



VANDERBILT KENNEDY CENTER
TREATMENT & RESEARCH INSTITUTE FOR AUTISM SPECTRUM DISORDERS

Tele-assessment of ASD in Toddlers

TELE-ASD-PEDS



VANDERBILT
UNIVERSITY
MEDICAL
CENTER

Jeffrey Hine, Ph.D., BCBA

Welcome! The workshop will begin soon...





Zachary Warren, Ph.D.
VKC/TRIAD
Executive Director



A. Pablo Juárez,
M.Ed., BCBA
VKC/TRIAD
Director



Alacia
Stainbrook,
Ph.D. BCBA-D
VKC/TRIAD
Associate
Director



Amy Nicholson,
M.A. SLPE
VKC/TRIAD
Director of
Research Staff



Amy Weitlauf,
Ph.D.
VKC/TRIAD
Associate
Director of
Research



Whitney Loring,
Psy.D.
Director of Training



Laura Corona, Ph.D.

Caitlin Stone,
Ph.D.

Liliana Wagner,
Ph.D., BCBA

Nicholas Holt,
Media Specialist

Kenna McConnell,
Project Manager

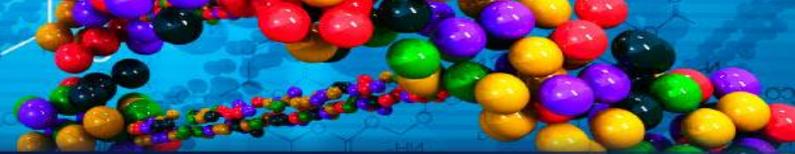


Nina Harris, M.Ed.
Family Services Coordinator
Family Navigation Lead

Aislynn Kiser, M.Ed., BCBA
Program Lead Online
Education

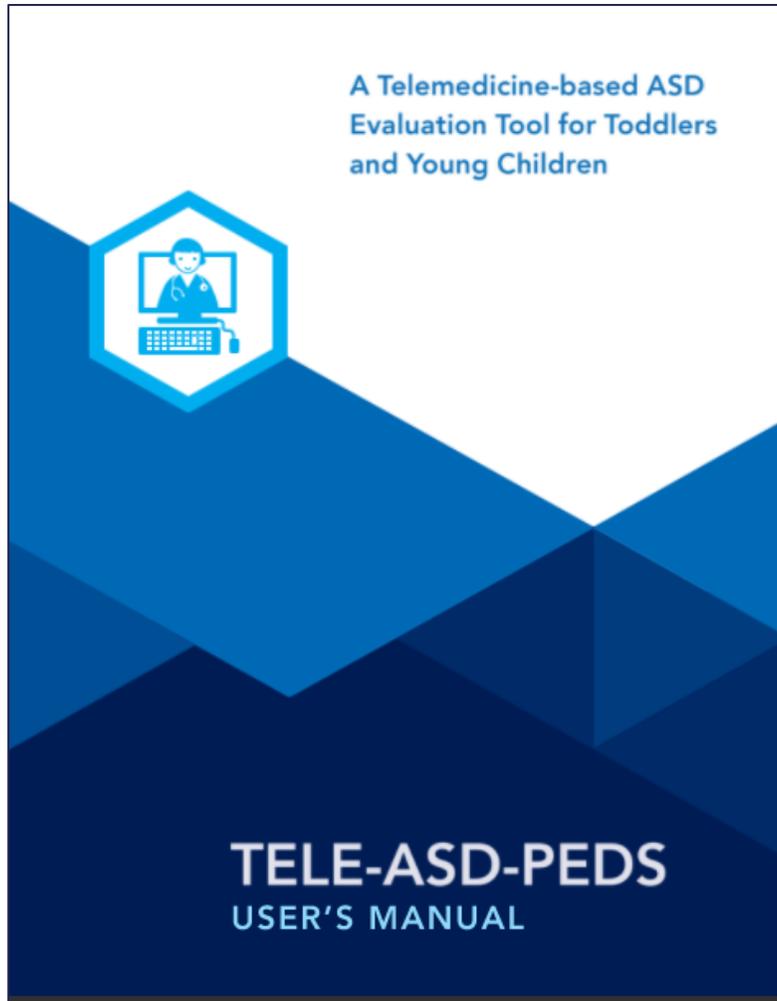
Josh Wade, M.S., CEO
Adaptive Technology
Consulting, LLC

Nilanjan Sarkar, Ph.D.
Mechanical Engineering
Vanderbilt University



Agenda

- Development of models and tools for tele-assessment
- TELE-ASD-PEDS overview and video scoring examples
- Lesson learned, trouble-shooting, and questions



Training materials:

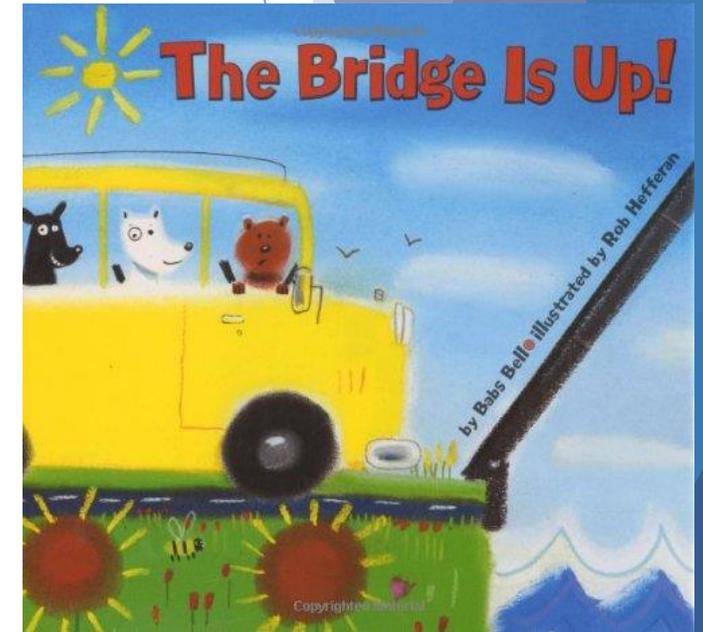
<https://vkc.vumc.org/vkc/triad/tele-asd-peds>

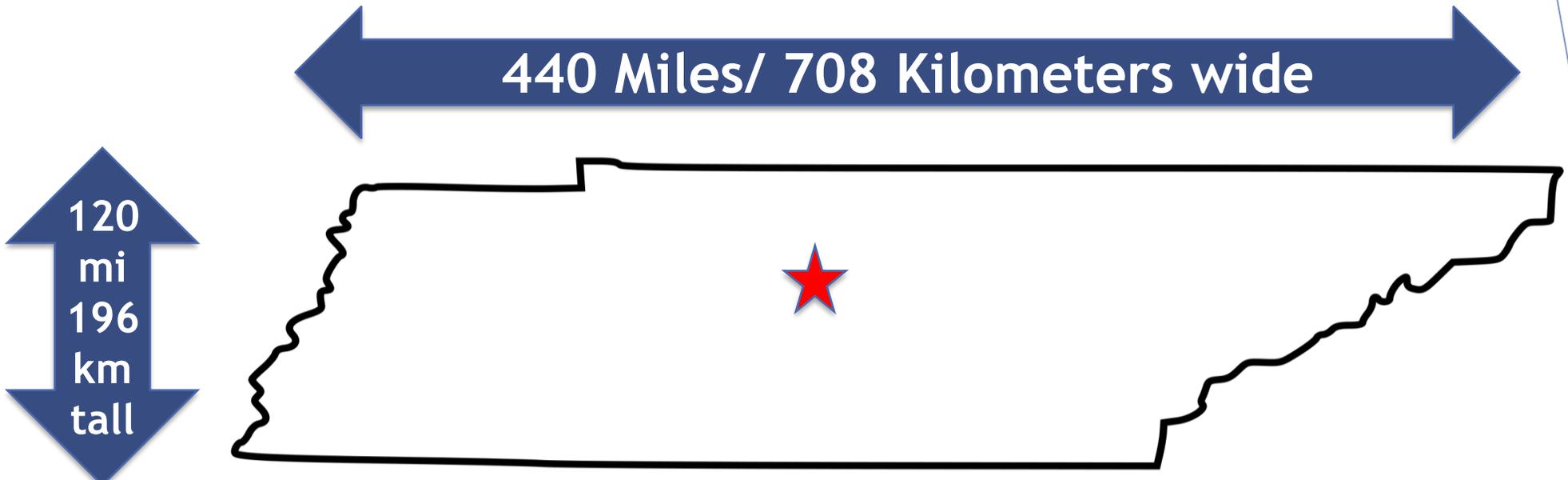
Manual:

