

## Parent-Reported Emotional and Behavioral Problems in ASD:

Implications for Research and Clinic

Thompson Center Annual Conference  
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## Conflicts of Interest

- None

## What we are going to cover:

- The Research
  - What are Emotional Behavioral Problems (EBPs) in autism
  - What others have shown
  - Extending it to MCHAT-R/F
- The Clinic
  - How we used this for clinic
  - Impact

## Where this happened

## The Thompson Center



- Clinical
  - 16,000+ visits
  - 800 ASD evals
  - Numerous clinics to facilitate triage
- Research
  - Research core
  - 5,000+ research grade assessments in database
- Research/Clinic
  - Always seems to be a Research/clinic tension
  - Attempt to blend
  - Each supports the other
  - Database is key (REDCap)

## The Research

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# Emotional Behavioral Problems & Autism

## Autism Spectrum Disorder

Diagnostic Features:

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### Emotional Behavioral Problems (EBPs) in ASD

- More than just ASD symptoms
  - Co-occurring disorders as high as 85% (Levy, 2010)
  - Creates overlapping symptoms
- EBPs include:
  - Deficits in attention and hyperactive behaviors
  - Aggression
  - Overt fearfulness
  - Worrying

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### Emotional Behavioral Problems in ASD

- Can lead to additional diagnoses: ADHD, DBD (e.g., ODD/CD), or Anxiety
  - ASD and ADHD (14-78%) (Jang et al., 2013)
  - ASD and DBD (25% kids with ASD) (Kaat et al., 2013)
  - ASD and Anxiety (11-84%) (White et al., 2009)
  - Meta-analysis 40 % of ASD had at least 1 anxiety related disorder (van Steensel et al., 2011)

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### Assessing risk for ASD

- Questionnaires/Screeners
  - Population-based
  - Targeted
  - Psychometrics: e.g., Sensitivity; Specificity; PPV; NPV
- Examples
  - Child Behavior Checklist (CBCL)
  - Social Responsiveness Scale, 2<sup>nd</sup> Edition (SRS-2)
  - Social Communication Questionnaire (SCQ)
  - Modified Checklist for Autism in Toddlers- Revised with Follow-Up (MCHAT-R/F)

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### A Quick Reminder

	<b>Autism</b>	<b>Not Autism</b>	
<b>Test Positive</b>	True Positive	False Positive	<b>Positive Predictive Value</b>
<b>Test Negative</b>	False Negative	True Negative	<b>Negative Predictive Value</b>
	<b>Sensitivity</b>	<b>Specificity</b>	

$Sensitivity = TP / (TP + FN)$   
 $Specificity = TN / (TN + FP)$   
 $PPV = TP / (TP + FP)$   
 $NPV = TN / (FN + TN)$

How often a test correctly generates a positive result for people who have the condition that's being tested for?

If I test positive for a disease, what are the chances that I actually have the condition that I was tested for?

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## Effects of EBPs on measuring ASD symptoms

- Behavior problems reduced specificity in 3 questionnaires
  - EBPs measured by Strengths and Difficulties Questionnaire
  - SCQ, SRS, & CCC  
(Charman et al., 2007)
- High reported EBPs increase parent report of social-reciprocal abilities
  - EBPs measured by CBCL
  - SRS  
(Hus et al., 2013)

## Effects of EBPs on measuring ASD symptoms

- Clinically significant CBCL subscales substantially reduced the SRS and SCQ specificity
  - EBPs measured by CBCL
  - SRS and SCQ  
(Moody, et al., 2017)

## Effects of EBPs on measuring ASD symptoms

- ADOS and ADI-R:
  - With high CBCLs, increased likelihood of false positives on ASD measures
  - lowered specificity on all 3 measures
    - SRS, ADOS, ADI-R
    - ADOS-2
      - 2 or more E codes
      - 27% reduction in specificity  
(Havdahl et al., 2016)

# EBPs & MCHAT-R/F

## Purpose of Study

- Replicate prior findings on impact of EBPs
- Examine EBPs in a clinically-referred population of 1.5 - 5 year olds
  - EBPs assessed by parent-report CBCL
- Assess the effects of EBPs on MCHAT-R/F
- Assess whether combining CBCL and MCHAT-R/F findings can help

## MCHAT-R/F

- Population screener
- Recommended by APA
- Many use it in tertiary clinics
  - Psychometrics will change
  - Used for ASD symptom indexing



