

A Smartphone-Based Assessment of Parenting and ADHD: Implications for Intervention

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Conflicts of interest

- None

- Funding sources:
  - Wisconsin Alumni Research Foundation (WARF)
  - Core grant to the Waisman Center from the National Institute of Child Health and Human Development (P30-HD03352) (no directly funding)

Who am I?

- My goal is to understand how biology and environments interact to explain **individual differences** in the expression of ADHD

- My research integrates measures using:
  - Molecular genetics (ADHD is ~80% heritable)
  - Cognition (executive function, IQ testing)
  - Neurobiology (fMRI)
  - Environment (parenting, peers, and teachers)



Check us out @

UW Social and Behavioral Development Lab

- My lab: https://lilab.waisman.wisc.edu/
- These slides will be available on my lab website
- https://www.facebook.com/SocialBehavioralDevelopmentLab/

What motivated today's talk

<u>Individual differences</u>: Some children with ADHD respond to psychosocial interventions better than others

- SES, more severe child problems, stress and parental psychopathology (Reyno & MacGrath, 2006)

Engagement and participation in treatment → better outcomes (Nock & Kazkin, 2006)

Overarching question: Can smartphones help us better connect with patients with low SES, more severe child problems, and stress/psychopathology?

Burke, Pardini, & Loeber, 2008; Chamberlain & Patterson, 1995; Kaiser, McBurnett, & Pfiffner, 2011

What this talk will be about

Previous/Current Research

1. A spotlight on stress and parenting
2. How stress and child ADHD affect parenting behaviors
3. The study: how smartphones can help us better monitor/understand the role of parenting behavior and child ADHD

Clinical Implications



Parenting and ADHD

- Nearly all psychosocial interventions for child ADHD feature some aspect of parent training
  - Harsher discipline
  - Less warmth and engagement
  - Praise less
  - Use more “negative talk” (e.g., commands, criticisms)

Burke, Pardini, & Loeber, 2008; Chamberlain & Patterson, 1995; Kaiser, McBurnett, & Pfiffner, 2011

Stress seriously affects how you parent

- **Family stress** (martial discord, lack of cohesion within the family)
  - Nelson, O'Brien, Blankson, Calkins, & Keane, 2009 → *less* supportive, warm and engaged in parenting



Stress seriously affects how you parent

- **Social support** (friends, co-workers, neighbors, non-family members)
  - Ceballo & McLoyd, 2002 → harsh discipline, yelling, and threatening behaviors in parenting

- **Parenting-related stress** (demands of parenting outweigh the resources to deal with them) (“child effects”)
  - Theule et al. (2013)

Stress may affect **how consistent** you are in your parenting

- Day-to-day parent-child interactions form “proximal engines of development” (Granic, O’Hara, Pepler, & Lewis, 2007)

- Inconsistent discipline → behavior problems and ADHD (Barry, Dunlap, Lochman, & Wells, 2005; Edens, Skopp, & Cahill, 2008; Halgunseth et al., 2013)

- Parental consistency on measures of warmth and responsiveness → faster growth in cognitive development in TD children (Landry et al., 2002)

- Parental inconsistency on measures of warmth and responsiveness → deceleration of cognitive development in TD children!

Consistency matters

Development and Psychopathology, 2017, page 1 of 10
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doi:10.1017/S0954579417000918

Consistency matters: Consistency in the timing and quality of daily interactions between parents and adolescents predicts production of proinflammatory cytokines in youths

ERIKA M. MANCZAK, ADAM K. K. LEIGH, CHIA-PING CHIN, AND EDITH CHEN
Northwestern University

Limitations in the field

- It’s really hard to measure
  - Self-report questionnaires (global, but ambiguous timeframe)
  - Observations (snapshots)
  - Daily diaries (snapshots over repeated measurement, but not practical)
  - Most studies have focused on inconsistent discipline, but rarely on inconsistent warmth and engagement
    - Effective parenting = discipline + warmth/engagement

How smartphones might help

It’s almost ready for primetime (we think)

- Widely-owned by most Americans
  - 77% of all Americans owned a smartphone as of 2015
  - 64% of the lowest-income Americans (household income < $30,000 per year)
  - 92% among 18 to 29-year-olds
  - 88% among 30 to 49-year-olds
  - 74% among 50 to 64-year-olds

- Convenient patient access without any **additional costs** or **equipment**

- High-resolution data: data collected **everyday**

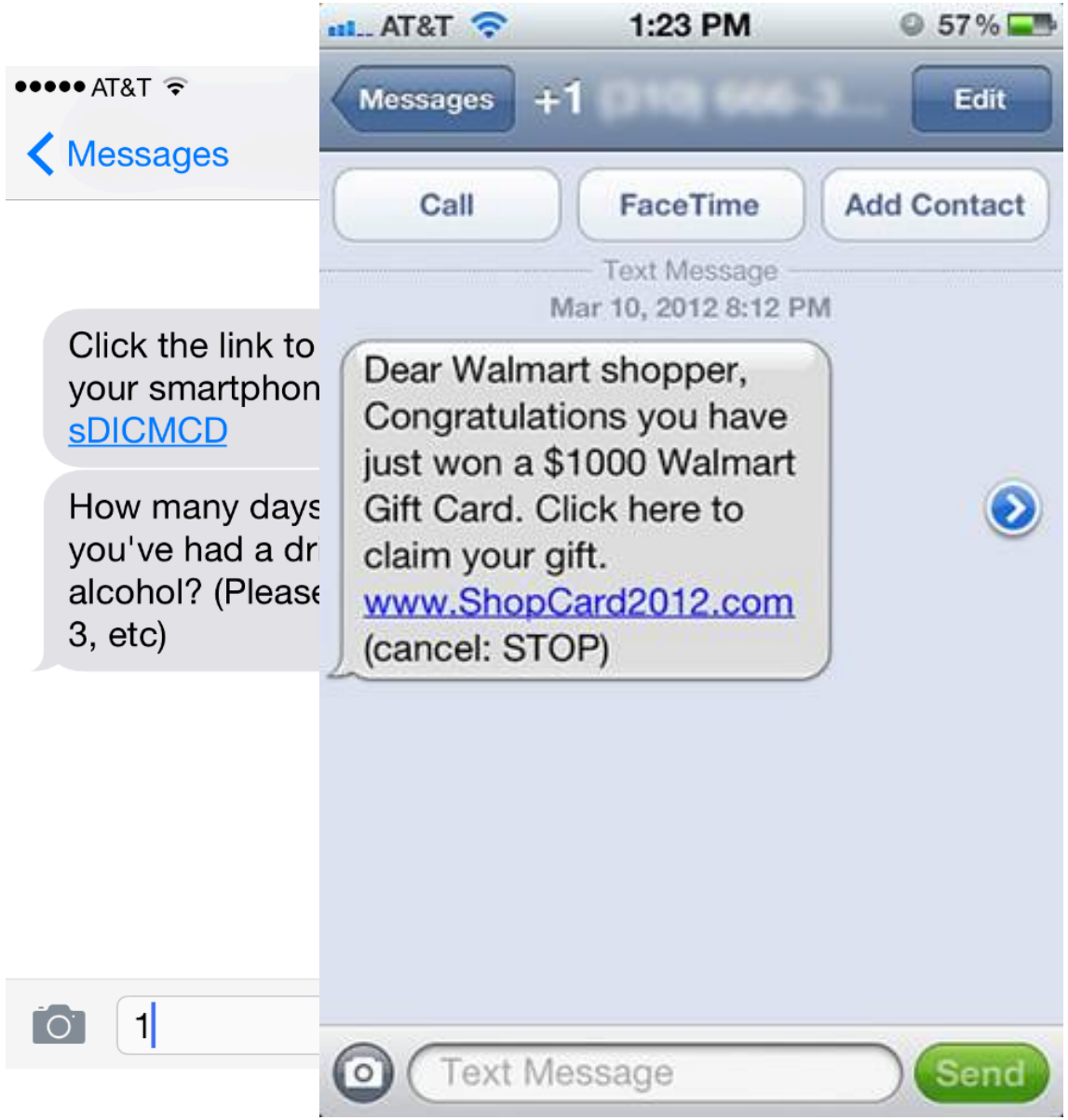
- Standardized apps (i.e., iOS and android)