<https://vkc.vumc.org/vkc/triad/manuals/>

Barriers to Ideal Plan

- We had problems before the pandemic
- “Wait-and-see” and “Screen-and-refer” no longer sufficient
- Models that meet families where they are and engage caregivers “in the meantime”
- Streamline services and empower parents





440 Miles/ 708 Kilometers wide

120
mi
196
km
tall

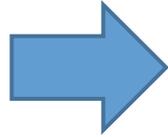
Triage

- Families enrolled in State's EI
- ASD concerns identified



Triage

- Families enrolled in State's EI
- ASD concerns identified



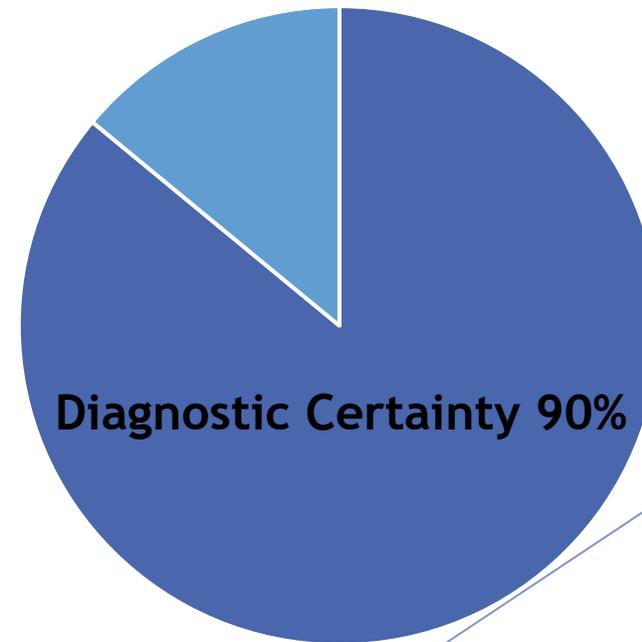
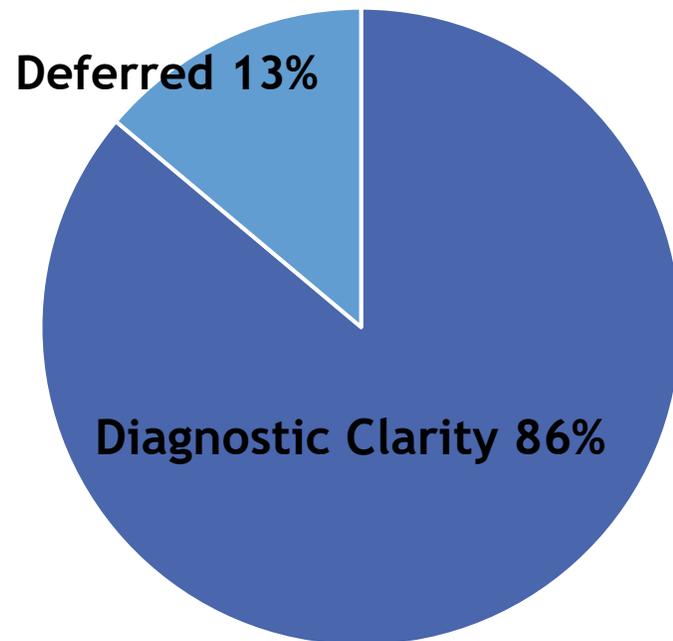
Streamlined Telediagnostic Evaluation

- STAT
- Record review
- Caregiver Interview
- Structured behavior observations
- Feedback and next steps
- Home follow-up



Feasibility/Validity Results

- ▶ Remote psychologists provide an ASD diagnosis for 65% of children
- ▶ Rule out an ASD diagnosis in 22%
- ▶ Psychologists “certain” in 90% of cases
- ▶ **All cases of ASD identified via telemedicine confirmed**

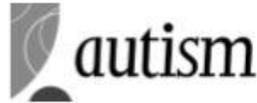




Early Identification of ASD Through Telemedicine: Potential Value for Underserved Populations

A. Pablo Juárez^{1,2,3} · Amy S. Weitlauf^{1,2} · Amy Nicholson^{1,2} · Anna Pasternak^{1,2} · Neill Broderick^{1,2} · Jeffrey Hine^{1,2} · J. Alacia Stainbrook^{1,2} · Zachary Warren^{1,2,3,4}

Short report



Measuring the service system impact of a novel teleradiologic service program for young children with autism spectrum disorder

Autism
1–6
© The Author(s) 2018
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/1362361318787797
journals.sagepub.com/home/aut

J Alacia Stainbrook^{ORCID}, Amy S Weitlauf, A Pablo Juárez, Julie Lounds Taylor, Jeffrey Hine, Neill Broderick, Amy Nicholson and Zachary Warren

We have found:

- It is feasible and valid to use an abbreviated autism evaluation process
- *Families* highly prefer telemedicine services over traveling
- Increasing the number of families we serve (more referrals, but less to tertiary center)
- Decreasing wait times
- Save *families* time/financial costs
- Start intervention for *families* faster

TELE-SUPPORT, RESEARCH, & SERVICE

We have found:

and valid to use an
evaluation

ine

What if we cannot have a
trained provider on the
other side?

costs

families

Journal of Autism and Developmental Disorders
<https://doi.org/10.1007/s10803-018-3524-y>

ORIGINAL PAPER

Early Identification of Autism
for Underserved Populations

A. Pablo Juárez^{1,2,3}
J. Alacia Stainbrook

Show

Meaning of a no-
program
autism spectre

J Alacia Stainbrook , Amy S Weitlauf, A Pablo Juárez,
Lounds Taylor, Jeffrey Hine, Neill Broderick, Amy Nicholson and
Zachary Warren

TELE-SUPPORT, RESEARCH, & SERVICE

Geography is not our only barrier in care...

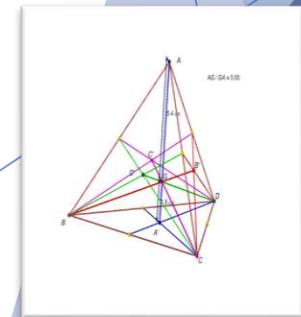
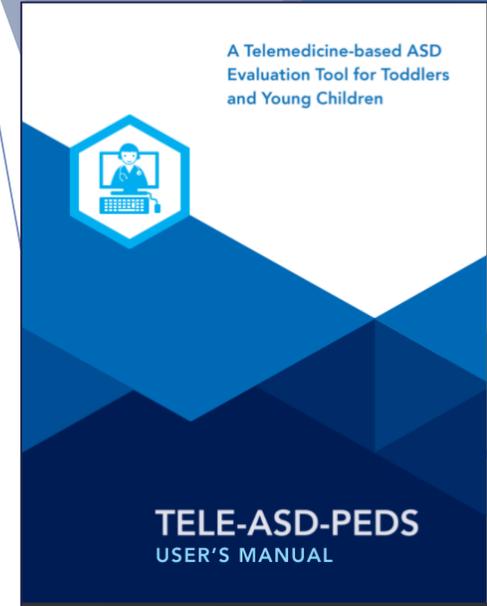