## Methods: Population/Procedure

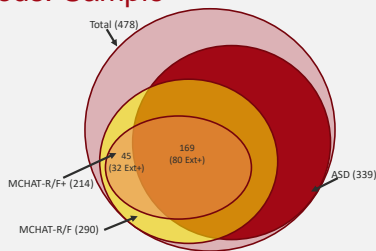
- Clinically referred sample –seeking ASD evaluation
- 1.5 - 5 year olds
- 3 sites
- Clinicians (doctoral level- MD, DO, PsyD, PhD)
  - Full developmental history and clinical interview

	ASD	Non-ASD
N	339	139
Mean Age (in months) (Range)	41.6 (18 – 73)	45.1 (19 -73)
Gender (male%)	79.4%	74.1%
ADOS-2 CS (Range)	7.7 (4 – 10)	4.6 (1 – 10)

## Methods: Measures

- EBPs: CBCL
- ASD symptom indexing: MCHAT-R/F
- ASD Symptoms: ADOS-2 (Research reliable)
- IQ: DAS-II or Mullen

## Methods: Sample

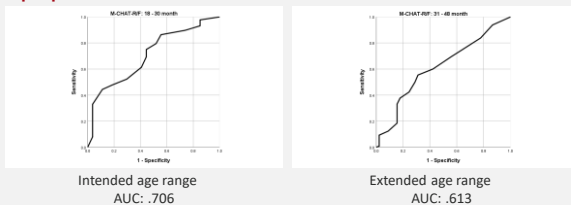


## Do children with ASD have higher parent-reported EBPs?

Test	ASD			Non-ASD		
	N	Mean (SD)	Range	N	Mean (SD)	Range
MCHAT-R/F	203	7.2 (4.7)*	0-17	71	4.8 (4.2)	0-17
Mullen/DAS	204	62.4 (16.9)*	49-121	71	76.2 (17.8)	49-125
CBCL	203			71		
Internalizing		62.8 (11.2)	29-86		64.4 (10.7)	41-86
Externalizing		62.3 (13.1)*	35-97		68.3 (14.1)	35-97
Total		64.9 (12.7)	32-90		68.6 (12.8)	40-94

- Those with ASD are lower in each case!
- Externalizing are significantly different between ASD and Non-ASD (controlled for age)

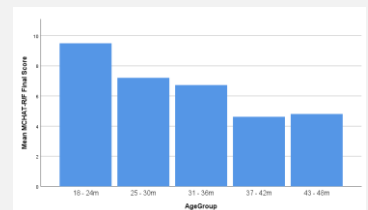
## How good is the MCHAT-R/F in a referred population?



## What predicts MCHAT-R/F results?

### Regression

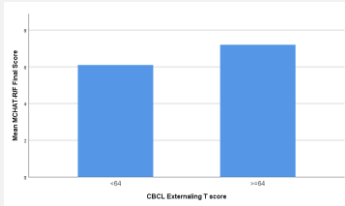
- EBPs and Age were entered
- Simulate only what we know prior to visit (not IQ)
- Results:
  - Age
  - CBCL Ext



## What predicts MCHAT-R/F results?

Regression results:

- Age
- CBCL Ext. T-scores



## A Quick Reminder (again)

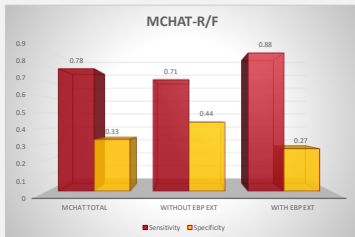
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Test Negative	False Negative	True Negative	Negative Predictive Value
	Sensitivity	Specificity	

$Sensitivity = TP / (TP + FN)$   
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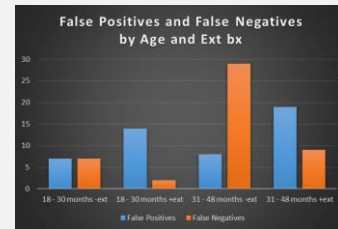
How often a test correctly generates a positive result for people who have the condition that's being tested for?

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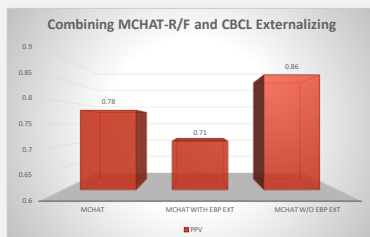
## How do Ext. EBPs affect MCHAT-R/F?