The Pew Research Center (2017)

Barriers

- Usually, they look like this:
  - Manual or automated text messages
  - Clunky interfaces
  - Not intuitive (for the patient or the clinicians)



Our research questions

(1) Is our smartphone app a feasible and valid way measure of parenting compared to traditional measures of parental consistency?

(1) Will parents do it?

(2) Can we reliably measure frequency and consistency of parenting behavior?

(2)What role do stress, including family, social, parenting-related stress and child ADHD, have on parental inconsistency, including both positive and negative dimensions?

Significance

- This research may help us better assess parent-child dynamics, a central treatment target in parenting-based interventions

- Lead to the development of more tailored interventions

The study



Duke | SANFORD SCHOOL OF PUBLIC POLICY

The study

- Longitudinal study on biological and environmental antecedents of trajectories of ADHD and co-occurring externalizing psychopathology in children
- 184 kindergarteners with and without ADHD
  - 20.7% met clinical criteria for any subtype of ADHD (4.9% inattentive subtype, 9.8% hyperactive/impulsive subtype, and 6.0% combined subtype)
  - Ineligible if: ASD/intellectual disability, not fluent in English, not living with at least one bio parent at least half the time
  - Child characteristics: 86% White, 55% male
  - Parent characteristics: 93% mothers (who took the survey), 88% married or living with a spouse, 84% college-educated, median income = $92K

IRB#2015-1177, Study title: Self-Control and Reward Sensitivity During Child Development

ADHD symptoms

- *Diagnostic Interview Schedule for Children, Version IV (Shaffer et al., 2000)*
  - Conducted with parent
  - Keyed to DSM criteria for ADHD (including impairment and context)

Alabama Parenting Questionnaire (Frick, 1991) – 42 items

Positive dimension

- Parental involvement
  - “You help your child with his/her homework”
- Positive reinforcement
  - “you praise your child if they behavior well”

Negative dimension

- Corporal punishment
  - “you spank your child with your hand when they have done something wrong”
- Poor monitoring
  - “your child is at home without adult supervision”
- Inconsistent discipline
  - “the punishment you give your child depends on your mood”

Dyadic Parent Child Interaction Coding System (Eyberg et al., 2013)





DPICS: Negative Talk

- Expressed disapproval of the child or the child's attributes, activities, products, or choices, and includes sarcastic, rude, critical, threatening or imprudent speech
  - "you're being naughty,"
  - "that's not quite right, sweetie," or
  - "what's with you today?"

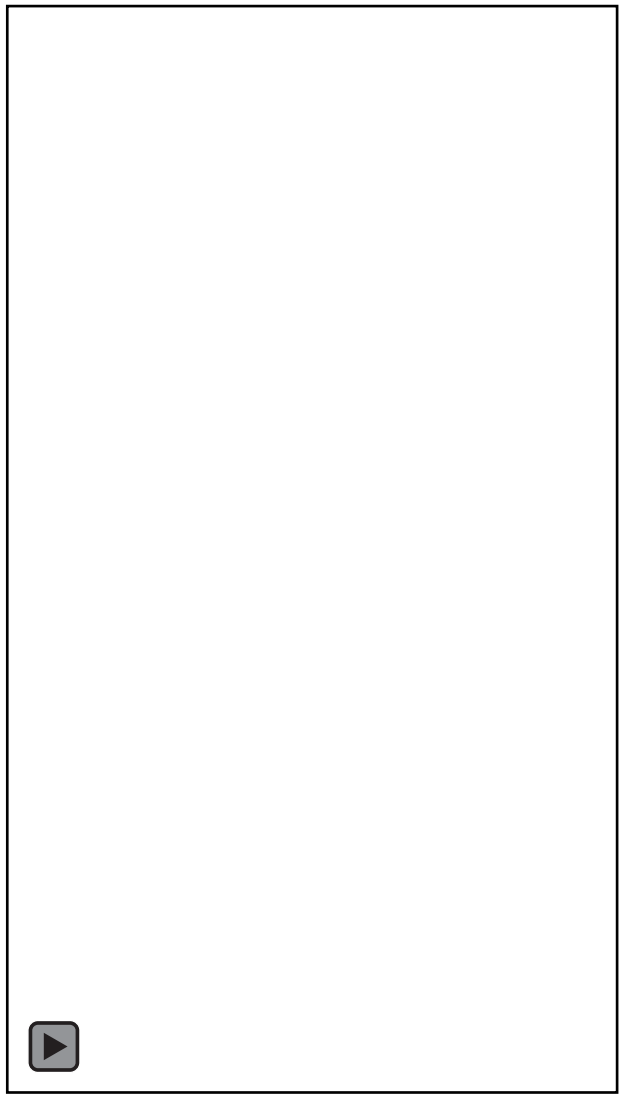
- # of negative talk/total verbalizations

DPICS: Praise

- Expressed a favorable judgment of an attribute, product, or behavior of the child
  - labeled (i.e., a positive evaluation of a specific behavior, activity or product of the child, e.g., “you did a great job building that tower.”)
  - unlabeled praise (i.e., unspecified evaluation of behavior, activity or product of the child, e.g., “great job”)