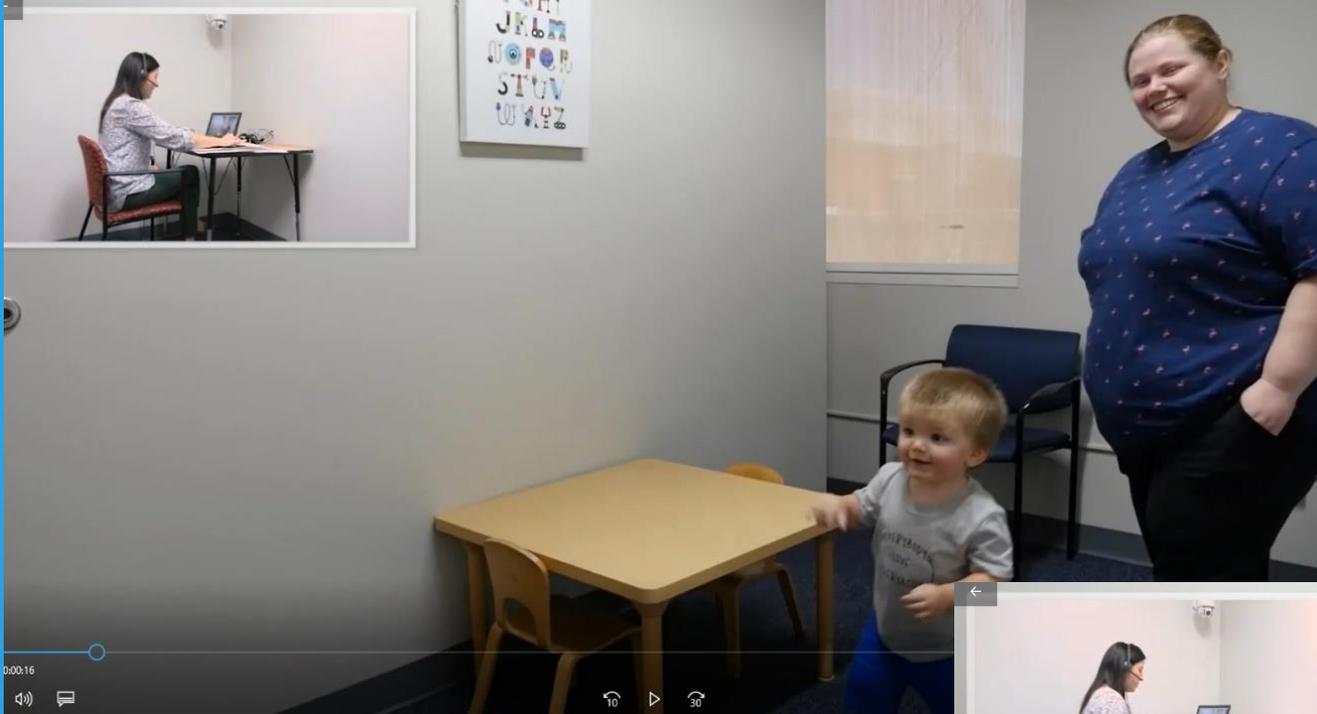
...we are fundamentally limited by tools we have

- Tests/trainings that are expensive protected intellectual property
- Tests that are lengthy
- Tests that are old, developed decades prior
- New tests with methodological flaws of data capture / processing
- Remote procedures that actually increase provider demand rather than lessen (2 providers for 1 visit)
- Tests that are not explicitly designed for the population and setting

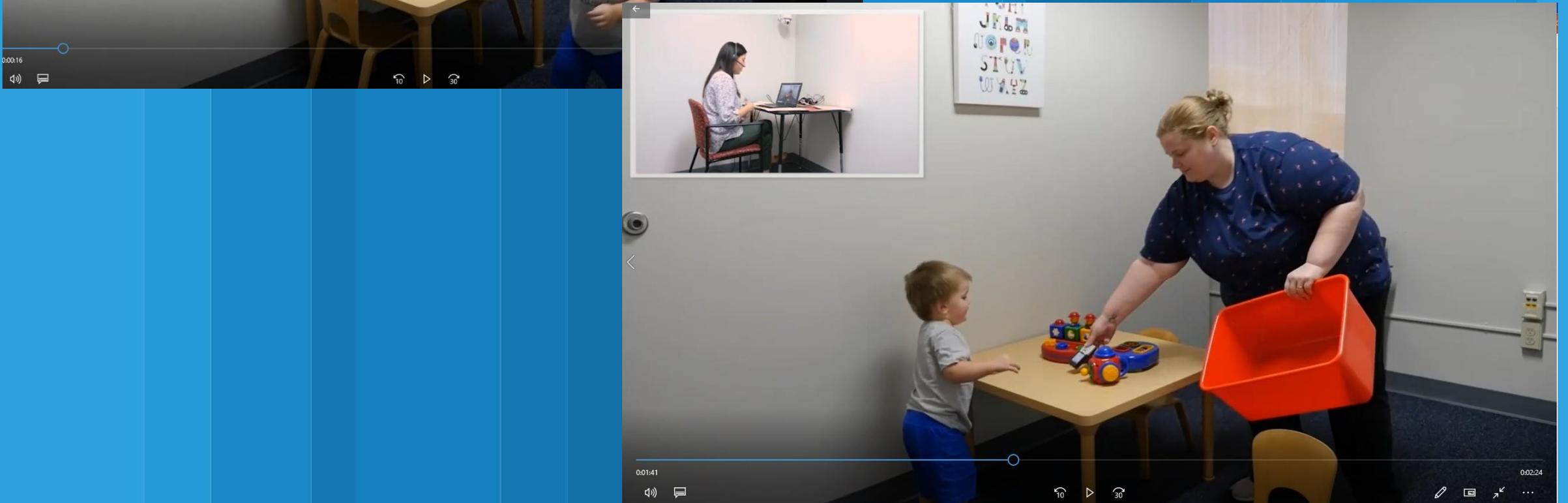
“Can Novel Telemedicine Tools Reduce Disparities Related to Early Identification of Autism?”

- Designed for use by during a telemedicine-based assessment
- Designed for open and free use
- Uses widely available/cheap materials
- Time-sensitive
- Play-based procedures could be performed by novel users





Parent (or non-specialist) is walked through a set of play tasks that can be modified, repeated as needed



Toward Novel Tools for Autism Identification: Fusing Computational and Clinical Expertise

Laura L. Corona^{1,2} · Liliana Wagner^{1,2} · Joshua Wade³ · Amy S. Weitlauf^{1,2} · Jeffrey Hine^{1,2} · Amy Nicholson^{1,2,4} · Caitlin Stone^{1,2} · Alison Vehorn¹ · Zachary Warren^{1,2,4,5}

Accepted: 19 December 2020
© The Author(s), under exclusive licence to Springer Science+Business Media, LLC part of Springer Nature 2021

