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Using telehealth in research to improve behavioral assessment and treatment for children with autism

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As things improve, Izzy is able to find more moments of calm.
(KC McGinnis / Spectrum)

Outline

1. Introduction to telehealth and its scope of usage
2. Brief history of telehealth research at UIowa
3. Current large-N telehealth studies at UIowa: Establishing best practice in assessment and treatment of behavior for ASD
4. Case study
5. Utility of telehealth for behavioral assessment and treatment for ASD

Telehealth: The provision of health care remotely by means of…technology, including telephones, smartphones, and mobile wireless devices (Dorsey & Topol, 2016)

Telehealth Terminology

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Broad and specialty specific terminology:

General: *Telehealth>telemedicine*

Specifics: *Telepsychology, teleradiology*, and *telepsychiatry*

Sites:

Originating or *Remote Site* = Patient site

Distant or *Host Site* = Provider site

Timing of interaction:

Synchronous = Real-time audio/video feed

Asynchronous = Storage and forwarding of clinical data (ex: teledermatology)

Telehealth's Rapid Expansion and Acceptance

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Usage:

- 2006 = 26,000 *visits*;
- 2012 = 10 million *users*;
- 2013 = 15 million + users

(Gilman & Stensland, 2013; Modahl, 2015)

- Telehealth soon to overtake in-person visits at some hospitals (Dorsey & Topol, 2016)

Acceptance:

- 64% of consumers are willing to use telehealth for physical and/or mental health care (Modahl, 2015)

UIOWA'S HISTORY OF TELEHEALTH RESEARCH

UIowa's ABA Telehealth Journey

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Type I: Feasibility Studies of Telehealth

Ulowa's ABA Telehealth Journey: Grant Support

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Type I: Feasibility Studies of Telehealth

Wacker, D. (1996-2000): U.S. National Library of Medicine/NIH

Lindgren, S. & Wacker, D. (2009-2012): R01 National Institute of Mental Health

Type II: Comparative Studies (Telehealth vs. In-Vivo)

Lindgren, S. & Wacker, D. (2011-2015) : R40 U.S. Dept. of Health and Human Services (MCHB)

Lindgren, S. & Wacker, D. (2013-2014): R40 U.S. Dept. of Health and Human Services (MCHB)

Type III: Telehealth as the Modality

Lindgren, S. & Wacker, D. (2011-2015) : U.S. Dept. of Health and Human Services, R40

Lindgren, S. & Wacker, D. (2015-2019) : R01 from the National Institute of Mental Health of the National Institutes of Health.

Ulowa's ABA Telehealth Journey: Type I Studies

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Type I: Feasibility Studies of Telehealth

- Clinic to school/clinic BFA: Baretto et al. (2006). *JABA*
- Clinic to clinic extended FAs with parents: Wacker et al. (2013) *JABA*
- Clinic to clinic FCT with parents: Wacker et al. (2013) *J Dev Phys Disabil*
- Clinic to home fidelity of treatment with parents: Suess et al. (2014) *J Behav Educ*
- Clinic to clinic brief assessment and treatment model: Suess et al. (2016) *JABA*

Ulowa's ABA Telehealth Journey: Type II Studies

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Type II: Comparative Studies (Telehealth vs. In-Vivo)

Lindgren, S., Wacker, D., Suess, A., Schieltz, K., Pelzel, K., Kopelman, T.,…& Waldron, D. (2016). Telehealth and autism: Treating challenging behavior at lower cost. *Pediatrics,* 137, S167-S175.

Results

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Behavioral Outcomes Achieved by Parents of FA+FCT Treatment Using Different Service Delivery Models

Variables	Group1 *In-Home Therapy* (n=44)	Group 2 *Clinic Telehealth* (n=20)	Group 3 *Home Telehealth* (n=30)	Significance *P*
Percent Reduction in Problem Behavior:				
Mean (SD)	95.76% (8.91)	91.00% (13.66)	97.27% (6.00)	.074
Range	59.07 - 100%	47.40 - 100%	77.01 - 100%	

From: Lindgren, S. et al. (2016). *Pediatrics*

TABLE 3 Costs of Treatment With FA and FCT When Delivered via Different Service Models

Variables	Group 1: In-Home Therapy (n = 44)	Group 2: Clinic Telehealth (n = 20)	Group 3: Home Telehealth (n = 30)	P
Staff costs				
Mean	$4687.86[a]	$1693.30[b]	$1190.00[b]	<.001[c]
(SD)	(1799.51)	(371.72)	(519.20)	
Facility costs				
Mean	$99.04[a]	$172.20[b]	$97.44[a]	<.001[c]
(SD)	(38.02)	(37.80)	(42.51)	
Family costs				
Mean	$1163.06[a]	$1202.96[a]	$858.20[b]	.002[c]
(SD)	(446.46)	(264.08)	(374.43)	
Total cost				
Mean total cost per child to complete treatment	$5949.97[a]	$3068.46[b]	$2145.64[b]	<.001[c]
(SD)	(2283.99)	(673.60)	(936.15)	

Sensitivity analyses based on 25%–50% higher or lower estimates of staff, facility, and family costs produced changes in total costs for each treatment, but the pattern of relative costs between groups remained similar.

[a] When there were significant between-group differences, groups with the same superscript in the same row did not differ from each other.

[b] When there were significant between-group differences, groups with the same superscript in the same row did not differ from each other.

[c] Significant differences were based on ANOVA.

From: Lindgren, S. et al. (2016). *Pediatrics*

Ulowa's ABA Telehealth Journey: Type III Studies

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- Clinic to clinic: Functional vs. arbitrary reinforcers in FCT : Fewell et al. (2016) *J Dev Phys Disabil*
- Recently completed: RCT of FCT
- Study in progress: RCT of FA

Type III: Telehealth as the Modality

CURRENT RESEARCH AT UIOWA: ASSESSMENT AND TREATMENT OF CHALLENGING BEHAVIOR IN CHILDREN WITH ASD

Current Projects

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Purpose: Conduct randomized controlled trials of common ABA procedures (FA+FCT) for severe and challenging behavior in children with autism

- Large-N designs may increase acceptance of ABA (Smith, 2012) & allows for greater dissemination

- The "Gold Standard" for "evidence-based" medicine = randomized controlled trial (RCT; Guyatt et al., 2008)

Treating Challenging Behavior

Two-Step Package:

1. Functional Analysis
   - "gold standard" of behavioral assessment

2. Functional Communication Training
   - Most studied behavioral treatment for S&C behavior

Functional Analysis

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What is it?