## How do Ext. EBPs affect MCHAT-R/F?



## Positive Predictive Value



## Conclusions

- In this referred for ASD sample:
  - Children with ASD have lower Externalizing EBPs compared to non-ASD
  - If Externalizing EBPs are significant, then the likelihood of a False Positive on MCHAT-R/F is increased
  - If Externalizing EBPs are not significant and the MCHAT-R/F is positive, the PPV increases

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# Clinic Triage

- ## Clinic implications
- These results made us think about our clinic triage
  - CASE clinic
  - How this research helped
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- ## Classic Autism Symptom Evaluation (CASE)
- Purpose:
    - Chart review to determine high risk
    - E.g., minimally verbal, minimal gestures, and/or pathognomonic symptoms
    - Patient can be referred to CASE in the interest of efficiency and quickest route to care
    - The CASE clinic specializes in "high risk" diagnoses and thus does not involve more comprehensive testing needed for complex diagnostic differentiation
    - Physician led
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- ## CASE
- Problem:
    - Needed Chart Review
      - \$\$ and FTE
    - Trouble articulating what we quantified for acceptance to clinic
    - Began taking too long
  - Answer
    - Apply study findings using REDCap
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- ## CASE
- Used regression with elements from parent-report history form
    - What predicted diagnosis
    - Key: included elements of EBP
  - For the screener, MCHAT-R/F  $\geq 3$ ; SCQ  $\geq 15$
- | The behavioral response formula is: |                         |
|-------------------------------------|-------------------------|
| +                                   | OCD                     |
| +                                   | Sensory                 |
| -                                   | Aggression              |
| -                                   | Depression              |
| -                                   | Unusual/excessive fears |
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## CASE

	Measure
TP	212
TN	369
FP	47
FN	632
Sens	0.25
Spec	0.89
PPV	0.82
NPV	0.37
Total	1260
Accuracy	46.1%

- Algorithm developed on 1260 patients
- Aiming for high PPV and high Specificity
  - Specificity depends on base rates

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### CASE

- Algorithm tested
- August through December 2019

All Ages		<72m	
	Measure		Measure
TP	35	TP	34
TN	106	TN	47
FP	11	FP	10
FN	131	FN	56
Sens	0.21	Sens	0.38
Spec	0.91	Spec	0.82
PPV	0.76	PPV	0.77
NPV	0.45	NPV	0.46
Total	283	Total	147
Accuracy	49.8%	Accuracy	55.1%

### After initial implementation

- Acknowledge that we are missing qualitative comments (e.g., pathognomonic)
- Added nonverbal
- Challenge: judging language
  - Caregivers are not very accurate (how to question?)
  - Looked at large database
    - Again, based in research
  - Easy to add question in REDcap

### CASE

- August through December 2019
- All Ages
- Adding Proxy for Language

	Measure		Measure
TP	35	TP	30
TN	106	TN	106
FP	11	FP	5
FN	131	FN	131
Sens	0.21	Sens	0.19
Spec	0.91	Spec	0.95
PPV	0.76	PPV	0.86
NPV	0.45	NPV	0.45
Total	283	Total	272
Accuracy	49.8%	Accuracy	49.8%

### Language addition

- Added verbal on November 13th:
  - Does your child use simple sentences to ask for or talk about things?
  - Does your child use 2 word phrases with a noun and a verb (e.g., "go home" or "mommy up")?

# Latest Update

### CASE (less than 72 months)

August 2019 – December 2019		August 2019 – August 2020	
	Measure		Measure
TP	34	TP	102
TN	47	TN	64
FP	10	FP	18
FN	56	FN	109
Sens	0.38	Sens	0.48
Spec	0.82	Spec	0.78
PPV	0.77	PPV	0.85
NPV	0.46	NPV	0.37
Total	147	Total	293
Accuracy	55.1%	Accuracy	56.7%

## Conclusion

- EBPs overlap with ASD symptoms
- EBPs confound our ASD measurements
- Knowing EBPs can impact accuracy of measurement
- This can be translated into clinic flow decisions in addition to help with research/phenotyping

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Christopher, K., Bishop, S., Carpenter, L., Warren, Z., & Kanne, S. (2020). The implications of parent-reported emotional and behavioral problems on the Modified Checklist for Autism in Toddlers. *Journal of Autism and Developmental Disorders*

Christopher, K., & Kanne, S. (2020, September 15). Listening to parents can curtail autism's diagnostic odyssey. *Spectrum News*.  
<https://www.spectrumnews.org/opinion/viewpoint/listening-to-parents-can-curtail-autisms-diagnostic-odyssey>

Special thank you to the families and participants

## CASE

- August 2019 – August 2020

All ages		<72 m	
	Measure		Measure
TP	105	TP	102
TN	180	TN	64
FP	19	FP	18
FN	260	FN	109
Sens	0.29	Sens	0.48
Spec	0.90	Spec	0.78
PPV	0.85	PPV	0.85
NPV	0.41	NPV	0.37
Total	564	Total	293
Accuracy	50.5%	Accuracy	56.7%