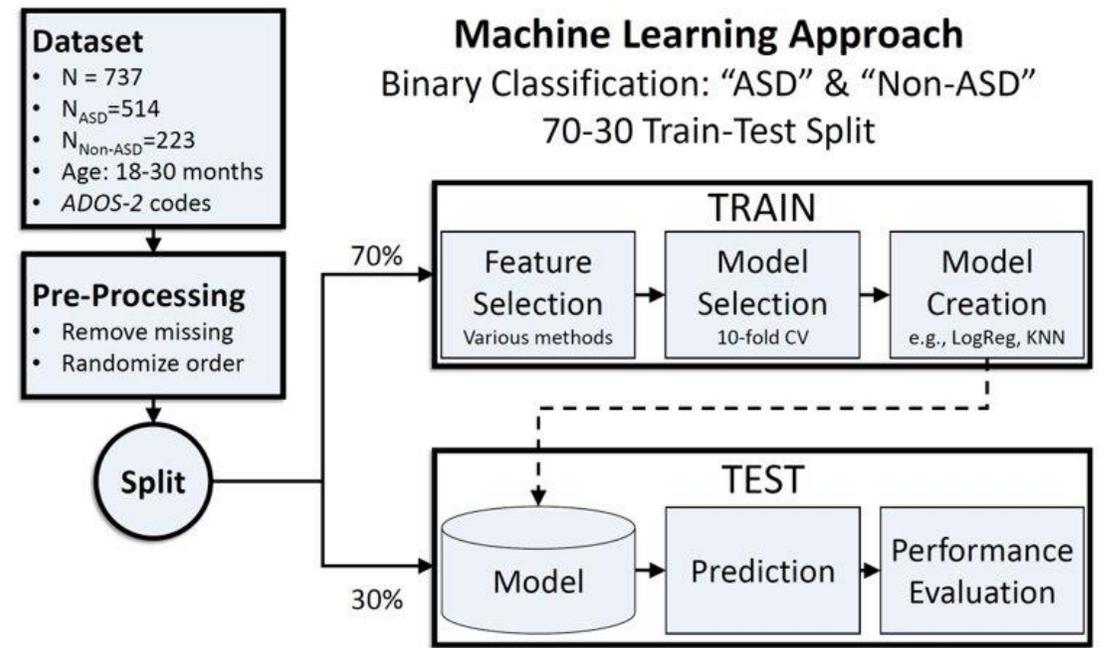


Figure courtesy of Josh Wade

Approach: Part 1

- ▶ Clinical database containing data from toddlers' ASD evaluations
- ▶ Application of machine learning

7 Key Behavioral Observations



Socially Directed
Speech & Sounds



Unusual or Repetitive
Body Movements

Frequent and
Flexible Eye
Contact



Combines gestures, eye
contact, vocalization



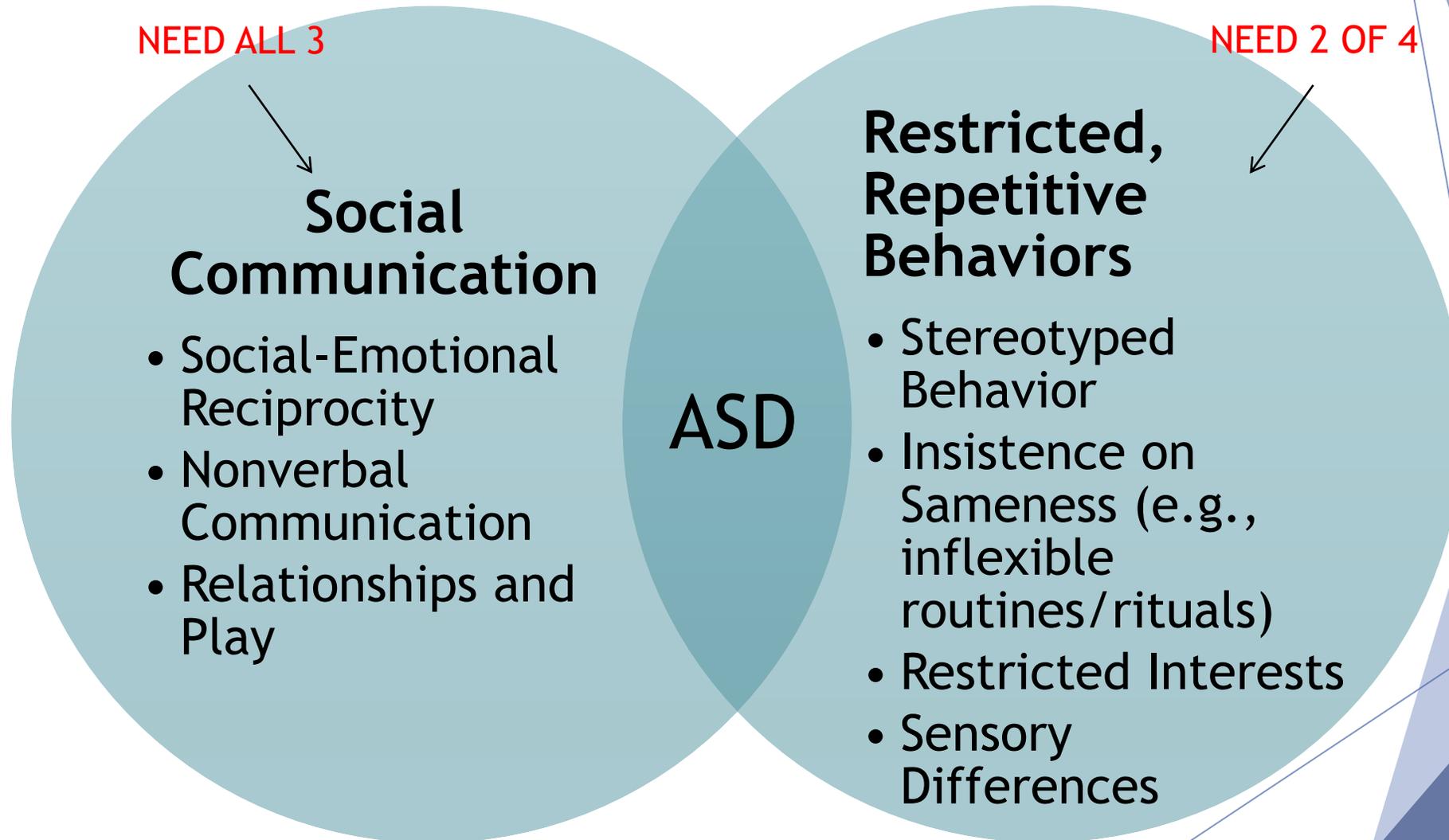
Unusual
Vocalizations

Unusual or
Repetitive Play



Unusual Sensory
exploration/reaction

ASD DSM-5 Diagnostic Criteria



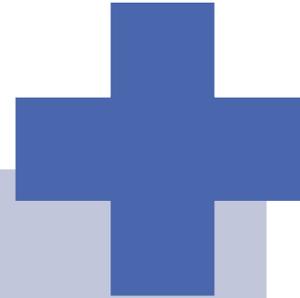
ASD Symptoms

Social Communication

- Absence of (or reduced) expected behaviors

RRBI

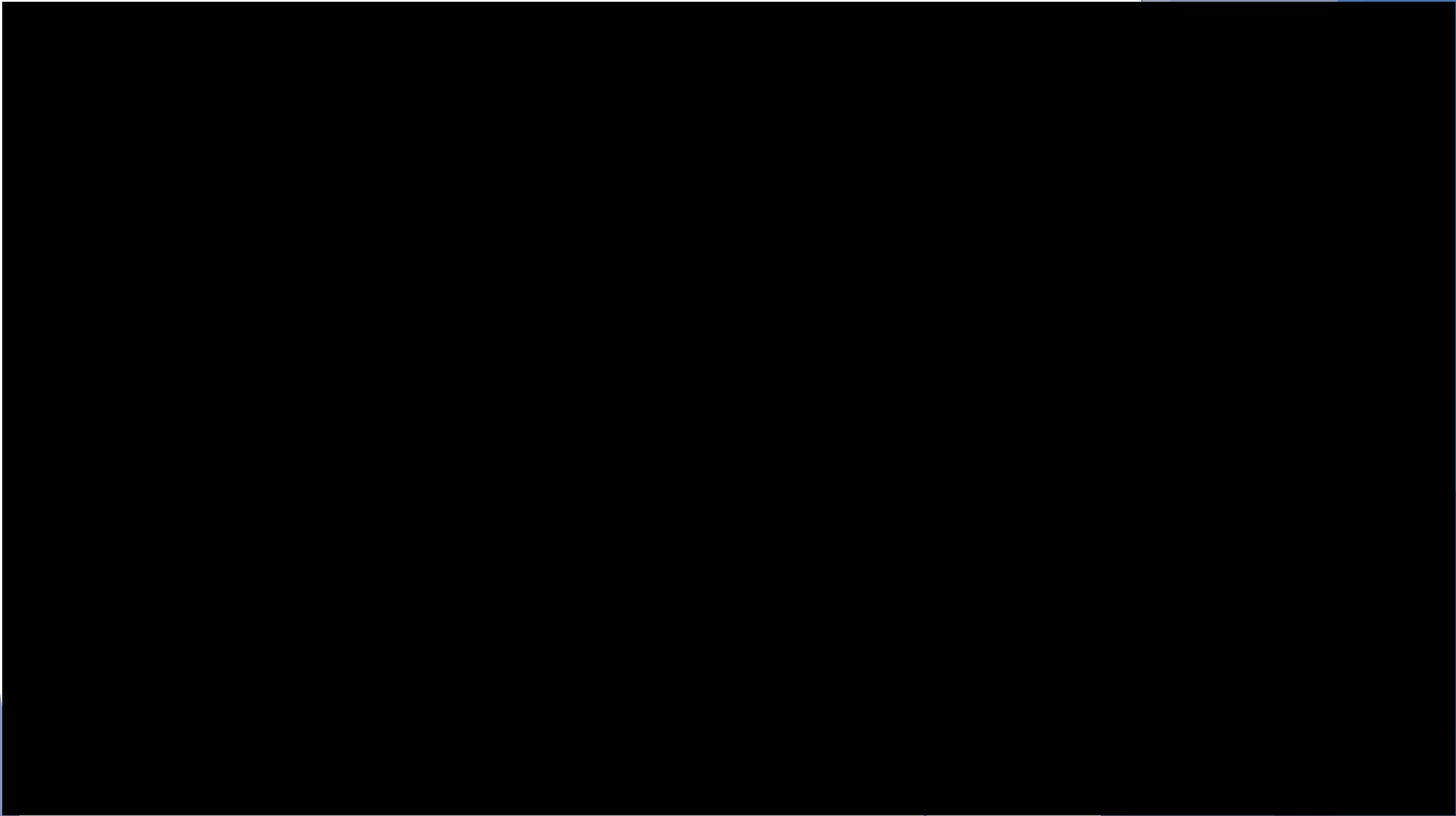
Presence of atypical or unusual behaviors



