The Intersection of Applied Behavior Analysis and Behavioral Pharmacology

Tom Byrne, Ph.D., BCBA-D
MCLA
Medication change
“Drug use is so entrenched in our society that anyone interested in human behavior must consider its influence.”
(Higgins, Hughes, & Gallager, 1987)
We practice the science of behavior change.

- Drugs can have profound effects on behavior.
- Behavior analysts may not receive specific training in the behavioral effects of drugs.
- Some of your clients are/will be prescribed psychoactive drugs.
- Estimates of the percentage of children diagnosed with autism and receiving pharmacotherapy range from 30 to 42 percent (Sullivan and Sadeh, 2014)
- Estimates of the percentage of children diagnosed with ADHD and receiving pharmacotherapy fall between 40 and 69 percent. (CDC, 2011)
Two assertions

• It would be beneficial for behavior analysts to be conversant regarding those psychoactive medications we encounter frequently.
• Our training and methodology places us in a good position to evaluate drug effects.
The FDA has approved two drugs for autism treatment

- Risperidone (Risperdal)
- Aripiprazole (Abilify)
- Both are atypical or second-generation antipsychotics
- Behavior analysts may be unfamiliar and perhaps, surprised, with the research methodology used in clinical drug trials.
Risperidone in Children with Autism and Serious Behavioral Problems

- James T. McCracken, James McGough, Bhavik Shah, Pegeen Cronin, Daniel Hong, Michael G. Aman, L. Eugene Arnold, Ronald Lindsay, Patricia Nash, Jill Hollway, Christopher J. McDougle, David Posey, Naomi Swiezy, Arlene Kohn, Lawrence Scahill, Andres Martin, Kathleen Koenig, Fred Volkmar, Deirdre Carroll, Allison Lancor, Elaine Tierney, Jaswinder Ghuman, Nilda M. Gonzalez, Marco Grados, Benedetto Vitiello, Louise Ritz, Mark Davies, James Robinson, and Don McMahon, M.S.
Conclusions

“Risperidone was effective and well tolerated for the treatment of tantrums, aggression, or self-injurious behavior in children with autistic disorder. The short period of this trial limits inferences about adverse effects such as tardive dyskinesia. (p. 315)”
Data

A graph showing the mean irritability score over weeks for Placebo and Risperidone treatments. The y-axis represents the mean irritability score, ranging from 0 to 30, and the x-axis represents the week, ranging from 0 to 8. The Placebo group shows a decrease in irritability score over time, while the Risperidone group shows a more significant and rapid decrease in irritability score compared to Placebo.
Irritability?

- Tantrums, aggression, and self-injurious behavior were viewed in a topographical rather than a functional context.
- IMHO, they were treated more like an infection.
- Behavior was not measured directly.
ABC’s were used

Antecedent  Behavior  Consequence?

No

Aberrant Behavior Checklist
Aberrant Behavior Checklist

- ABC includes an “Irritability” subscale
- “Please rate the child’s behavior according to the scale below:
  0 = behavior is not a problem
  1 = The behavior is a slight problem
  2 = The behavior is a moderate problem
  3 = The behavior is a severe problem
ABC continued

- Self injury
- Tantrums
- Crying and screaming
- “Irritable and Whiny”
Fast and easy
Side Effects
(p < .05)

• Increased appetite
• Fatigue
• Drowsiness
• Drooling
• Weight gain (mean of 2.7 kg in 8 weeks)
A note regarding placebo control
Influence: Cited over 500 times

- Impact Factor:

  [The NEW ENGLAND JOURNAL of MEDICINE] 54.42

  [Journal of Applied Behavior Analysis] 1.087
A Placebo-Controlled, Fixed-Dose Study of Aripiprazole in Children and Adolescents With Irritability Associated With Autistic Disorder


(I will list the authors later)
“Aripiprazole was efficacious and generally safe and well tolerated in the treatment of children and adolescents with irritability associated with autistic disorder.”
Main DV?