Systematic manipulation of antecedents and consequences to determine their effect(s) on occasioning and maintaining behavior.

The Goal:

Identify:

A. What evokes problem behavior?

B. What maintains problem behavior?

Functional Analysis (Iwata et al., 1982/1994)

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- Randomized 5-min sessions
- Multi-element design
- Assessment length: once a stable pattern of responding with separation across conditions
- Criteria developed by Roane et al., (2013) for determinations of function

Step 1: Functional Analysis

(Iwata et al., 1982/1994)

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Test Condition	ANTECEDENT (E.O.)	BEHAVIOR	CONSEQUENCE/ PUTATIVE REINFORCER
Free Play (control)	---	---	---
Attention	*divert/divide attention*	target	*brief statement of disapproval*
Escape	*demand*	target	*break from demand for 30 sec*
Tangible	*remove tangible*	target	*return tangible for 30 sec*

FA with Izzy – Escape Condition

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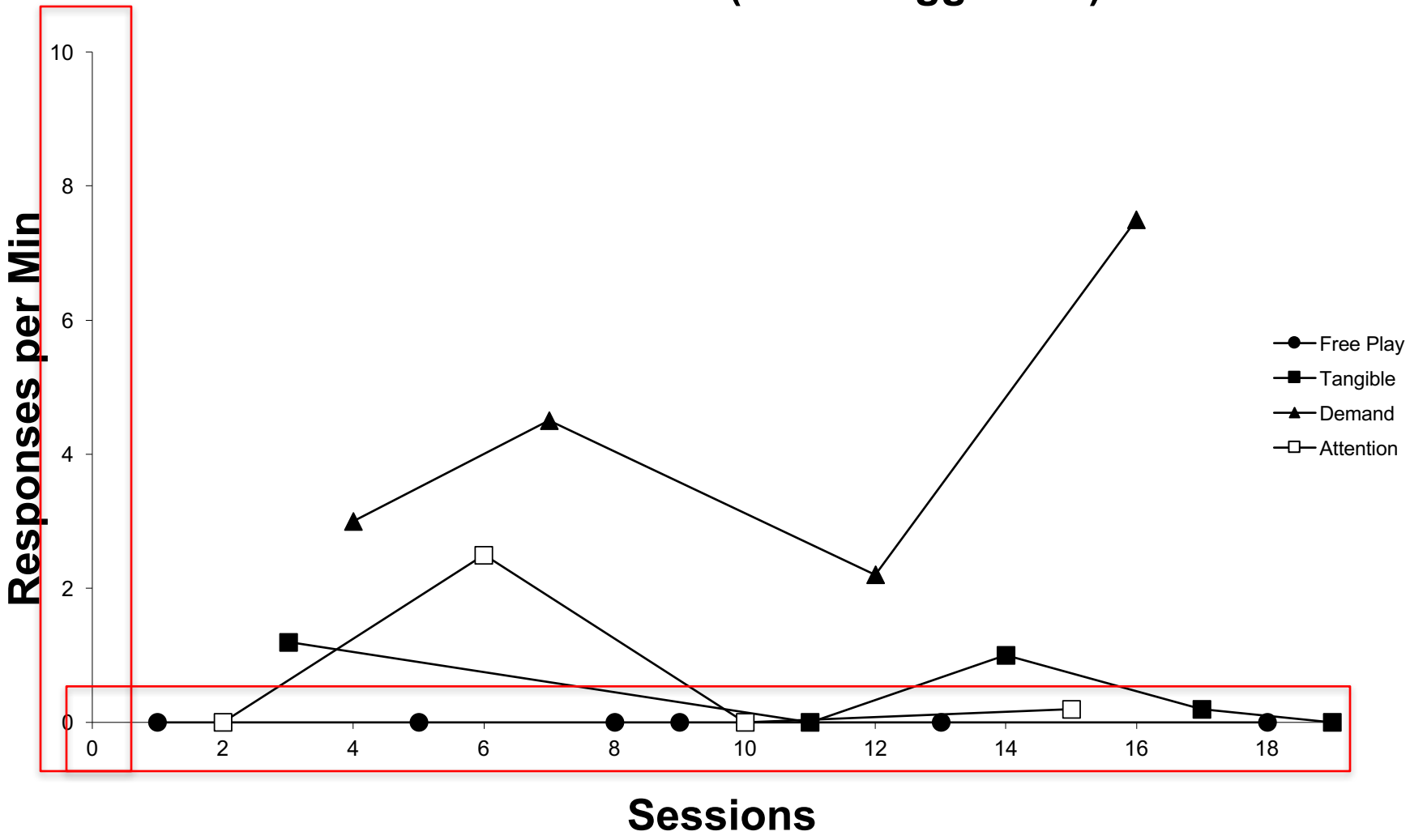
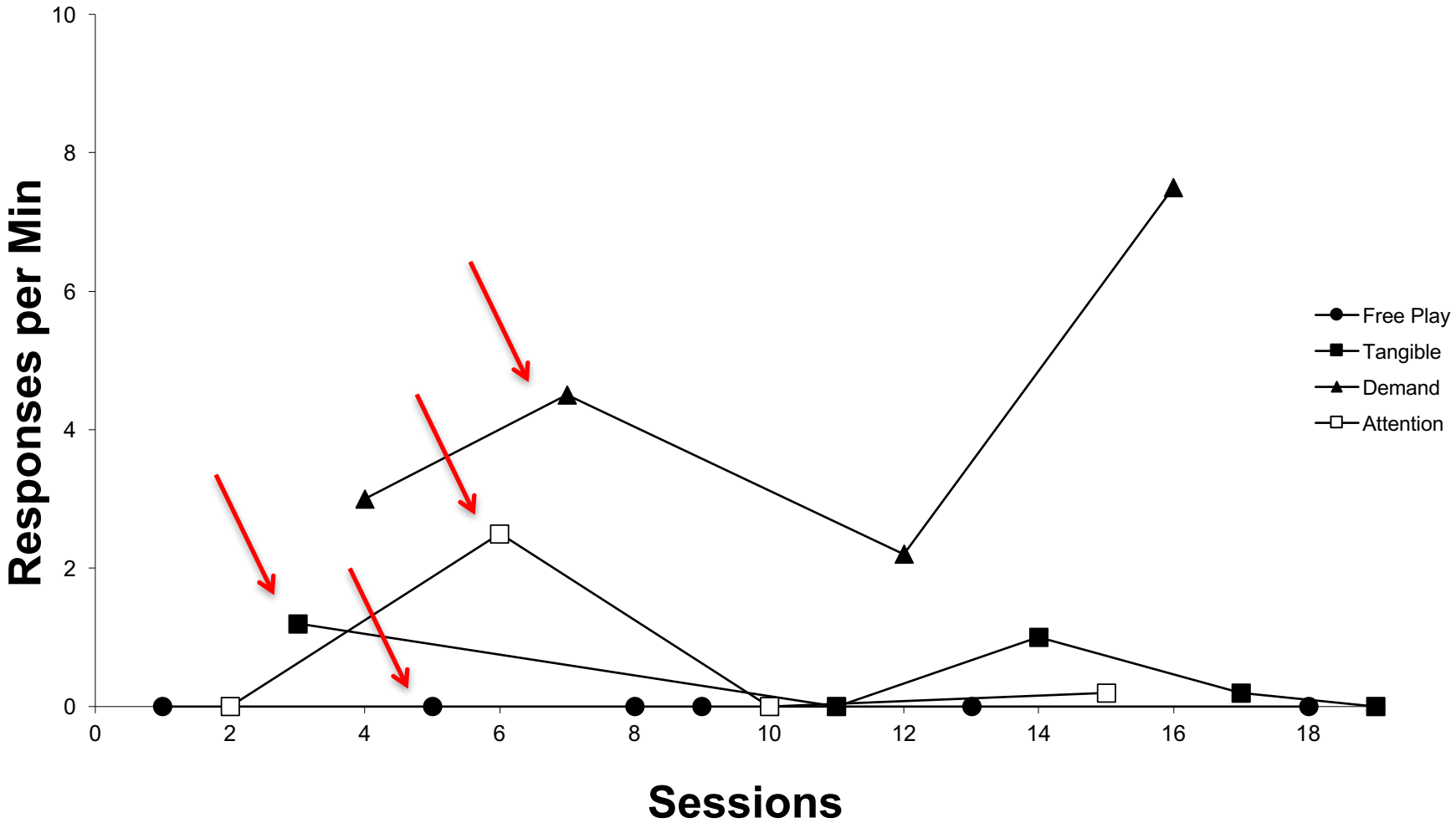
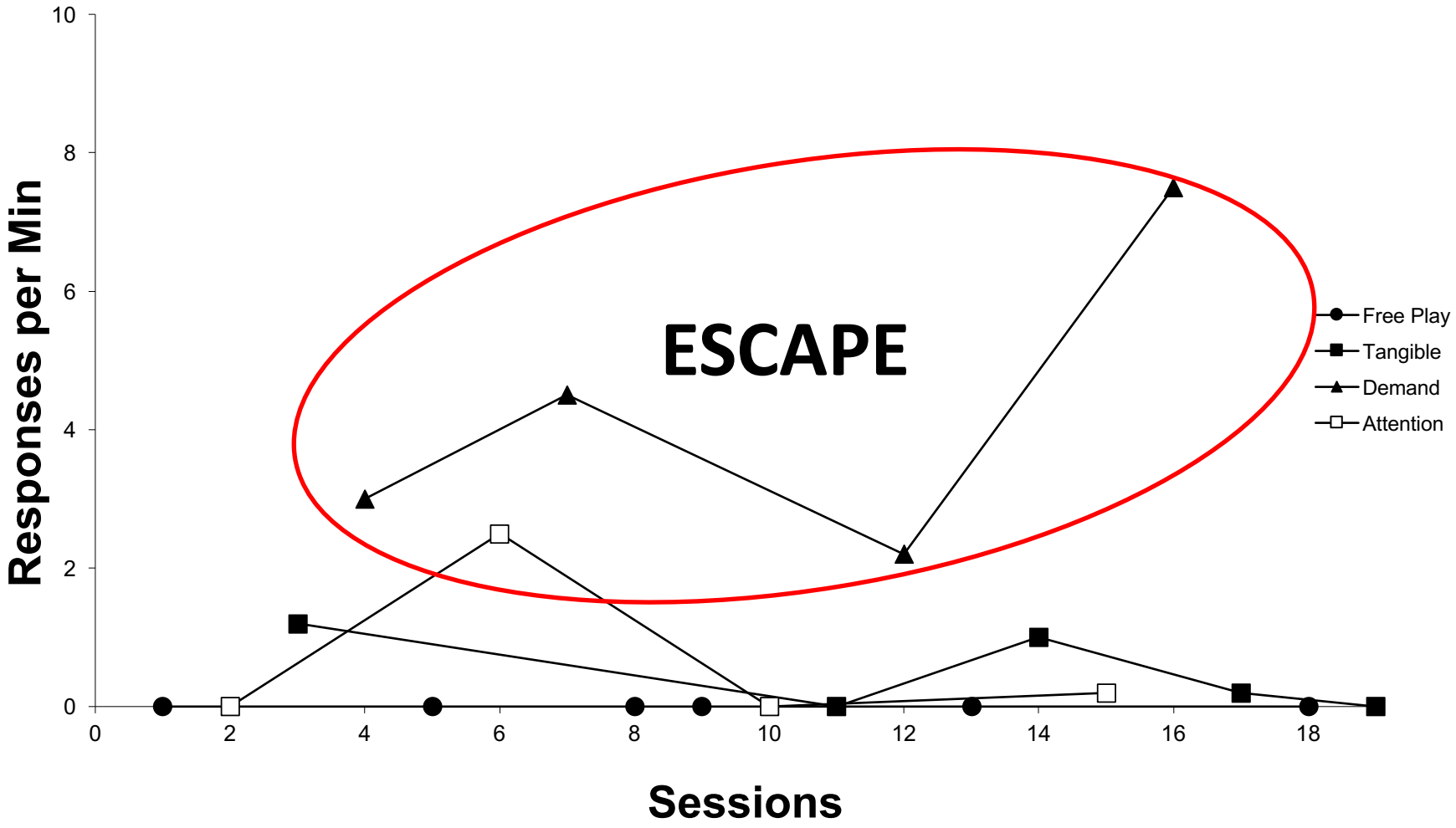
Standard Functional Analysis
Total Problem Behavior (Dest + Agg + SIB)