Seven Key Behaviors

1. Socially directed speech/sounds
 2. Frequent and flexible eye contact
 3. Combines gestures, eye contact, and speech/vocalization
-
4. Unusual vocalizations
 5. Unusual or repetitive play
 6. Unusual or repetitive body movements
 7. Unusual sensory exploration or reaction





Seven Key Behaviors

1. Socially directed speech/sounds
 2. Frequent and flexible eye contact
 3. Combines gestures, eye contact, and speech/vocalization
-
4. Unusual vocalizations
 5. Unusual or repetitive play
 6. Unusual or repetitive body movements
 7. Unusual sensory exploration or reaction



Child age: mos
 Gender: M F

TELE-ASD-PEDS Rating Form

Dichotomous score: Is the symptom present or not (1 vs. 3)
 Likert score: 1 = symptom not present; 2 = symptom present but at subclinical levels; 3 = symptom obviously consistent with AS

Item	1	2	3	Dichotomous 1/3	Likert 1/2/3
Socially directed speech and sounds	Child often uses words or other vocalizations for a variety of social purposes (e.g. requesting, protesting, directing attention, sharing enjoyment).	Inconsistent socially directed speech.	Most of the child's sounds are self-directed. May make atypical non-word noises (e.g., "digga digga").	3	3
Frequent and flexible eye contact	Child frequently makes eye contact with others and across a variety of activities.	Child's eye contact seems inconsistent. Gaze seems less flexible and harder to catch than expected.	Child infrequently makes eye contact. Might only make eye contact during one activity (e.g., asking for help).	3	2
Unusual vocalizations	No unusual qualities of speech/language observed. Most of child's speech is appropriate for the child's age and developmental level.	Speech is not clearly unusual, but there are some differences (e.g., volume, slight repetitive quality of speech/language, unclear echoing, some occasional sounds that are unusual).	Child produces unusual jargon, sounds, or speech/language (e.g., undirected jargon, speech of peculiar intonation, unusual sounds, repetitive vocalizations, echoing or repetitive speech/language).	3	3
Unusual or repetitive play	Child plays with toys in appropriate ways (uses toys as expected).	Child's play is not clearly unusual, but child is strongly focused on some toys, routines, or activities. May sometimes be hard to shift child's attention to something new.	Child shows clearly repetitive or unusual play, such as repeatedly pushing buttons, watching how objects move, lining things up, or scrambling/dropping toys.	1	2
Unusual or repetitive body movements	No unusual or repetitive body movements seen.	Unclear unusual/repetitive body movements. Some repetitive jumping or very brief posturing of fingers, hands, or arms that is not clearly atypical.	Child clearly shows unusual or repetitive (e.g., hand-flapping, posturing or tensing upper body, toe-walking, facial grimacing, hand/finger mannerisms) repetitive running/walking/spinning/jumping.	3	3
Combines gestures, eye contact, and speech/vocalization	Child frequently points and uses other gestures to communicate. Child's gestures are usually combined with vocalizations and eye contact.	Child may sometimes point or use other gestures, but less than expected. Child does not always look at you or make a sound when gesturing.	Child does not usually gesture to communicate. May sometimes reach or point, but does not usually combine these with eye gaze or sounds. May move your hand or push on your body to get help.	3	3
Unusual sensory exploration or reaction	No unusual sensory behavior observed.	Unclear sensory exploration or reaction. May have a brief response to a sound, smell, or how something feels or moves.	Child shows sensory differences. May closely inspect objects, overreact to sounds, show intense interest or dislike to textures (e.g., touching, licking, biting, refusing to touch specific toys), or clear self-injurious behavior.	1	2
ASD if forced to choose? <input type="radio"/> Absent <input type="radio"/> Unsure <input checked="" type="radio"/> Present	Did you recommend in person evaluation for diagnostic clarification? <input type="radio"/> Yes <input checked="" type="radio"/> No	How certain are you of your diagnostic impression? <input type="radio"/> 1 Completely uncertain <input type="radio"/> 2 Somewhat uncertain <input type="radio"/> 3 Somewhat certain <input checked="" type="radio"/> 4 Completely certain			Total Score
Diagnosis issued: Autism Spectrum Disorder F84.0					18

TELE-ASD-PEDS - Administration

- Parent is walked through a set of play tasks that can be modified, repeated as needed for clinician to make meaningful observations.
- Tasks include:
 - Toy play (child-directed, parent-directed, ignore)
 - Responding to social bids (name, joint attention)
 - Physical/social play (peekaboo, chasing, tickling)
 - “Ready-set-go” play (balloons, balls, cars)
 - Requesting (container with snack, sticker, bubbles, or toy)

An illustration of a clipboard with an orange border and a green clip at the top. The clipboard contains a white sheet of paper with a checklist. The checklist has three items, each with a green checkmark in a circle. To the right of the checkmarks are three bar charts of varying heights. The background is a teal color with a white line graph icon.

Approach

- ▶ Created behavioral descriptors
- ▶ Created 3-point rating system
 - ▶ 1 = symptom not present
 - ▶ 2 = present but subclinical
 - ▶ 3 = clear evidence of ASD
- ▶ Set of administration tasks to best elicit observations

Child age: mos
 Gender: M F

TELE-ASD-PEDS Rating Form

Distraction: None Mild Moderate Severe (1 vs. 3)
 Likert score: 1 = symptom not present; 2 = symptom present but at subclinical levels; 3 = symptom obviously consistent with AS

