monthly.)

• Experience of therapists/consultants (trade-offs)

• Nimble adaptive adjustments to protocol as needed
Implications of these Studies for Further Study of EBPs in ADHD

• Disentangle parent role/involvement from school role/involvement
  – Separate SMART trials for home and school interventions (e.g., our new RtI SMART—next slide)

• Investigate parental uptake/implementation and the impact of prior and concurrent medication
  – Design sufficient N to investigate moderation/mediation and mechanisms

• Investigate teacher uptake/implementation and the impact of concurrent medication
  – Design sufficient N and number of classroom observations to investigate mediation/moderation and mechanisms (current interest)
Current Trial: IES-Funded RtI Study—School Only, CM/DRC First, Enhanced CM or Med as Last Stage, Larger N, BAU Group

Phase 1 Randomization

Tier 1 Classroom-wide Management Strategies (Est. N = 200)

Phase 1: Tier 1 vs BAU

Monthly Follow-Up Assessment

Responders (Est. N = 10)

Non-Responders (Est. N = 190)

RTI: DRC (Est. N = 190)

Phase 2: Tier 2 A vs. BAU

Monthly Follow-Up Assessment

Responders (Est. N = 63)

Non-Responders (Est. N = 127)

Phase 3 Randomization

Phase 3: Tier 2 B vs Med vs BAU

MED (Est. N = 63)

RTI Enhanced (Est. N = 63)

BAU (Est. N = 109)
Implications of these Studies for Further Study of EBPs in ADHD

• Need to extend this study to the domains of academic functioning and interventions for peer relationships for children who need intervention in these domains.

• Need to extend this study to long-term treatments for ADHD as a chronic condition model of treatment (e.g., diabetes). How can we make interventions feasible for and palatable for families and schools so they will be maintained in the long run?

• Effective treatment requires systems cooperation (e.g., collaboration between families, schools, mental health clinics, primary care, payors) and a public health perspective. Can SMART trials be designed and implemented in medical/MH systems levels (e.g., pediatricians’ offices, Community MH Centers)?
Implications of these Studies for Evidence-based Treatments in Routine Care for ADHD

• Focus on impairment in daily life functioning rather than DSM symptoms, treat for settings and domains of impairment, and monitor impairment to modify treatment

• Depending on child’s severity, start with low dose behavioral treatment (parent, teacher, child) and evidence-based academic interventions if needed

• Add medication or more intensive Behavioral interventions when impairment is not minimized to an acceptable level

• Use low dose of medication (not “optimal” dose) so as not to remove need for behavioral/educational treatments and to minimize SE & risks

• Be mindful that once medication is used initially as first line tx, the average child’s outcome will be worse than otherwise no matter what subsequent treatments are used.—what do we do to work this fact into clinical trials and clinical practice?
Additional Clinical Recommendations for Evidence-based Treatment of ADHD Going Forward

• Start behavioral and academic interventions at as early an age as possible and continue—reading example and severity of social problems

• Stay in regular contact with family to monitor both behavioral treatments and medication--chronic condition model of treatment

• Make interventions feasible for and palatable for families so they will be maintained in the long run

• Effective treatment requires systems cooperation (e.g., collaboration between families, schools, mental health clinics, primary care, payers) and a public health perspective and effective governmental contingencies for payment to providers
Additional Suggestions for Research and Practice in the Future of Treatment for ADHD

• Predicting from baseline measures which children should get what treatment--e.g., cognitive testing, neuroimaging, genetics? Nothing has panned out with this approach in the past 50 years.

• Developing simple measurement tools for home and school implementation of the “stepped care” treatment model we have been studying—e.g., IRS.

• Incorporate new technologies (e.g., telehealth, web apps)? E.g., EMA using cell phones in parent training.

• Much more study of transitions beyond childhood—only a dozen or so studies on adolescents and even fewer on transition post H.S. to young adulthood.
Additional Suggestions for Research and Practice in the Future of Treatment for ADHD

• For example, should high schools go back to teaching trades for children like those with ADHD?
• High school ”home ec” classes for teaching adult daily life skills to ADHD teens (e.g., financial independence)

• Can/will child psychiatry change in the US?
• Focus on collaboration with primary care—pediatricians and family practitioners
• Develop initiatives with payers—emphasize reduced cost and potential increased profits of Behavioral- First treatment for ADHD
Additional Suggestions for Research and Practice in the Future of Treatment for ADHD

• How to improve school district implementation of existing federal laws regarding services for ADHD children

• Effective treatment requires systems cooperation (e.g., collaboration between families, schools, mental health clinics, primary care, payers) and a public health perspective

• Improvements in MH services for ADHD require policy changes (e.g., federal/state/provincial dollars contingent on EBTs) for which MH professionals must learn and practice lobbying
Instruments
Impairment Rating Scales (Parent and Teacher)
Disruptive Behavior Disorder Symptom Rating Scale (Parent and Teacher)
Pittsburgh Side Effect Rating Scale
DBD Structured Interview
Parent Application Packet and Clinical Intake Outline
Initial Teacher Interview

Information
What Parents and Teachers Should Know about ADHD
Medication Fact Sheet for Parents and Teachers
Psychosocial Treatment Fact Sheet for Parents and Teachers
Many reprints
Videos of lectures on child treatments

“How to” Handouts
How to Establish a School-Based Daily Report Card
Summer Treatment Program—training video and manual
I Express my Sincere Gratitude to the Hundreds of Graduate Students, Postdocs, Colleagues, Research, and Administrative Staff Who Were Involved in These Studies over the Past 40 Years
Buffalo Treatment Algorithm for ADHD

- Conduct assessment using evidence-based measures
  - Use brief P and T rating scales rather than structured interviews
  - Provide information about ADHD
  - Focus assessment on functional impairment in key domains:
    - Family/parenting skills/parent-child relationship
    - Academic progress/school behavior
    - Relationships with peers

- Impairment found?

- Explain risks and benefits of treatment and develop management plan with family
  - Begin evidence-based behavioral treatment focusing on areas identified as impaired:
    - Family/Parenting: 8-week group-based behavioral parent training course
    - School: School-based Daily Report Card established by parent
    - Peer: 8-week group-based child social skills training (concurrent with parent training)

- Conduct ongoing, brief, idiographic assessments of functioning (e.g., IRS, ITBE) in home, school, and peer domains throughout treatment

- Continued impairment?

- Add limited number of individual, problem-focused behavioral parent-training sessions and/or teacher consultations to establish additional evidence-based programs to deal with continued impairment in key domains (family/parents, school, peers)

- Continued impairment?

- Discuss with family risks and benefits of additional treatments to develop management plan, taking into account parental preference, family resources (e.g., insurance coverage, teacher cooperativeness, socioeconomic factors), and risk:benefit ratios

- Parental Choice

- Add medication trial with methylphenidate or amphetamine compounds; start with very low dose for school time only; if inadequate response, increase dose and/or add doses for other times/settings; if inadequate response, assess the other stimulant compound; if inadequate response, assess Strattera

- Continued Impairment?

- Increase intensity of behavioral interventions according to continued impairment; add parent training sessions; add Summer Treatment Program; add teacher consultations or pursue special education placement

- Continued Impairment?
Thank you!