Standard Functional Analysis
Total Problem Behavior (Dest + Agg + SIB)



Standard Functional Analysis
Total Problem Behavior (Dest + Agg + SIB)



Step 2: Functional Communication Training

Most published function-based treatment (Tiger et al., 2008)

Differential reinforcement (teach child recognizable movements or sounds to produce a specific outcome)

+

Extinction (withhold reinforcement for problem behavior)

Carr & Durand (1985)

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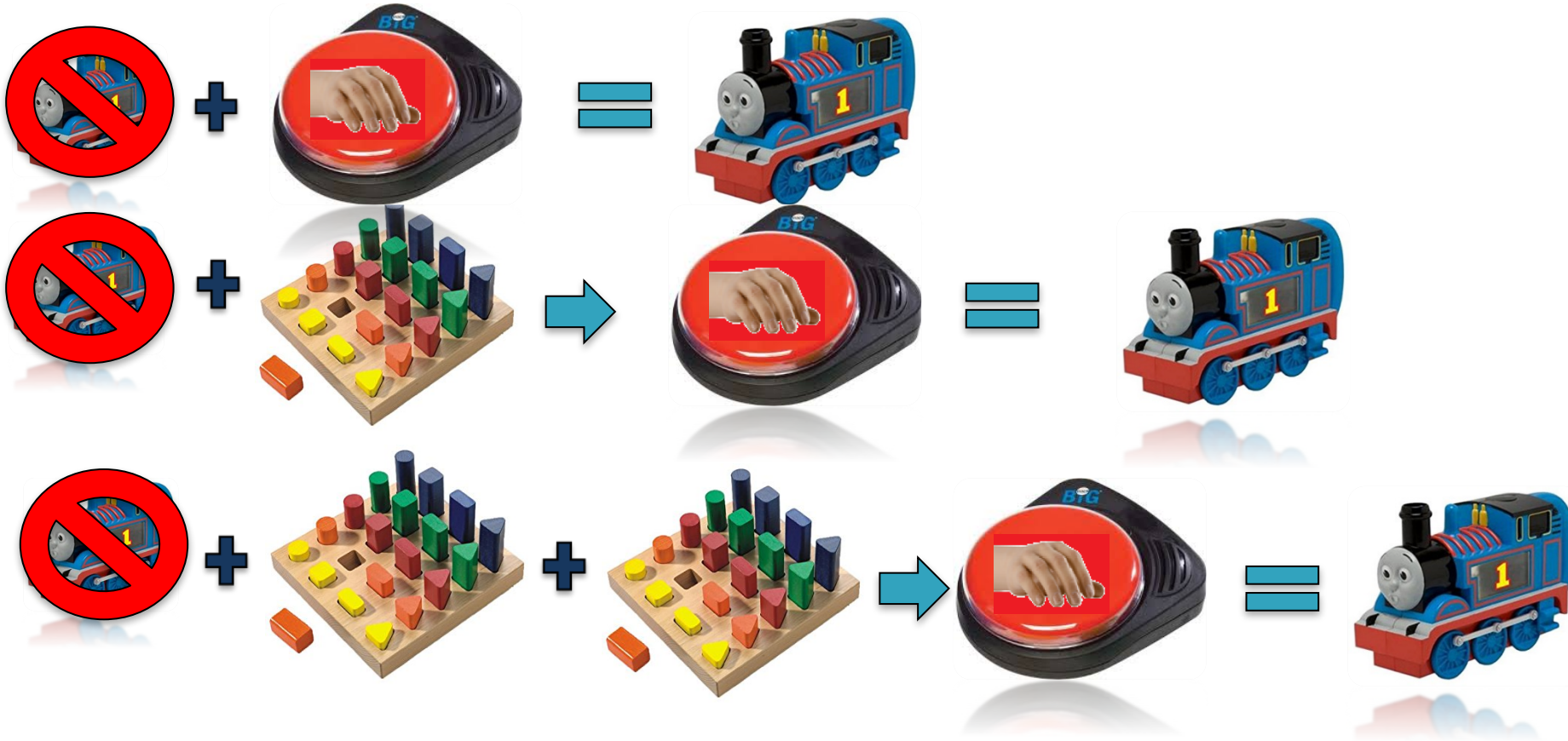
FCT (with Demand Fading)



FCT with Izzy

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STUDY 1: RANDOMIZED CONTROLLED TRIAL OF FUNCTIONAL COMMUNICATION TRAINING

RCT OF FCT

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Lindgren, S. & Wacker, D. (2011-2015)

- N=56
  - Dx: autism
  - 18 mo. to 83 mo. (6 yr., 11 mo.)
  - Exhibit destructive or disruptive behavior (score of 12+ on ABC Irritability subscale)
- Two step-procedure for all participants
  - FA to identify function
  - FCT tailored to function

RCT OF FCT

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- Non-inferiority (intent to treat) design structured with single-case design
- Randomized to *Immediate FCT* or *Delayed FCT* (delay = 3 months)
- Statistical analysis: Repeated measures ANOVA

Clinic-to-home

- All sessions conducted in participant home (e.g., bedroom, living room)
  - Families provided webcam, laptop, and Ethernet cable
- Remote coaching from telehealth center
  - Equipped with PC, video monitor, webcam, and headset