Item	1	2	3	Distraction 1/2/3	Likert 1/2/3
Socially directed speech and sounds	Child often uses words or other vocalizations for a variety of social purposes (e.g., requesting, protesting, directing attention, sharing enjoyment).	Inconsistent socially directed speech.	Most of the child's sounds are self-directed. May make atypical non-word noises (e.g., "digga digga").	3	3
Frequent and flexible eye contact	Child frequently makes eye contact with others and across a variety of activities.	Child's eye contact seems inconsistent. Gaze seems less flexible and harder to catch than expected.	Child infrequently makes eye contact. Might only make eye contact during one activity (e.g., asking for help).	3	2
Unusual vocalizations	No unusual qualities of speech/language observed. Most of child's speech is appropriate for the child's age and developmental level.	Speech is not clearly unusual, but there are some differences (e.g., volume, slight repetitive quality of speech/language, unclear echoing, some occasional sounds that are unusual).	Child produces unusual jargon, sounds, or speech/language (e.g., undirected jargoning, speech of peculiar intonation, unusual sounds, repetitive vocalizations, echoing or repetitive speech/language).	3	3
Unusual or repetitive play	Child plays with toys in appropriate ways (uses toys as expected).	Child's play is not clearly unusual, but child is strongly focused on some toys, routines, or activities. May sometimes be hard to shift child's attention to something new.	Child shows clearly repetitive or unusual play, such as repeatedly pushing buttons, watching how objects move, lining things up, or scrambling/dropping toys.	1	2
Unusual or repetitive body movements	No unusual or repetitive body movements seen.	Unclear unusual/repetitive body movements. Some repetitive jumping or very brief posturing of fingers, hands, or arms that is not clearly atypical.	Child clearly shows unusual or repetitive (e.g., hand-flapping, posturing or tensing upper body, toe-walking, facial grimacing, hand/finger mannerisms) repetitive running/walking/spinning/jumping.	3	3
Combines gestures, eye contact, and speech/vocalization	Child frequently points and uses other gestures to communicate. Child's gestures are usually combined with vocalizations and eye contact.	Child may sometimes point or use other gestures, but less than expected. Child does not always look at you or make a sound when gesturing.	Child does not usually gesture to communicate. May sometimes reach or point, but does not usually combine these with eye gaze or sounds. May move your hand or push on your body to get help.	3	3
Unusual sensory exploration or reaction	No unusual sensory behavior observed.	Unclear sensory exploration or reaction. May have a brief response to a sound, smell, or how something feels or moves.	Child shows sensory differences. May closely inspect objects, overreact to sounds, show intense interest or dislike to textures (e.g., touching, licking, biting, refusing to touch specific toys), or clear self-injurious behavior.	1	2
ASD if forced to choose? <input type="radio"/> Absent <input type="radio"/> Unsure <input checked="" type="radio"/> Present	Did you recommend in person evaluation for diagnostic clarification? <input type="radio"/> Yes <input checked="" type="radio"/> No	How certain are you of your diagnostic impression? <input type="radio"/> 1 Completely uncertain <input type="radio"/> 2 Somewhat uncertain <input type="radio"/> 3 Somewhat certain <input checked="" type="radio"/> 4 Completely certain			Total Score
Diagnosis issued: Autism Spectrum Disorder F84.0				18	

TELE-ASD-PEDS – Scoring

Current use suggests that children who score 11 or higher on the TELE-ASD-PEDS are considered “at risk” for ASD

- Children with ≥ 5 items with rating of 3 are considered “very high-risk”

Diagnosis is never be based on a single score

DSM-5 Checklist with Developmental Anchors

NOTE: This checklist is merely a tool for facilitating diagnosis specific to ASD in young children. This is not an exhaustive or exclusive list of developmental behavioral markers that rise to the level of clinical significance within these specific ASD related domains.

Cluster A: Persistent deficits in social communication and social interaction: Deficits and impairment must be present in **all three** symptom domains

DSM-5 Symptom	Developmental Markers (<i>mark "O" for Observed and "R" for Reported</i>)
___ Deficits in social reciprocity	<input type="checkbox"/> /R Limited showing, directing attention, sharing of enjoyment/attention with others <input type="checkbox"/> /R Does not frequently initiate interactions with others <input type="checkbox"/> /R Inconsistent response to social bids of others <input type="checkbox"/> /R Inconsistent response to name or attempts to get attention <input type="checkbox"/> /R Limited sharing or back-and-forth play <input type="checkbox"/> /R Focused language or communication on particular interests
___ Atypical nonverbal social behavior	<input type="checkbox"/> /R Atypical or inconsistent eye gaze <input type="checkbox"/> /R Limited index pointing <input type="checkbox"/> /R Limited conventional gesture use (e.g., head shaking/nodding, waving, reaching) <input type="checkbox"/> /R Limited other gesture use (e.g., emphasizing, miming, pretend) <input type="checkbox"/> /R Physical direction of others (e.g., leading, hand as a tool use) <input type="checkbox"/> /R Challenges communicating wants and needs <input type="checkbox"/> /R Limited range of directed facial expressions (e.g., extremes only)
___ Deficits in maintaining relationships	<input type="checkbox"/> /R Limited or inconsistent interest in peer interaction and play <input type="checkbox"/> /R Limited or inconsistent skills participating in interactive games with siblings/adults <input type="checkbox"/> /R Challenges appreciating basic social/safety rules <input type="checkbox"/> /R Limited or inconsistent response to approach of novel peers and adults <input type="checkbox"/> /R Limited spontaneous initiation of play/ interaction <input type="checkbox"/> /R Limited imitative and pretend play

Cluster B: Restricted, repetitive patterns of behavior, interests, or activities: Deficits and impairment in **two** of the following four domains

DSM-5 Symptom	Developmental Markers (<i>mark "O" for Observed and "R" for Reported</i>)
___ Stereotyped, repetitive, idiosyncratic speech; motor stereotypes; repetitive use of objects	<i>Speech/language:</i> <input type="checkbox"/> /R Echolalia, scripting <input type="checkbox"/> /R Atypical jargonizing (undirected speech, peculiar vocalizations) <input type="checkbox"/> /R Idiosyncratic speech (pronominal reversal, neologisms) <i>Motor stereotypes:</i> <input type="checkbox"/> /R Body/hand/finger mannerisms/posturing (e.g., hand-flapping, tensing, finger/ear-flicking, hand/finger inspection, rocking, spinning, repetitive clapping, toe-walking, facial grimacing) <i>Objects:</i> <input type="checkbox"/> /R Repetitive use of objects (e.g., lining-up, organizing, stacking, spinning, dropping, repeated activation, interest in parts of objects)
___ Excessive adherence to nonfunctional routines	<input type="checkbox"/> /R Requires activities performed in exact same way (e.g., requires caretakers to say things in certain order, motor rituals) <input type="checkbox"/> /R Distresses surrounding changing routine (e.g., placement of objects in house, change in physical appearance to others, driving route, order of daily activities, food presentation) <input type="checkbox"/> /R Carries out specific sequence in play or other activities <input type="checkbox"/> /R Insistence on sameness (e.g., extreme reaction to changes)
___ Atypical sensory behavior (hypo or hyper-sensitivity or interest)	<input type="checkbox"/> /R Visual interest/ inspection <input type="checkbox"/> /R Noise sensitivity <input type="checkbox"/> /R Atypical pain threshold / strong interest in physical stimulation <input type="checkbox"/> /R Sensory aversions (smells, textures, touch, daily routine challenges) <input type="checkbox"/> /R Sensory seeking behavior (sights, smells, mouthing, loud noises, tactile interests)
___ Restricted/Fixated interests	<input type="checkbox"/> /R Requires certain objects to be on his/her person at all times <input type="checkbox"/> /R Focused repetitive play (e.g., sorting/stacking/lining-up objects) <input type="checkbox"/> /R Unusual interests in objects (e.g., appliances, fans, mirrors, shiny objects, etc.) <input type="checkbox"/> /R Intense/rigid focal interests (e.g., cars, trains, specific videos, vacuums)