- # of praise/total verbalizations

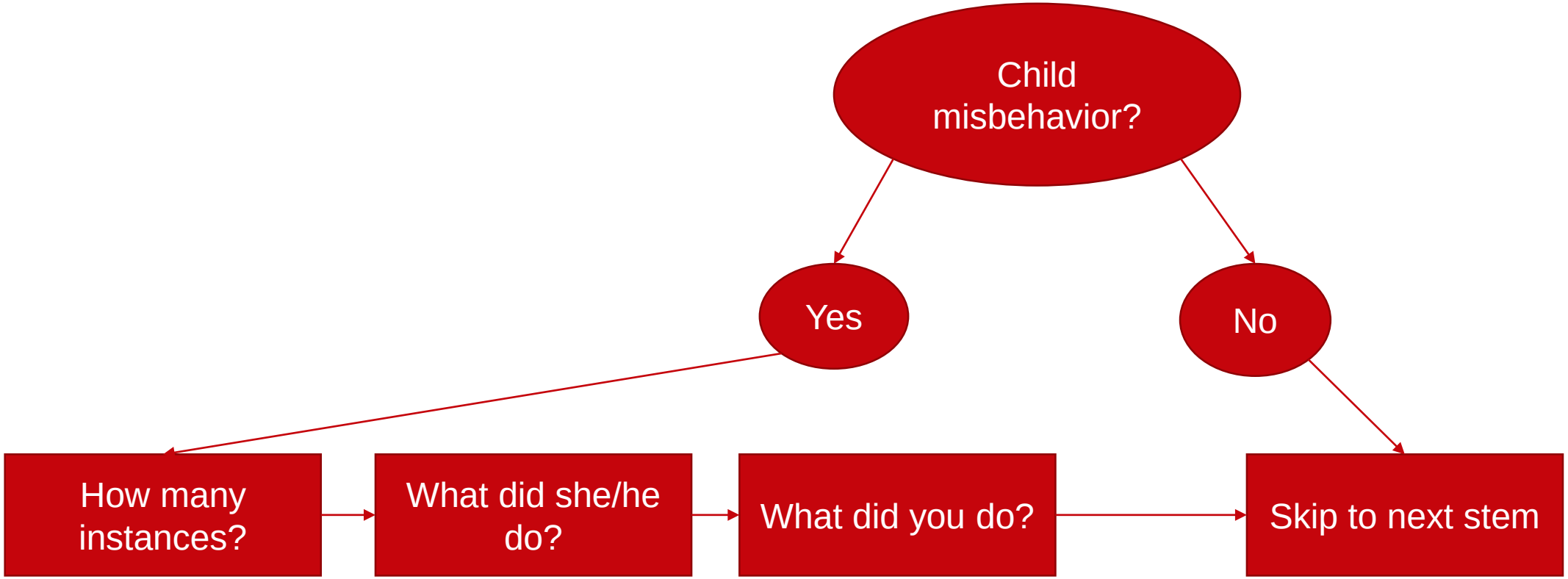
The smartphone app

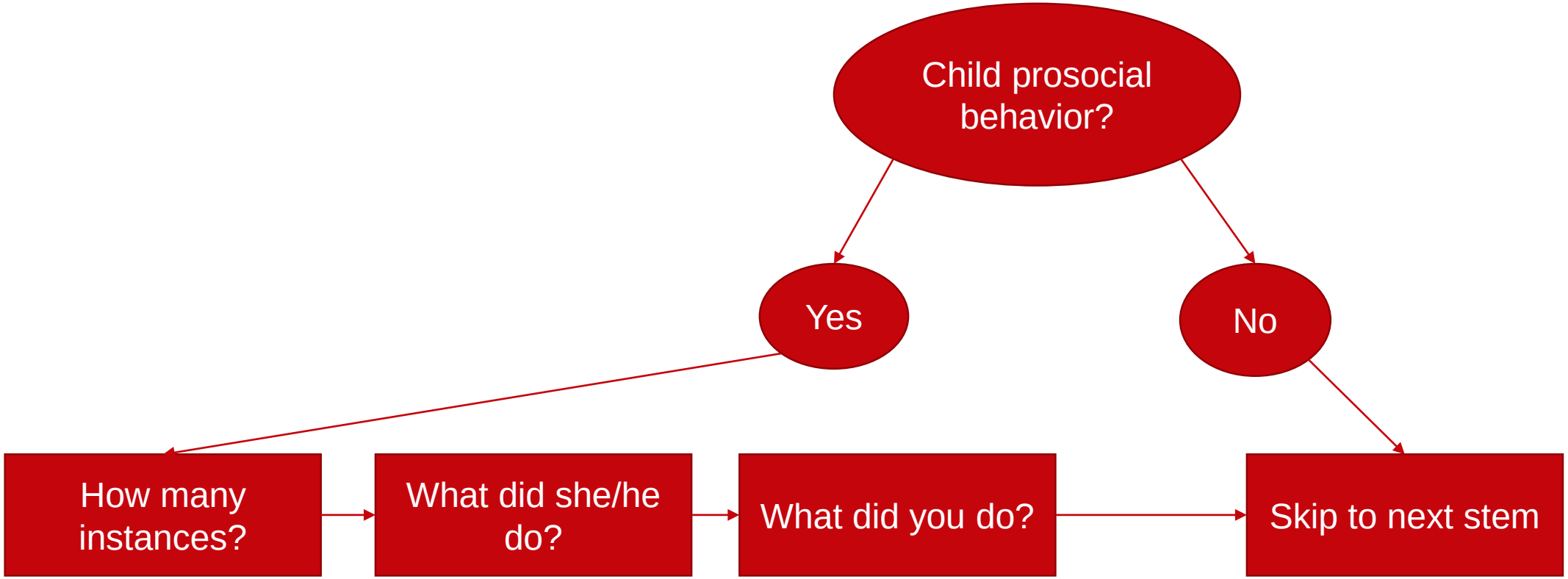


- Metricwire (emerging app platform for clinical trails)
  - No text messages or links
  - Intuitive interface
  - Push notifications for daily data collections
  - Easy set up, compatible on apple and android devices
  - Can be done on a computer too

Mobile Survey of Parent-Child Dynamics

- 15 questions about parental response to child behavior
  - Frequency and consistency of parenting behavior in response to child
  - User-adapted questions




Child prosocial behavior?
Yes
No
How many instances?
What did she/he do?
What did you do?
Skip to next stem

What do the data look like?

Active Participants

Add Participants

Tip: You can hold CTRL(on windows) or Command(on Mac) and click rows to easily select multiple rows.

Select All | Un-Select All | 0 Rows Selected | Diagnose Issues | Export to CSV

Name	Identifier	Phone Number	Email	Daily Parent-Child Dyna…	Downloa
☐ James Li	559447d9445ce82105ef2825		james.li@wisc.edu	0 View Activity	true
☐ Karly Rosinsky	5697e7b7539f3d04710c6205		krosinsky@wisc.edu	5 View Activity	true
☐ Karly Rosinsky	58fe327db2afba068108c3aa		karlyrosinsky@gmail.com	0 View Activity	true

What do the data look like?