RCT of FCT: Results

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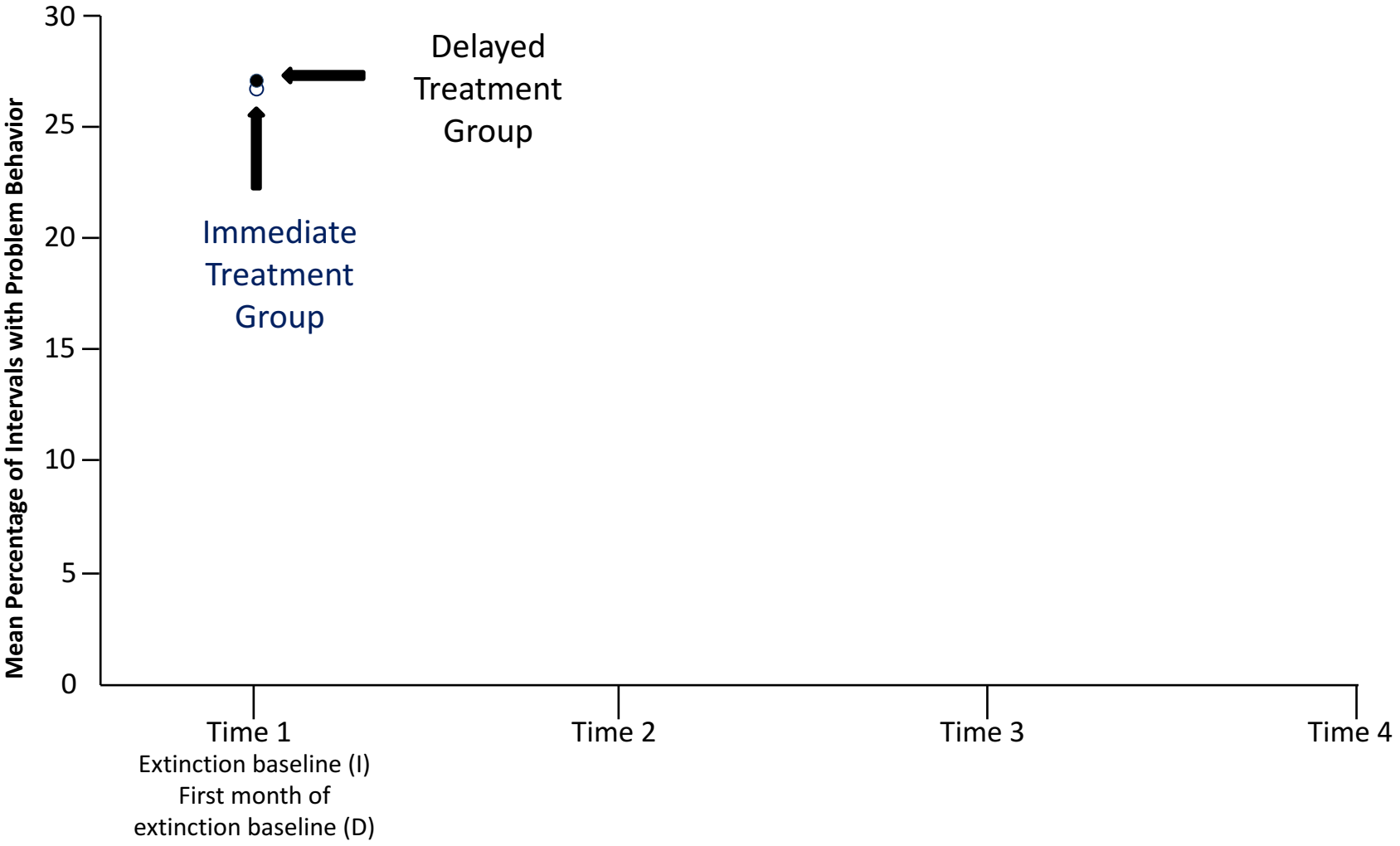
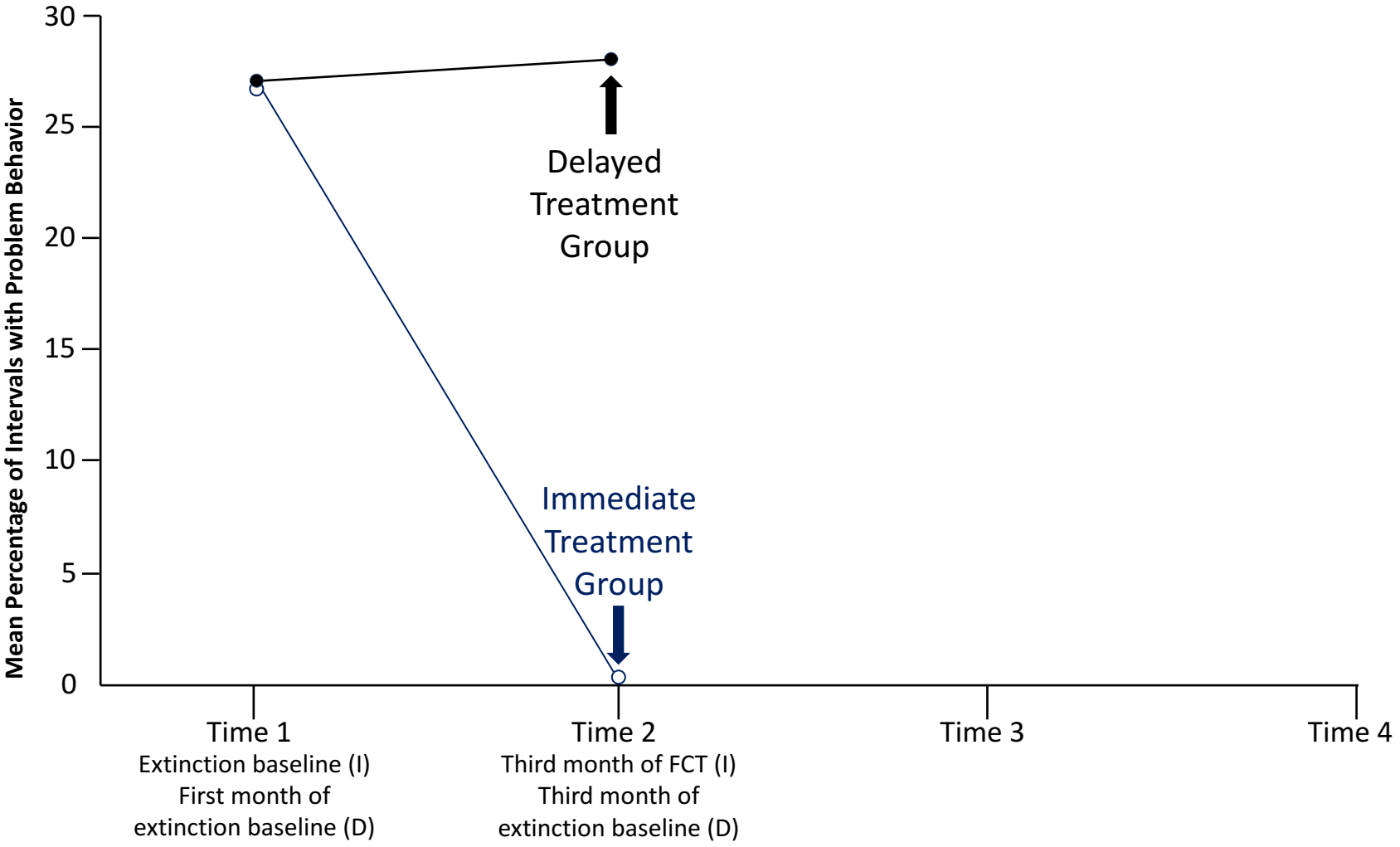