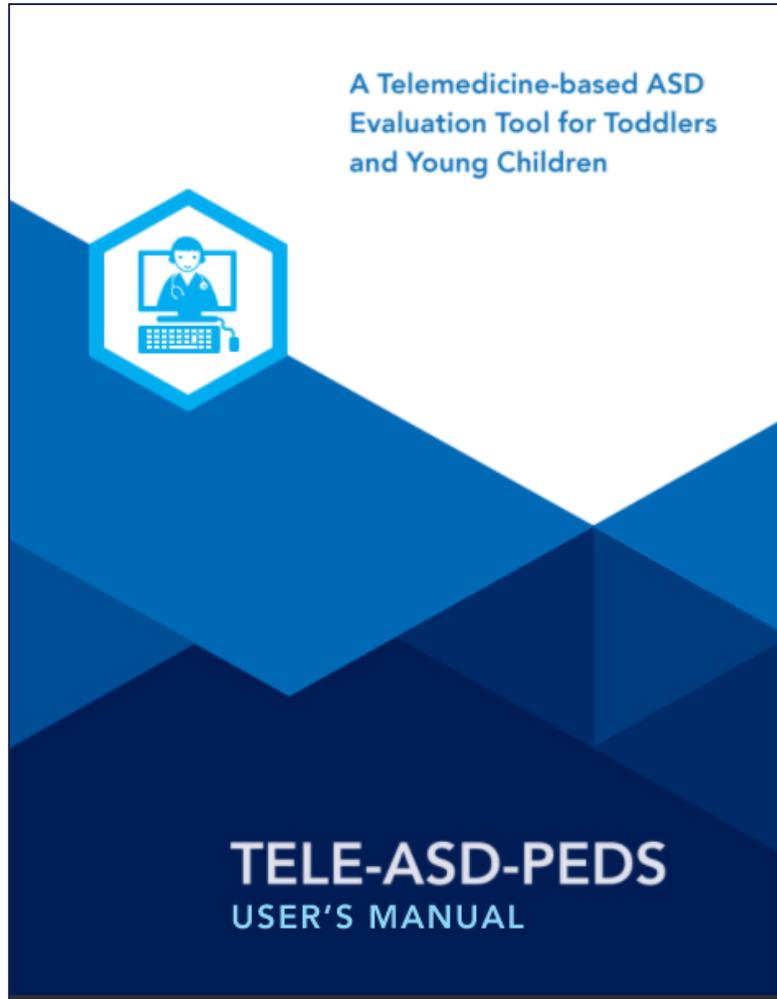
**Cluster A: Persistent deficits in social communication and social interaction:
Deficits and impairment must be present in all three symptom domains**

DSM-5 Symptom	Developmental Markers (<i>mark "O" for Observed and "R" for Reported</i>)
___ Deficits in social reciprocity	<u>O/R</u> Limited showing, directing attention, sharing of enjoyment/attention with others <u>O/R</u> Does not frequently initiate interactions with others <u>O/R</u> Inconsistent response to social bids of others <u>O/R</u> Inconsistent response to name or attempts to get attention <u>O/R</u> Limited sharing or back-and-forth play <u>O/R</u> Focused language or communication on particular interests
___ Atypical nonverbal social behavior	<u>O/R</u> Atypical or inconsistent eye gaze <u>O/R</u> Limited index pointing <u>O/R</u> Limited conventional gesture use (e.g., head shaking/nodding, waving, reaching) <u>O/R</u> Limited other gesture use (e.g., emphasizing, miming, pretend) <u>O/R</u> Physical direction of others (e.g., leading, hand as a tool use) <u>O/R</u> Challenges communicating wants and needs <u>O/R</u> Limited range of directed facial expressions (e.g., extremes only)
___ Deficits in maintaining relationships	<u>O/R</u> Limited or inconsistent interest in peer interaction and play <u>O/R</u> Limited or inconsistent skills participating in interactive games with siblings/adults <u>O/R</u> Challenges appreciating basic social/safety rules <u>O/R</u> Limited or inconsistent response to approach of novel peers and adults <u>O/R</u> Limited spontaneous initiation of play/ interaction <u>O/R</u> Limited imitative and pretend play

**Cluster B: Restricted, repetitive patterns of behavior, interests, or activities:
Deficits and impairment in two of the following four domains**

DSM-5 Symptom	Developmental Markers (<i>mark "O" for Observed and "R" for Reported</i>)
<p>___ Stereotyped, repetitive, idiosyncratic speech; motor stereotypes; repetitive use of objects</p>	<p><i>Speech/language:</i> <u>O/R</u> Echolalia, scripting <u>O/R</u> Atypical jargoning (undirected speech, peculiar vocalizations) <u>O/R</u> Idiosyncratic speech (pronominal reversal, neologisms) <i>Motor stereotypies:</i> <u>O/R</u> Body/hand/finger mannerisms/posturing (e.g., hand-flapping, tensing, finger/ear-flicking, hand/finger inspection, rocking, spinning, repetitive clapping, toe-walking, facial grimacing) <i>Objects:</i> <u>O/R</u> Repetitive use of objects (e.g., lining-up, organizing, stacking, spinning, dropping, repeated activation, interest in parts of objects)</p>
<p>___ Excessive adherence to nonfunctional routines</p>	<p><u>O/R</u> Requires activities performed in exact same way (e.g., requires caretakers to say things in certain order, motor rituals) <u>O/R</u> Distresses surrounding changing routine (e.g., placement of objects in house, change in physical appearance to others, driving route, order of daily activities, food presentation) <u>O/R</u> Carries out specific sequence in play or other activities <u>O/R</u> Insistence on sameness (e.g., extreme reaction to changes)</p>
<p>___ Atypical sensory behavior (hypo or hyper-sensitivity or interest)</p>	<p><u>O/R</u> Visual interest/ inspection <u>O/R</u> Noise sensitivity <u>O/R</u> Atypical pain threshold / strong interest in physical stimulation <u>O/R</u> Sensory aversions (smells, textures, touch, daily routine challenges) <u>O/R</u> Sensory seeking behavior (sights, smells, mouthing, loud noises, tactile interests)</p>
<p>___ Restricted/Fixated interests</p>	<p><u>O/R</u> Requires certain objects to be on his/her person at all times <u>O/R</u> Focused repetitive play (e.g., sorting/stacking/lining-up objects) <u>O/R</u> Unusual interests in objects (e.g., appliances, fans, mirrors, shiny objects, etc.) <u>O/R</u> Intense/rigid focal interests (e.g., cars, trains, specific videos, vacuums)</p>

TAP Manual



Manual:

<https://vkc.vumc.org/vkc/triad/manuals/>

Training webinars:

<https://vkc.vumc.org/vkc/triad/tele-asd-peds>

Appointment Structure

- Children 3 and under
 - Visits scheduled for 90 minutes (Zoom)
 1. Interview, unstructured observations
 2. TELE-ASD-PEDS (15-20 min)
 3. Additional measures (VABS-3 Comm/Soc, DAYC-2, CARS-2)
 4. Feedback/diagnosis/resources

Preparing families for telehealth visits

- Start during scheduling phone calls
- Share resources (online/written) in advance
- Spend time at the beginning of the visit orienting families to the process
 - What will the appointment include?
 - What will you, the clinician, be looking for?
 - What are the possible outcomes of this appointment?

Before your appointment:

- Familiarize yourself with the Zoom instructions (attached to this email). Think about which device you will use (phone, tablet, etc.) and where you can place it in the room so that you can be hands-free to play. Please reach out to us with any questions.
- Think about a room you can use to play with your child and chat with us that is as free from distractions as possible (e.g., TV, tablets, siblings). We realize that not all distractions can be avoided all the time!
- Find 5 or 6 toys and set them aside in the room you intend to use (on a table or in a container). Examples of toys include shape sorters, musical toys, puzzles, vehicles, pretend play toys, balls, or anything else that your child loves to play with. Please avoid the use of phones or tablets. We will also need a clear Tupperware with a lid (or similar container with a lid) with a snack in it that your child likes.

What to expect during the appointment:

- The clinician will talk with you about your concerns, ask questions about your child's development and medical history, and ask you to observe, interact, and play with your child.
- The activities are designed so that we can observe how your child communicates and interacts with you and plays.
- Some of these activities will probably feel different from the way you normally interact with your child at home—or even a little silly.
- The clinician will ask you to use specific words or movements so that we can observe specific behaviors and interactions.
- If we have trouble seeing or hearing you or your child clearly, we may ask you to tell us what your child said or where he/she was looking.
- The clinician will give you feedback regarding the evaluation before the end of the meeting.

We look forward to "seeing" you soon!