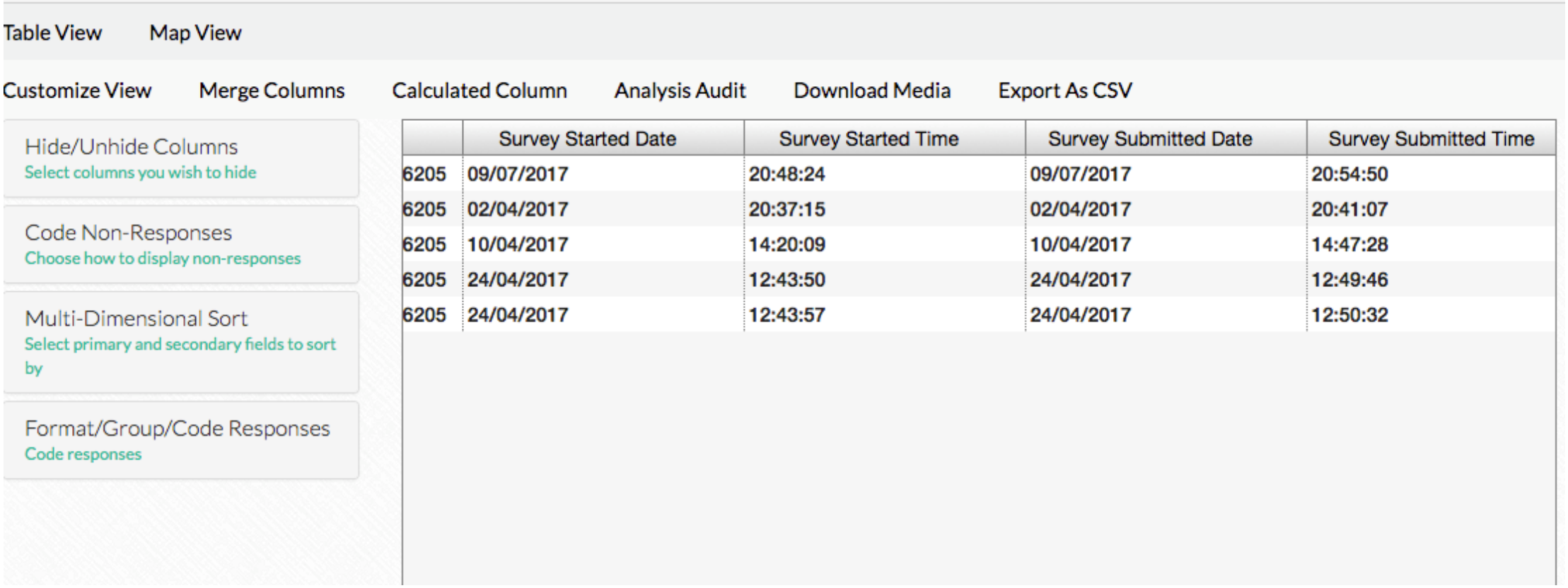


Table View Map View

Customize View Merge Columns Calculated Column Analysis Audit Download Media Export As CSV

Hide/Unhide Columns
Select columns you wish to hide

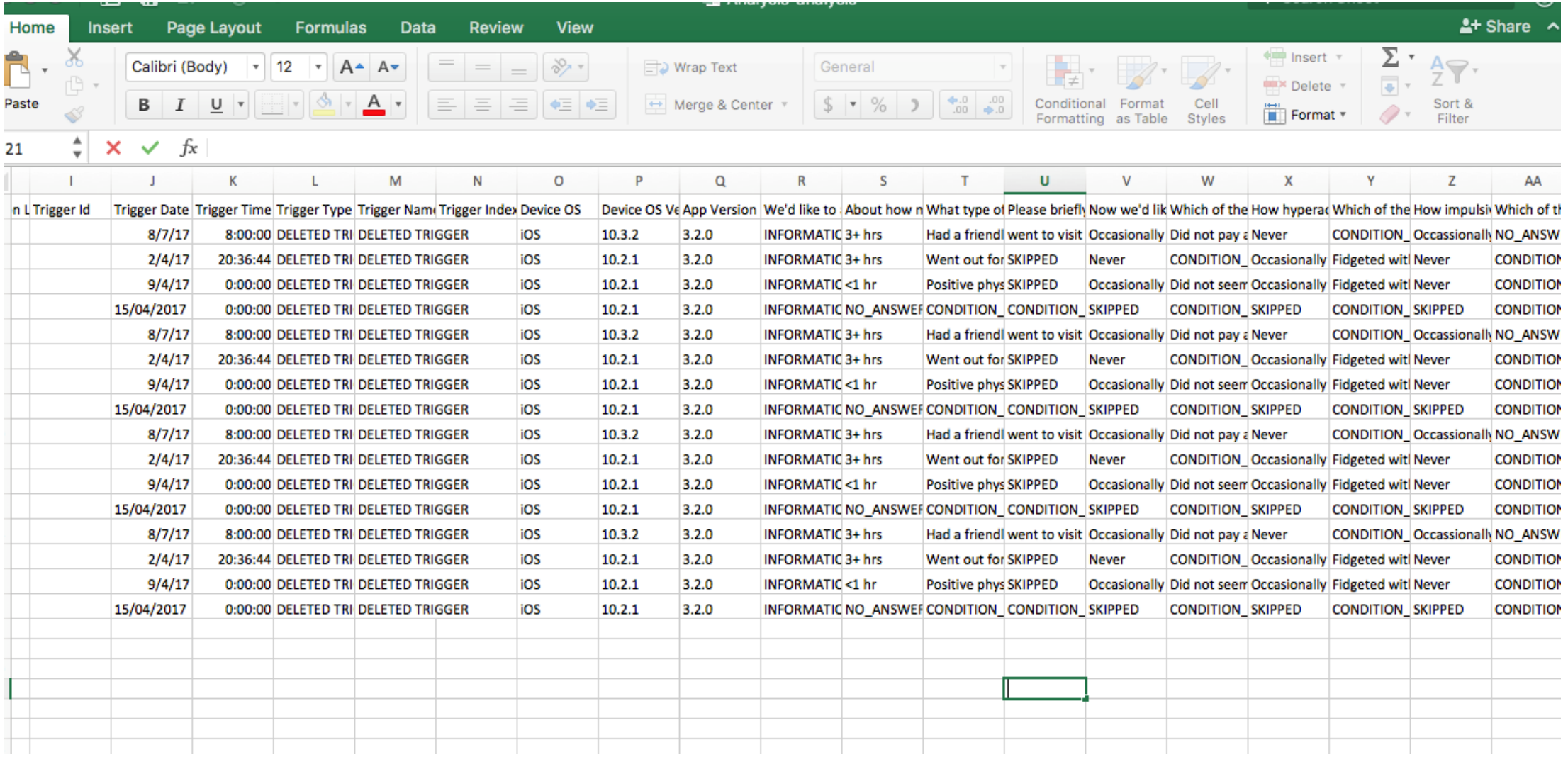
Code Non-Responses
Choose how to display non-responses

Multi-Dimensional Sort
Select primary and secondary fields to sort by

Format/Group/Code Responses
Code responses

	Survey Started Date	Survey Started Time	Survey Submitted Date	Survey Submitted Time
6205	09/07/2017	20:48:24	09/07/2017	20:54:50
6205	02/04/2017	20:37:15	02/04/2017	20:41:07
6205	10/04/2017	14:20:09	10/04/2017	14:47:28
6205	24/04/2017	12:43:50	24/04/2017	12:49:46
6205	24/04/2017	12:43:57	24/04/2017	12:50:32

What the data look like



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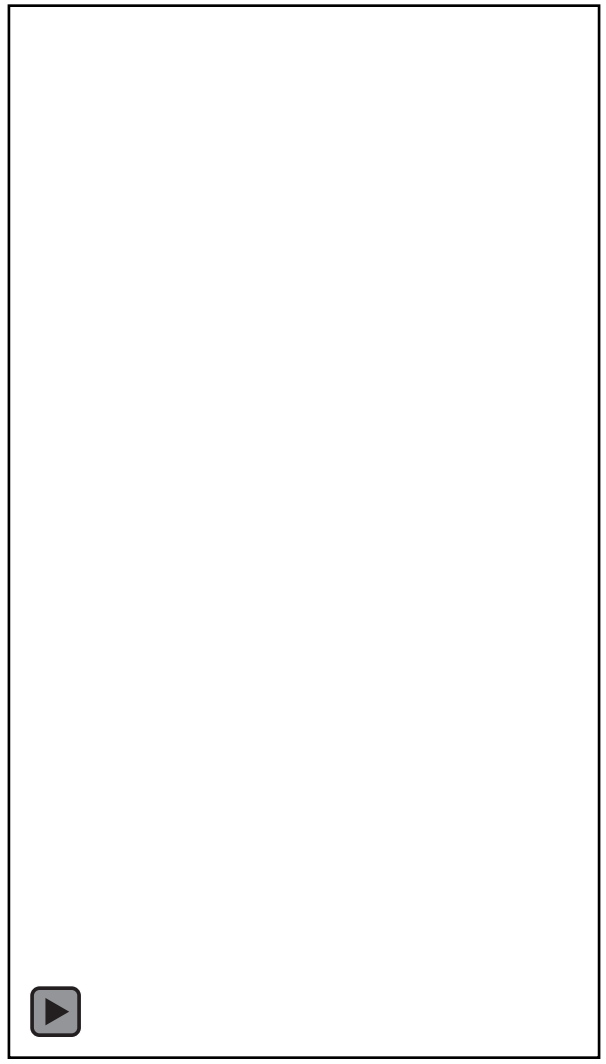
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		2/4/17	20:36:44	DELETED TRI	DELETED TRIGGER		iOS	10.2.1	3.2.0	INFORMATIC	3+ hrs	Went out for	SKIPPED	Never	CONDITION_	Occasionally	Fidgeted with	Never	CONDITION
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		15/04/2017	0:00:00	DELETED TRI	DELETED TRIGGER		iOS	10.2.1	3.2.0	INFORMATIC	NO_ANSWEF	CONDITION_	CONDITION_	SKIPPED	CONDITION_	SKIPPED	CONDITION_	SKIPPED	CONDITION