Results

University of Iowa Stead Family Children's Hospital



Results

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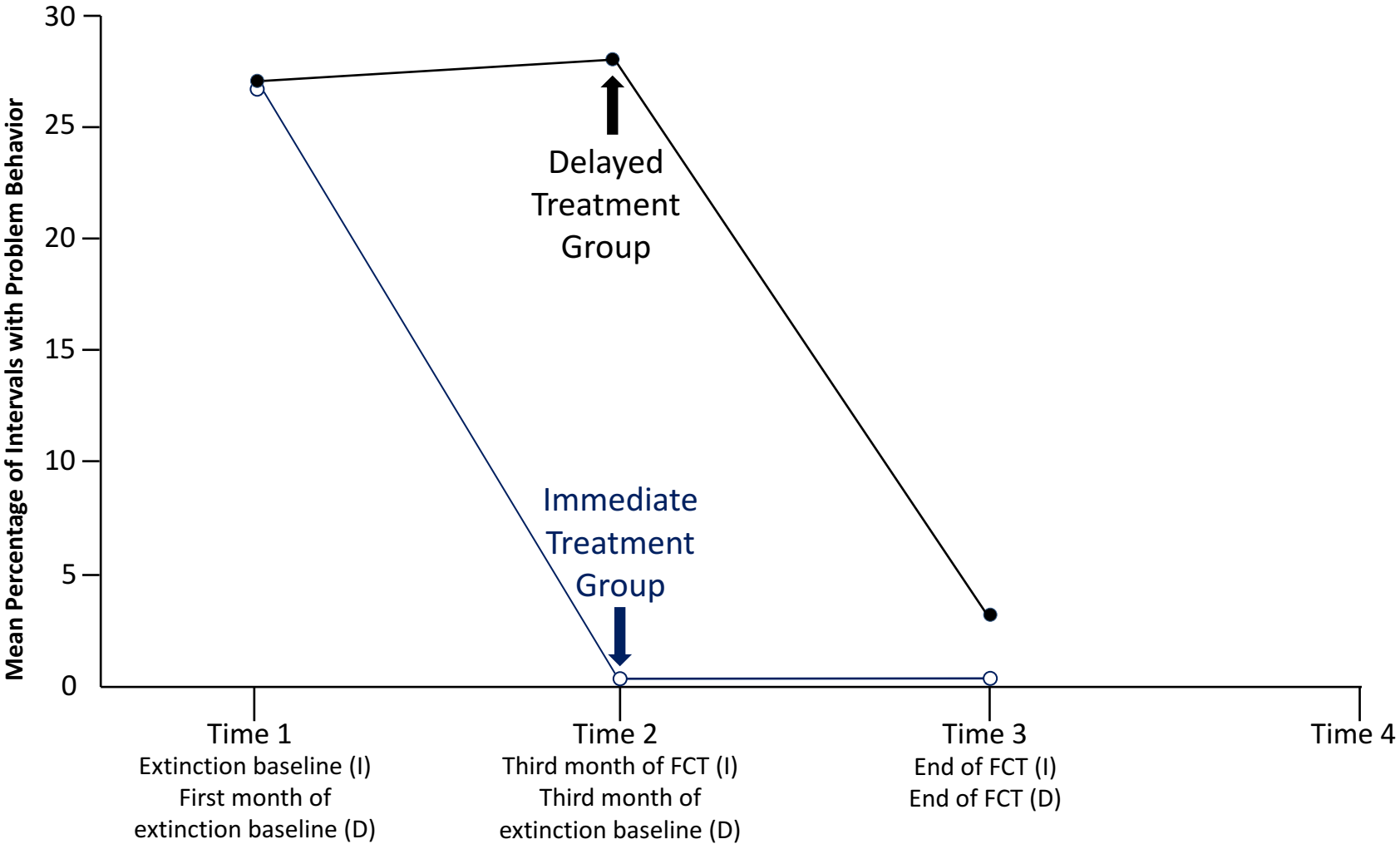
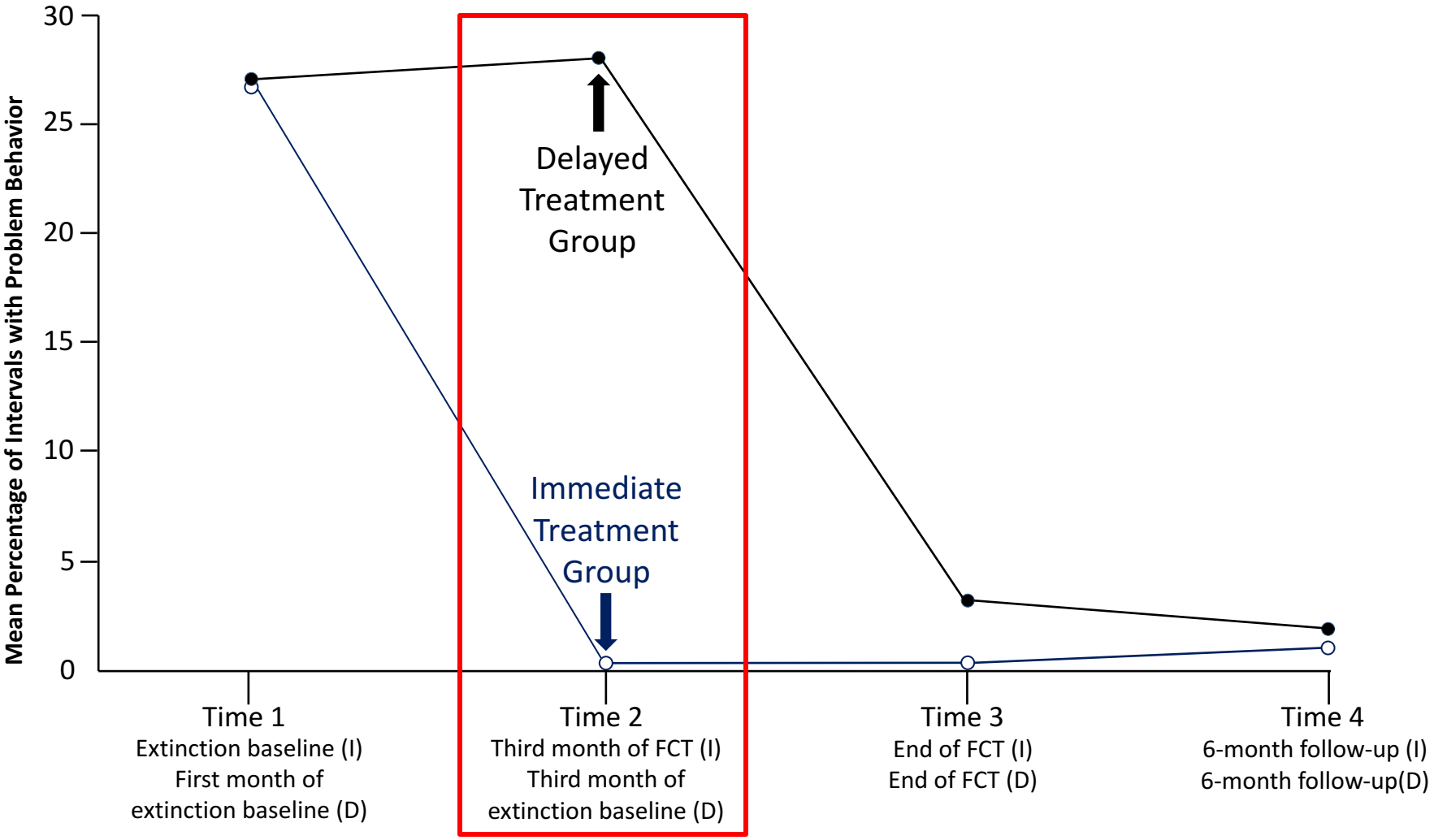