“At week 8, all aripiprazole doses produced significantly greater improvement than placebo in mean Aberrant Behavior Checklist Irritability subscale scores”
<table>
<thead>
<tr>
<th>Author</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.N. Marcus</td>
<td>Bristol-Myers Squibb</td>
</tr>
<tr>
<td>R. Owen</td>
<td>Bristol-Myers Squibb</td>
</tr>
<tr>
<td>L. Kamen</td>
<td>Bristol-Myers Squibb</td>
</tr>
<tr>
<td>G. Manos</td>
<td>Bristol-Myers Squibb</td>
</tr>
<tr>
<td>R.D. McQuade</td>
<td>Bristol-Myers Squibb</td>
</tr>
<tr>
<td>W.H. Carson</td>
<td>Otsuka Pharmaceutical Co</td>
</tr>
<tr>
<td>M. Aman</td>
<td>Otsuka Pharmaceutical Co</td>
</tr>
<tr>
<td></td>
<td>Ohio State University</td>
</tr>
</tbody>
</table>
A metaphor: intervention for reducing automobile accidents

Prior to designing intervention, we should examine why accidents happen:
- Driver impairment (drugs, sleep, texting)
- Weather (ice, glare)
- Mechanical failure (faulty brakes, blowouts)
- Driver experience
- Animal crossings
Never mind!

• Too much trouble! Let’s just lump it all together and call it . . .
• Crashability
• Intervention will involve setting speed governors at 10 mph.
• Data: Let’s not bother with actually counting accidents.
UCLC (Unusual Car Condition Checklist)

• Please rate your car’s condition for the past four weeks. For each item assign the appropriate number:
  0 = Not a problem
  1 = A little problem
  2 = A moderate problem
  3 = A severe problem
Crashability Subscale

• Seek frequent contact with large objects.
• Accelerate at inappropriate times
• Unresponsive to pedestrians
• Make lane changes quickly and unpredictably
Some Historical Notes

- Johnson & Johnson Ordered to Pay More Than $2.2 Billion to Resolve Criminal and Civil Investigations (Department of Justice, 2013)
- Note that J&J sold $4.5 billion of Risperidone in 2007 alone
- Current lawsuits (hundreds) regarding gynecomastia. One recent settlement involved a young man who developed size 44DD breasts.
When it comes to assessing drug effects, you can do better

- As behavior analysts, we are in a good place to a) measure behavior, b) evaluate treatment efficacy and c) identify stimulus function.
- With some study, these skills can be applied to investigating drug effects.
Behavioral Pharmacology

• Essentially a merger of behavior analysis and pharmacology
• If you have formal training in behavior analysis, you already understand much of the approach
## Stimulus Functions of Drugs

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>discriminative stimuli</td>
<td></td>
<td>reinforcers</td>
</tr>
<tr>
<td>motivational operations</td>
<td></td>
<td>punishers</td>
</tr>
<tr>
<td>unconditioned stimuli</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conditioned stimuli</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Stimulus Functions of Drugs

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>discriminative stimuli</td>
<td></td>
<td>reinforcers</td>
</tr>
<tr>
<td>motivational operations</td>
<td>unconditioned stimuli</td>
<td>punishers</td>
</tr>
<tr>
<td>unconditioned stimuli</td>
<td>conditioned stimuli</td>
<td></td>
</tr>
</tbody>
</table>

- **A**: Discriminative stimuli, motivational operations, unconditioned stimuli, conditioned stimuli
- **B**: (Blank)
- **C**: Reinforcers, punishers
Drugs as Motivational Operations

- A drug functions as a motivational operation if it alters the reinforcing efficacy of other stimuli.
Methylphenidate increases cigarette smoking in participants with ADHD.

- *Psychopharmacology* (2011)

Fig. 1 Dose–response functions for total number of puffs (top panel) and carbon monoxide levels (bottom panel). X-axes methylphenidate dose in milligrams; data points above PL designate placebo values. Data points show the means of nine participants. Filled symbols indicate those values that are significantly different from the placebo value.
Fig. 2 Dose–response functions for number of food items (*top panel*) and calories consumed (*bottom panel*). All other details are the same as for Fig. 1.
An Evaluation of Methylphenidate as a Potential Establishing Operation for Some Common Classroom Reinforcers

*Journal of Applied Behavior Analysis (1998)*

Northup, J., Fusilier, I. Swanson, V., Roane, H., and Borrero, J.
Use of Functional Analysis Methodology in the Evaluation of Medication Effects


Fig. 2. Responses per minute of self-injury and aggression during all phases of the functional analysis for Sean.
Back where we started

Could medication change cause an increase in maladaptive behavior?

- AO: Reduce reinforcing efficacy of contrived reinforcers.
- MO: Increase reinforcing efficacy of food/attention
- MO: Increase value of escaping from demands
Resources


References available upon request

Thank you