MSPCD (Smartphone app)

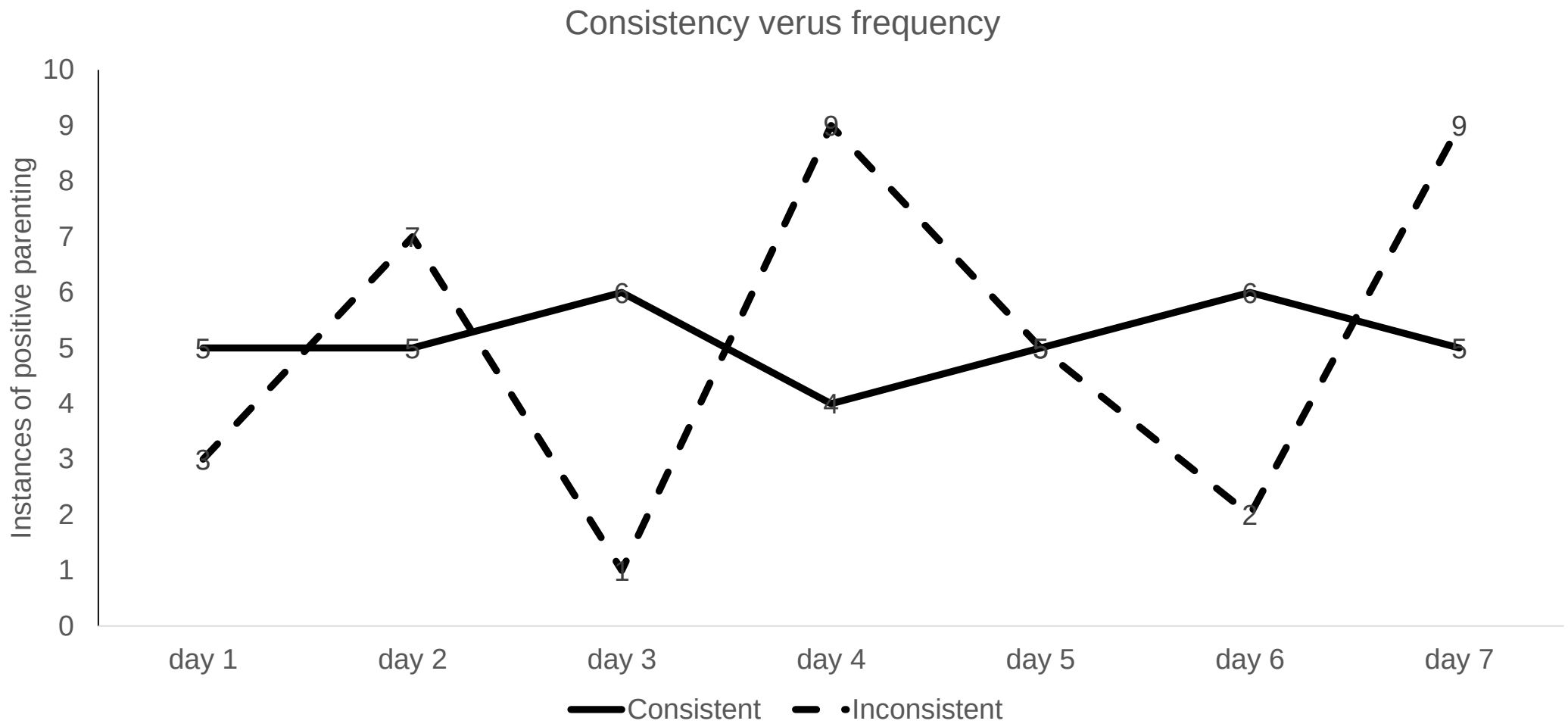
- Two subscales:
  - Frequency: Parenting means (over 7 days)
  - Consistency: Parenting variability (usually measured as SDs, but we used MSSD)

$$MSSD = \frac{\sum_{i=1}^{n-1}(x_{i+1} - x_i)^2}{n-1}$$

- Warm and harsh parenting dimensions assessed



How frequency can be differentiated from consistency



Parental stress

- *Duke Social Support and Stress Scale (Parkerson, Broadhead, & Tse, 1991) – 12 items*
  - How often do the following individuals cause problems for [the parent] and makes [the parent's] life more difficult…at this time your life?
    - Family: significant others, children or grandchildren, parents or grandparents, brothers or sisters, other blood relatives, and relatives by marriage (in-laws, ex-spouses)
    - Social: neighbors, coworkers, church members, or other friends

- Parenting Stress Index (Abidin, 1995) – 36 items
  - Parent-child dysfunction ("child rarely does things for me")
  - Child difficulty ("child is more of a problem than expected")

	No ADHD (n = 146)	ADHD (n = 38)	
	N or M (SD)	N or M (SD)	p
Parent ADHD (T-scores)	51.99 (4.09)	56.16 (9.25)	<.001
DISC-IV child ADHD symptoms	2.29 (2.56)	11.05 (3.01)	<.001
Global positive parenting	66.88 (5.15)	66.21 (5.70)	.53
Global negative parenting	28.65 (4.04)	31.33 (5.31)	<.01
Observed % praise	.06 (.03)	.05 (.03)	.30
Observed % negative talk	.02 (.03)	.05 (.05)	<.01
Daily warm parenting mean	8.25 (1.67)	8.15 (2.10)	.78
Daily warm parenting MSSD	2.09 (.61)	2.41 (.73)	.02
Daily harsh parenting mean	.46 (.47)	.54 (.57)	.38
Daily harsh parenting MSSD	.43 (.42)	.47 (.47)	.63
Family stress	24.48 (14.56)	30.40 (15.17)	.03
Social stress	8.28 (10.76)	14.36 (16.35)	<.01
Parenting-related stress	24.05	34.28	<.01

Results

(1) Is our smartphone app a feasible and valid way measure of parenting compared to traditional measures of parental consistency?