Results

University of Iowa Stead Family Children's Hospital



STUDY 2:
RANDOMIZED CONTROLLED TRIAL OF FUNCTIONAL ANALYSIS PROCEDURES

RCT of FA

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Purpose:

To evaluate the effects of functional analysis (FA) procedures on treatment outcomes.

Primary Research Question:

Are treatment outcomes (i.e., reduction in problem behavior; time to reduction criterion) similar for children who receive a more rigorous FA than those who do not?

RCT of FA

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Funding:

NIMH – 4 yr project (2015-2019)

(PIs: Lindgren & Wacker; now: Berg & O'Brien)

Research Sites:

Marcus Autism Center – Atlanta, GA

(Investigator: Nate Call)

University of Houston (Clear Lake) – Houston, TX

(Investigator: Dorothea Lerman)

University of Iowa – Iowa City, IA

Marcus AUTISM CENTER

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University of Houston Clear Lake

Participants:

114 families with a child meeting the following:

- Diagnosed with autism (DSM-5 criteria)
- 18 mo. to 83 mo. (6 yr., 11 mo.)
- Exhibit destructive or disruptive behavior (score of 12+ on ABC Irritability subscale)
- Live or receive services in Iowa, Georgia, or Texas

Setting:

Clinic-to-home

- All sessions conducted in participant home (e.g., bedroom, living room)
  - Families provided webcam, laptop, and Ethernet cable
- Remote coaching from telehealth center at each site
  - Equipped with PC, video monitor, webcam, and headset

Design:

Randomized controlled trial using a non-inferiority (intent to treat) design.

Stratification across site, gender, age, and intellectual ability.

Single case design to structure assessments and interventions.

Study Procedures:

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Pre:
Autism evaluation; functional behavioral assessment interview

I. Assessment Phase (Randomly Assigned):
A. Brief Assessment of Motivation (BAM) only (see Call et al., 2013)
or
B. BAM + Standard Functional Analysis (SFA)

II. Extinction Baseline:
Matched to function

III. Treatment Phase:
FCT is customized to match the results of the BAM or the SFA:
Treatment goal is established based upon baseline data

IV. Follow-up:
Maintenance probes at 6 mo. post treatment completion

Treatment Duration and Follow-up

Criteria for Completion:

Three consecutive sessions with:

1. Reduction of problem behavior by 90% over baseline
2. Compliance with 90% of task requests (for escape)
3. Independent and appropriate manding

Follow-up:

Maintenance probes at 6 mo. post treatment completion

Case Study: Akiva

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6 yr., 0 mo., biracial male

- Family:
  - divorced parents
  - 5 children; 3 with developmental disabilities
- DXs: autism, moderate ID
- Target BXs: self-injury (hand to head, head to ground), aggression (hitting, biting, kicking), destruction, and noncompliance
- Meds: Seroquel, fluoxetine, and guanfacine
- Communication: nonvocal; no AAC
- Distance to teleconsultation center: 259 mi. (~4 hr. 20 min.); very rural location
- Total travel without telehealth: 7252 mi. (14 visits)

Akiva: Location

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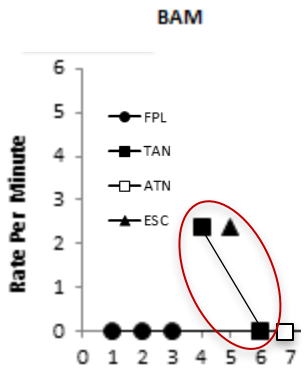
Phase I: BAM