Feasibility

	N	Mean	S.D.
Sample size	184	--	--
% Android	78	--	--
% iOS	104	--	--
Mac/Windows	2	--	--
Average # days completed	--	5.56	1.63
Average minutes spent	--	--	--
Day 1	184	0:05:45	0:04:48
Day 2	177	0:04:21	0:03:09
Day 3	175	0:04:04	0:03:39
Day 4	161	0:03:46	0:02:57
Day 5	145	0:03:30	0:02:45
Day 6	117	0:03:12	0:02:16

Correlations

Correlations with APQ positive parenting dimension

	Variable	1	2	3	4	5	6	7	8	9
1	Child ADHD symptoms	1								
2	Global positive parenting	-.078	1							
3	Global negative parenting	**.221****	**-.196****	1						
4	Observed % praise	-.007	.100	-.055	1					
5	Observed % negative talk	**.341****	-.024	**.309****	-.047	1				
6	Daily warm parenting mean	-.053	**.377****	**-.210****	**.229****	-.065	1			
7	Daily warm parenting MSSD	.151	-.012	**.213****	-.016	.121	-.008	1		
8	Daily harsh parenting mean	.043	**-.168***	**.347****	-.082	**.285****	-.036	.022	1	
9	Daily harsh parenting MSSD	.024	-.018	**.352****	-.137	**.286****	-.071	.109	.475**	1

Correlations

Correlations with APQ negative parenting dimension

	Variable	1	2	3	4	5	6	7	8	9
1	Child ADHD symptoms	1								
2	Global positive parenting	-.078	1							
3	Global negative parenting	**.221****	**-.196****	1						
4	Observed % praise	-.007	.100	-.055	1					
5	Observed % negative talk	**.341****	-.024	**.309****	-.047	1				
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Correlations

Correlations with observed praise during the parent-child interaction coding task

	Variable	1	2	3	4	5	6	7	8	9
1	Child ADHD symptoms	1								
2	Global positive parenting	-.078	1							
3	Global negative parenting	**.221****	**-.196****	1						
4	Observed % praise	-.007	.100	-.055	1					
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Correlations

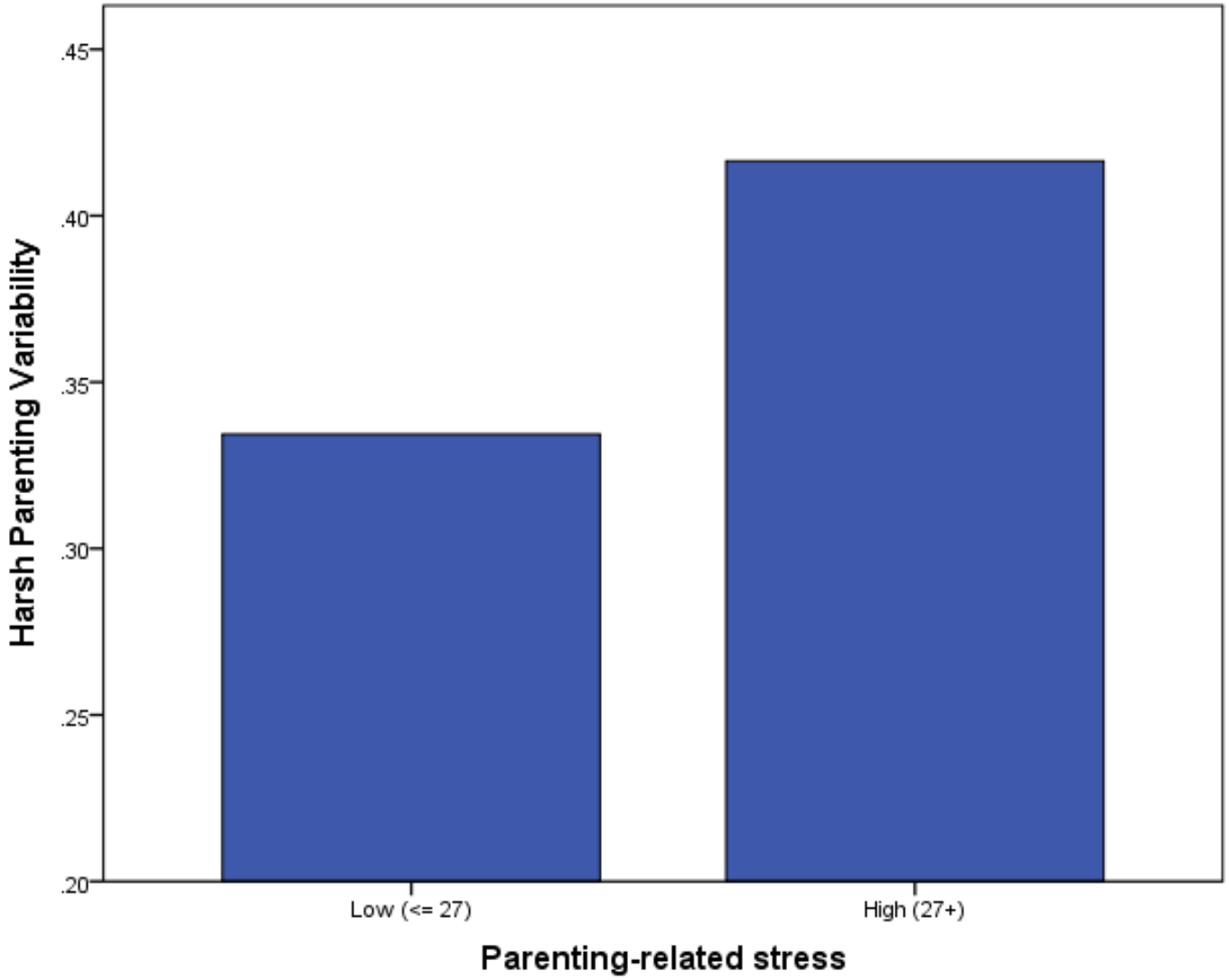
Correlations with observed negative talk during the parent-child interaction coding task

	Variable	1	2	3	4	5	6	7	8	9
1	Child ADHD symptoms	1								
2	Global positive parenting	-.078	1							
3	Global negative parenting	**.221****	**-.196****	1						
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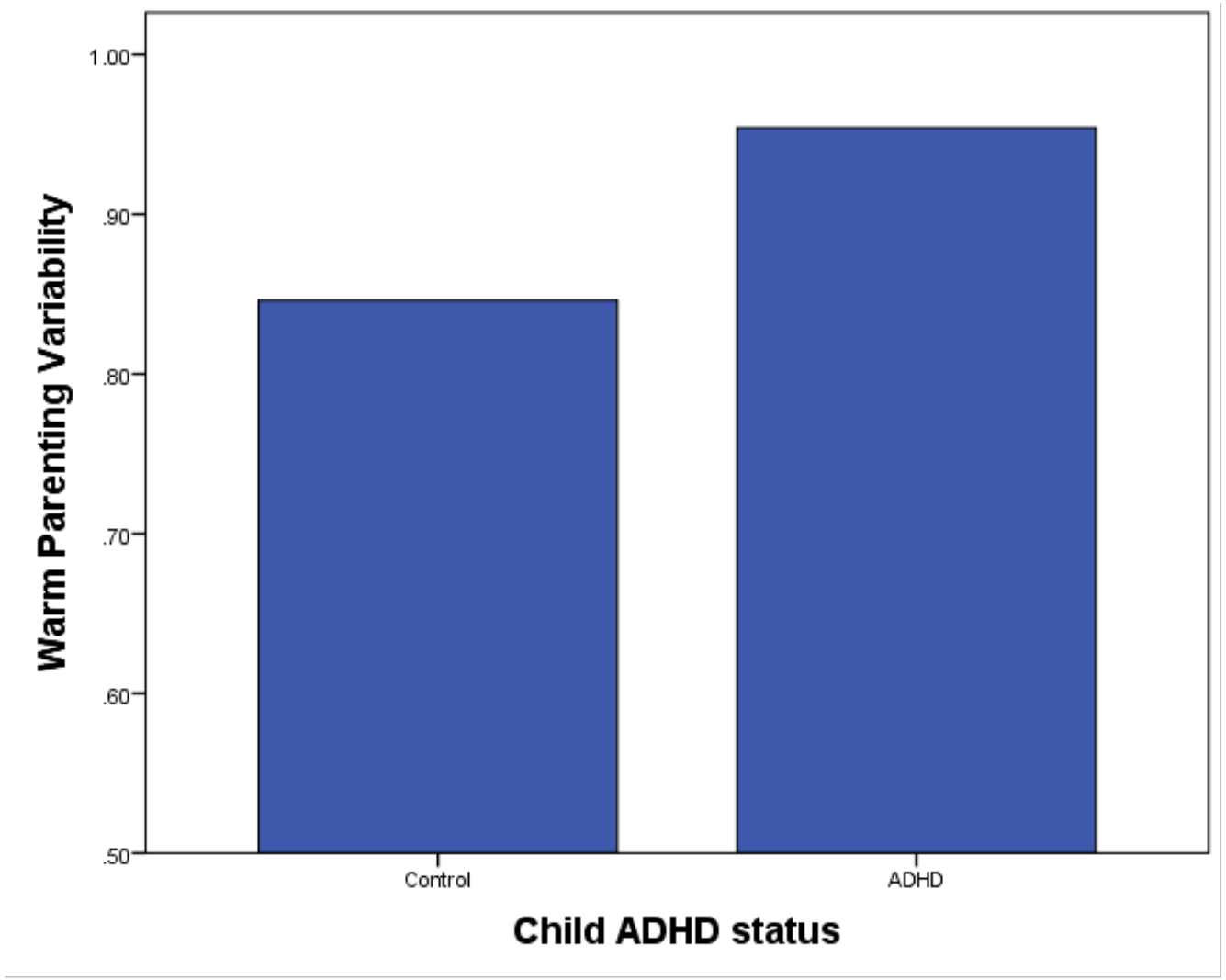
Results

(2) What role do stress, including family, social, parenting-related stress and child ADHD, have on parental inconsistency, including both positive and negative dimensions?

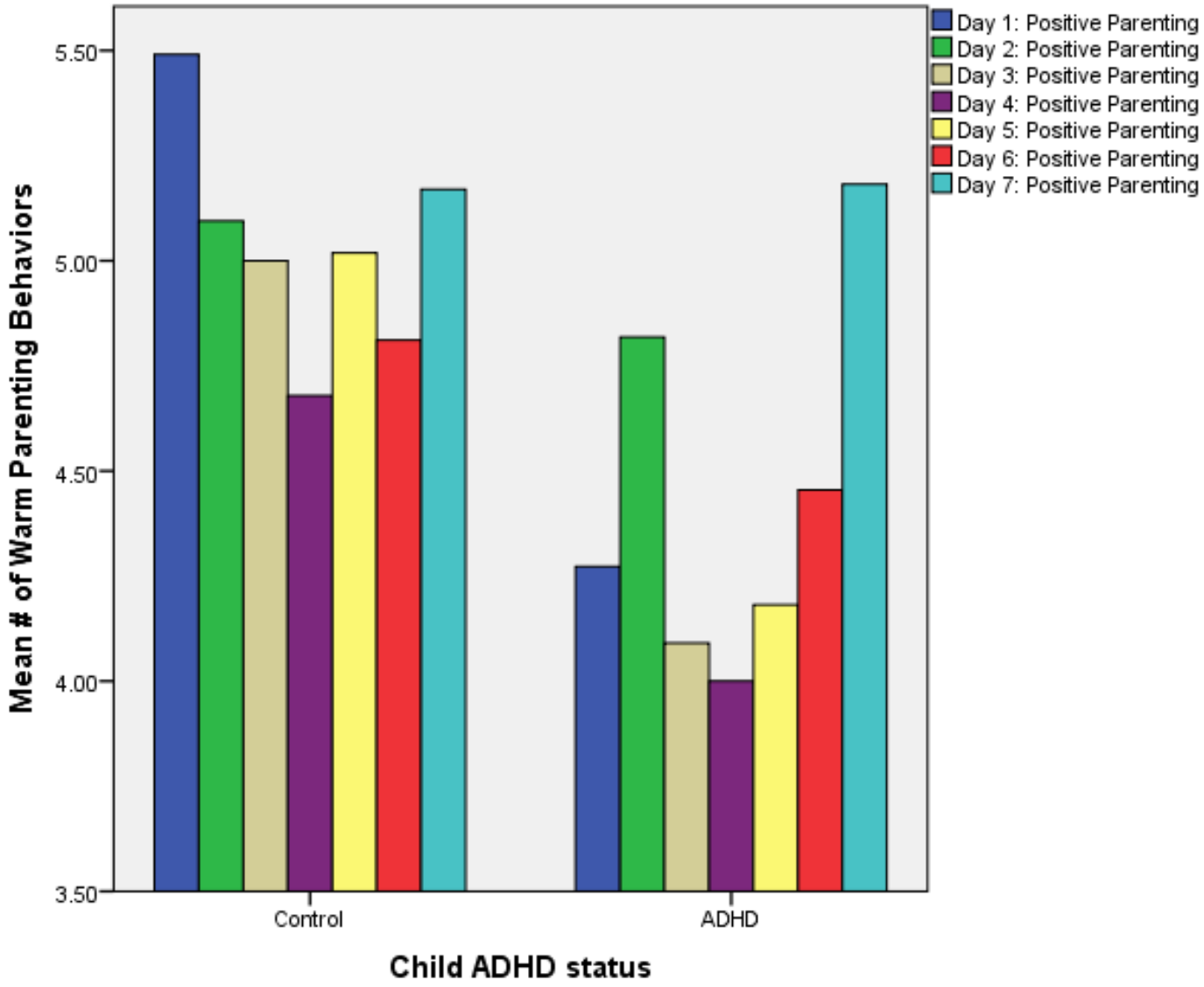
Parenting-related stress is associated with greater inconsistency in harsh parenting



Child ADHD is associated with greater inconsistency in warm parenting behaviors



Child ADHD and warm parenting



What we didn’t find

- Warm parenting:
  - No association of child’s gender, household income, race-ethnicity, marital status, respondent, and frequency (i.e., mean) of warm parenting behaviors
  - Family, social and parent-related stressors not associated with consistency
  - No interactions between child ADHD and stress