Total Problem Behavior

Sessions

Phase II: Extinction Baseline

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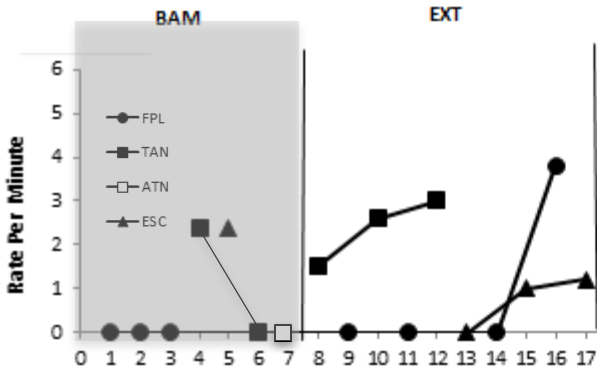

Total Problem Behavior

Sessions

Phase III: Treatment

Treatment goal:

- Reduction of problem behavior by 90% (from BL)
- Compliance with 90% of tasks
- Independent manding for break

Early Stages of FCT – Akiva

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Phase III: Treatment (FCT)

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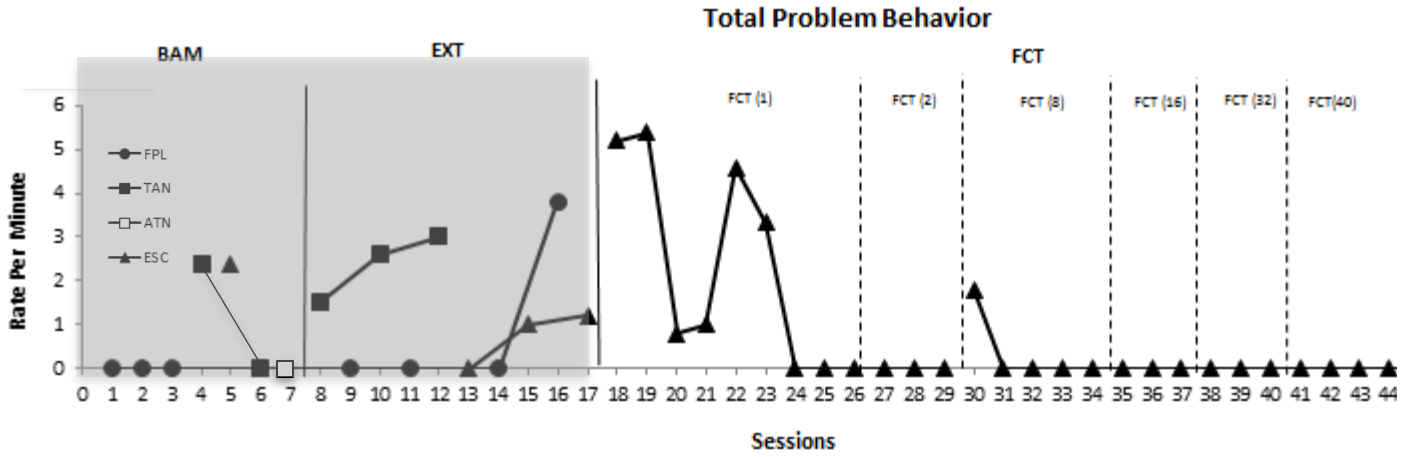

Phase IV: Follow-up

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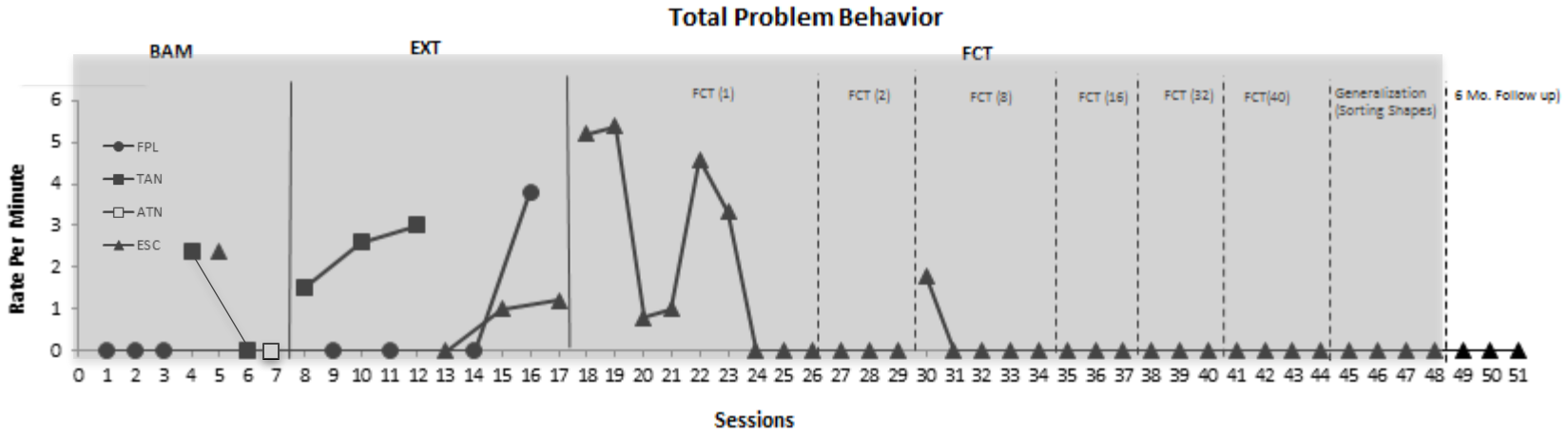

Nearing treatment completion

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FA FCT Results

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Lessons Learned: Benefits of Telehealth ABA

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1. Increased access & reduction in travel and wait time
   - See Wacker et al. (2013): 222mi from clinic
   - 20 min appt = 2hours (15% direct care time)
2. Results consistent with in-vivo service delivery
   - See Lindgren et al. (2016)
3. Comfort and flexibility of remote in-home consultation
   - Wacker et al. (N.d.): comparable to in-vivo
4. Reduced costs
   - See Lindgren et al. (2016)
5. Increased access for research

Challenges to Successful Telehealth ABA

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1. Technology
   - Adequate equipment and internet connections needed on both ends
   - HIPAA compliance (need a BAA)
2. State laws and regulations
   - Originating and home site laws/policies
3. Insurance and Reimbursement Limitations
   - Medicaid-only reimbursement in many states
   - 33 states have parity laws
4. Challenging Patients
   - Safety risks
   - Limited ability to model and intervene
5. Reduced environmental control

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