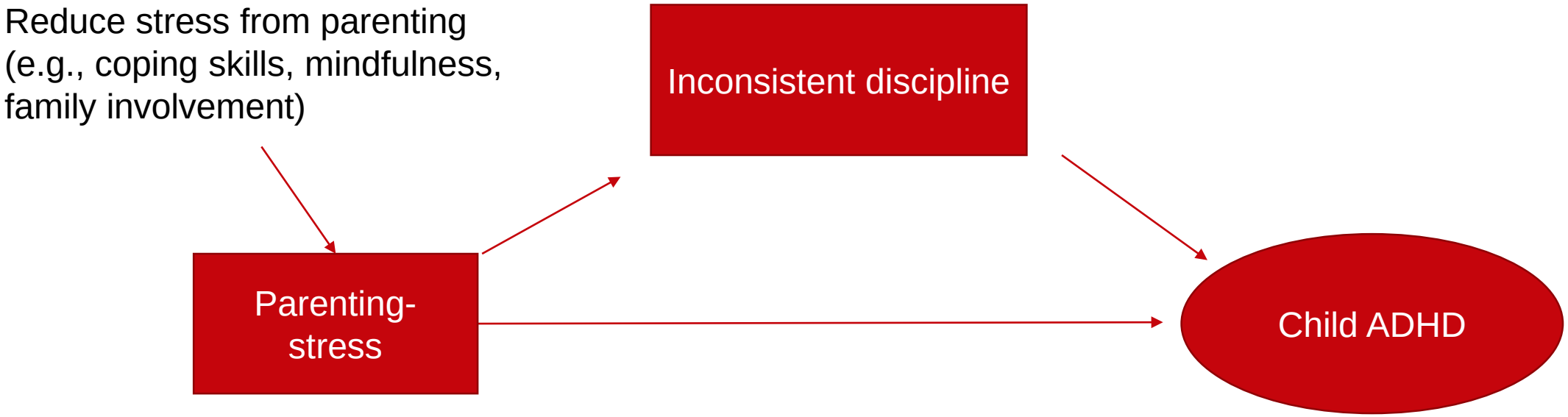
- Harsh parenting:
  - No association of child’s gender, household income, race-ethnicity, marital status, respondent, and frequency (i.e., mean) of harsh parenting behaviors
  - Family, social or child ADHD not associated with consistency
  - No interactions between child ADHD and stress

Summary and conclusions

- Smartphones may be really helpful as part of the **assessment process**
  - A measure of **frequency** and **variability** of behavior
    - Only modestly correlated with traditional measures of parenting
    - But variables are distinct enough to warrant further study

Conclusions

One interpretation: Addressing parenting-related stress (when parents feel the burden of parenting is > resources to deal with them) might improve consistency in discipline → better outcomes



Conclusion

- Child ADHD is associated with greater warm parental inconsistency (or the other way around…)
  - Nurturing behavior is partly inherited:
    - Licking-and-grooming behavior in rats (Meany, 2001; Meany & Szyf, 2005; Michalska et al., 2014)
    - Sensitivity in humans (Bakermans-Kranenburg & van Ijzendoorn, 2008; Oliver & Plomin, 2014)
  - But gene-environment correlation may also be at play
    - Parents' ADHD → warm parenting variability → Child ADHD
    - Parents with ADHD themselves may be more inconsistent in their positive activities with children, engagement (needs to be tested)

Additional issues/questions for future research

- Not longitudinal, only 1 week
- Can’t address the SES factor (~income 92K)
- Mothers versus fathers?
- Not all parents completed the survey for 7 days
- Not a true case control sample (how would this work/look in a clinic population?)

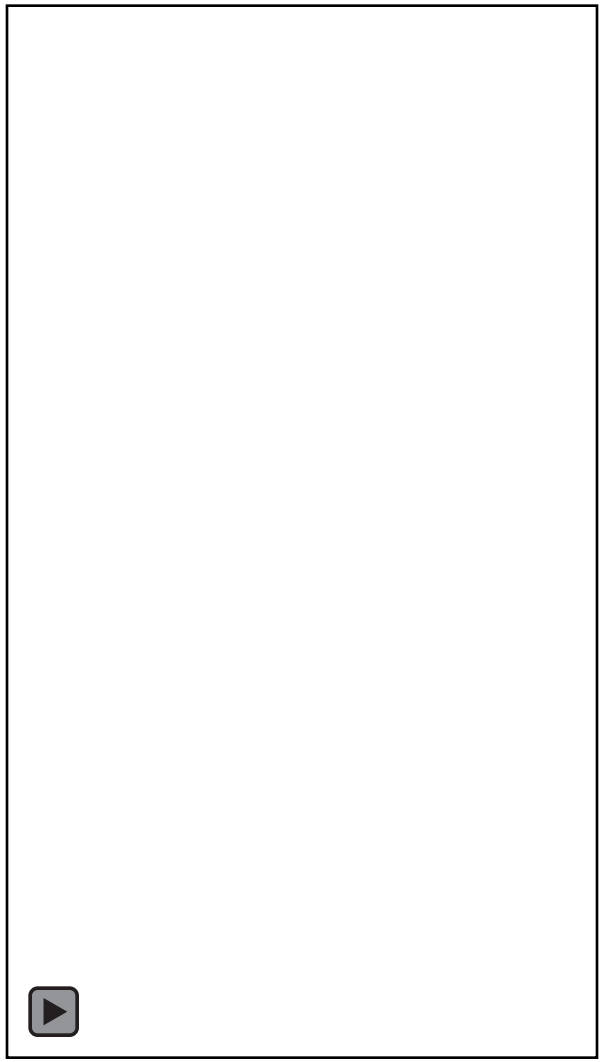
Clinical implications

Recommendations and forward progress

Where smartphones *may* help

- Jones and colleagues (2010) – using smartphones can promote **engagement and retention**
  - Support for parents outset of therapy setting
  - Parental monitoring is a key part of PMT, an app can make this way easier without any added burden
  - Formal feedback using daily assessments, weekly-check ins, etc.
  - Enhance recall for therapy sessions

Enhancing treatment precision



- Knowing what to focus before patient even comes in (saves time, improves treatment planning)
- Use data, rather than ambiguous weekly update that usually focus on the most recent event or most memorable event
- For example:
  - Child was argumentative on 5 out of 7 days
  - Parent endorsed “yelling, screaming” in response to 4 of the 5 times, but “time out” in only 1 of the 5
  - Identifying barriers to using appropriate response
    - Stress
  - Introduce new skills for parents to overcome barrier

Is there an app yet?

- No
- But they’re coming (see Perle & Hommel, 2017)

Potential perils

Recommendation: Do NOT go out and create your own smartphone app for your practice.

- Risks
  - HIPAA compliance. How will you ensure security and confidentiality of the data?
    - (we obtained IRB approval, have several layers of encryption, and run a research laboratory with several checks from IRB)
  - Big data "problem." How will you use ALL the data so that it's not a complete waste of everyone's time?
  - Cost. It's potentially costly (don't waste your money on unsanctioned app platforms that haven't been tested before).
  - Efficacy. No studies show that integrating smartphones into EBTs can actually improve treatment outcomes yet (need an RCT)

Some recommendations



- Measure parenting behavior in your clinics
  - Alabama Parenting Questionnaire (APQ) (Free)

- Measure parental stress in your clinics
  - Parent-stress index (PSI) (not free)
  - DUSOCS (free)

- Clinicians should emphasize to parents about the importance be being **consistent** in both **discipline** and **warmth**

Where are we going from here?

Version 2.0

- Improved data monitoring for direct applications in treatment (i.e., streamline data output)
- Incorporate audio record feature
- Measure variability in child's symptomatology! (i.e., ADHD symptoms, prosocial behaviors)

If you’re interesting in trying out app in your clinic…

Let’s get in touch.

We want to do an RCT with it.

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Thank you. Questions?

UW Social and Behavioral Development Lab

- My lab: https://lilab.waisman.wisc.edu/
- https://www.facebook.com/SocialBehavioralDevelopmentLab/

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