General Guidelines

- ▶ Instructions, materials, and tasks can be modified as needed
- ▶ Discourage use of technology during assessment
- ▶ Trials for tasks can be discontinued or administered later if a child loses interest
- ▶ Clinician may ask caregiver for observations (e.g., eye contact, words, vocalizations)

TELE-ASD-PEDS & COVID-19



Use of TELE-ASD-PEDS
in clinical evaluations

Decision to share tool
and related resources
with other providers

Initial web-based
training on the TELE-
ASD-PEDS:
2,100+ providers

Small-group, interactive
consultation:
**37-47 providers
registered across each
of 3 days**

Individual consultation:
35 sites and counting

Use of the TAP at VUMC: Direct-to-home

- ▶ 9 providers
- ▶ 204 children (3.5 months early pandemic)
- ▶ TAP provided enough information when ASD is clearly present (>70%)
 - ▶ High levels of diagnostic certainty
 - ▶ TAP scores significantly differentiating those with/without ASD



Evaluation Outcomes-VUMC

Clinician Diagnostic Impression	N (%)	Further Testing Recommended (% Yes)	Clinician Diagnostic Certainty*
ASD Present	145 (71%)	6%	3.77 (0.46)
ASD Suspected	14 (7%)	100%	2.50 (0.65)
Diagnosis Unclear	22 (11%)	100%	2.09 (0.61)
ASD Absent	23 (11%)	48%	2.83 (0.72)

*Clinicians rated diagnostic certainty on a Likert scale, ranging from 4 = completely certain, to 1 = completely uncertain.

Evaluation Outcomes-VUMC

Clinician Diagnostic Impression	N (%)	TAP Score M(SD)
ASD Present	145 (71%)	17.96 (2.36)
ASD Suspected	14 (7%)	15.14 (2.45)
Diagnosis Unclear	22 (11%)	12.32 (1.52)
ASD Absent	23 (11%)	9.96 (1.64)

Caregiver Feedback

	Very True	Somewhat True	Not True	N/A
Before I started the visit, I understood what I would be doing.	80%	20%	-	-
The instructions given by the psychologist were easy to follow.	86%	7%	-	7%
The activities got my child to show the behaviors I am concerned about.	72%	23%	5%	-
It was comfortable for me to play with my child as part of the evaluation.	84%	9%	7%	-
I would recommend participating in a telehealth evaluation to others.	81%	14%	5%	-

External Providers

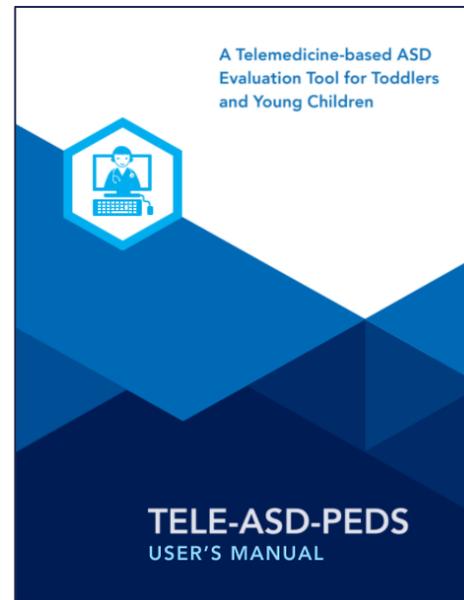
- ▶ 202 providers completed survey regarding ASD tele-assessment and the TAP.
 - ▶ Licensed psychologists, medical providers, SLPs, behavior analysts, school psychologists, trainees
 - ▶ 96% reported expertise in the assessment of children age 0-3.

Challenges

- Technology - Thinking of physical space and camera placement/operators becomes critical.
- Parents following prompts from the provider
- Distractions in the home
- Complexity -
 - Language
 - Medical complexity
 - Significant developmental delays
 - Comorbidity

What about the Clinical Trial?

Can Novel Telemedicine Tools Reduce Disparities Related to Early Identification of Autism (NIMH 1R21MH118539-01)



Study Design

- ▶ Participants were randomized to receive either:
 - ▶ TELE-STAT or
 - ▶ TELE-ASD-PEDS (TAP)
- Tele-assessment was immediately followed by traditional in-person diagnostic evaluation
- Families received feedback after in-person evaluation only



Participants

- ▶ N = 144 toddlers
- ▶ Child mean age = 2.52 years
 - ▶ (SD = 0.33; Range = 16-36 months)
- ▶ Caregivers were primarily mothers (85%) or fathers (9%)

Diagnostic accuracy

Overall diagnostic agreement = 92%

Clinical Diagnosis- Telemedicine Diagnosis	TELE-STAT N = 72	TAP N = 72
ASD-ASD	64 (89%)	60 (83%)
No ASD-No ASD	2 (3%)	7 (10%)
ASD-No ASD	4 (6%)	4 (6%)
No ASD-ASD	2 (3%)	1 (1%)

Changes in Practice Behavior

▶ Telemedicine

- ▶ 78% using telemedicine for diagnostic services during COVID-19 (up from 6% pre-COVID)

▶ Measures

- ▶ Declines use of measures related to cognitive functioning, adaptive skills, language, and emotional/behavioral functioning.
- ▶ 92% of providers reported using ADOS-2 prior to COVID-19

Provider Perceptions: Tele-assessment

▶ **Benefits**

- ▶ Increased access for families
- ▶ In-home observations with familiar caregivers
- ▶ Increased caregiver involvement
- ▶ Increased flexibility (scheduling, multiple providers)

▶ **Challenges**

- ▶ Technology-related problems
- ▶ Caregiver difficulty following prompts
- ▶ Distractions in home environment
- ▶ Child-level factors

ORIGINAL PAPER

Toward Novel Tools for Autism Identification: Fusing Computational and Clinical Expertise

Laura L. Corona^{1,2} · Liliana Wagner^{1,2} · Joshua Wade³ · Amy S. Weitlauf^{1,2} · Jeffrey Hine^{1,2} · Amy Nicholson^{1,2,4} · Caitlin Stone^{1,2} · Alison Vehorn¹ · Zachary Warren^{1,2,4,5}

Accepted: 19 December 2020

Journal of Autism and Developmental Disorders (2021) 51:476–486
<https://doi.org/10.1007/s10803-020-04554-9>

ORIGINAL PAPER

Parent Perceptions of Caregiver-Mediated Telemedicine Tools for Assessing Autism Risk in Toddlers

Laura L. Corona^{1,2,5} · Amy S. Weitlauf^{1,2} · Jeffrey Hine^{1,2} · Anna Berman¹ · Alexandra Miceli¹ · Amy Nicholson^{1,2,3} · Caitlin Stone^{1,2} · Neill Broderick^{1,2} · Sara Francis^{1,2} · A. Pablo Juárez^{1,2,3,4} · Alison Vehorn¹ · Liliana Wagner^{1,2} · Zachary Warren^{1,2,3,4}

Journal of Autism and Developmental Disorders
<https://doi.org/10.1007/s10803-020-04767-y>

ORIGINAL PAPER

Use of the TELE-ASD-PEDS for Autism Evaluations in Response to COVID-19: Preliminary Outcomes and Clinician Acceptability

Liliana Wagner^{1,2} · Laura L. Corona^{1,2} · Amy S. Weitlauf^{1,2} · Kathryn L. Marsh⁵ · Anna F. Berman¹ · Neill A. Broderick^{1,2} · Sara Francis^{1,2} · Jeffrey Hine^{1,2} · Amy Nicholson^{1,2,3} · Caitlin Stone^{1,2} · Zachary Warren¹

We have found:

- Providers
 - Comfortable completing assessments
 - Making diagnoses
 - Providing feedback
- Families
 - Comfortable playing with child
 - Instructions easy to follow
 - Took right amount of time
 - Comfortable discussing diagnosis
 - Provider had seen behaviors of concern

Key Takeaways

- ▶ Large percentage (>50%) of children can be accurately identified through novel measures including TAP
- ▶ Telehealth clinicians correctly identified ASD with certainty in many cases.
- ▶ Satisfaction is high, but difference between **acceptable, preferred, and “gold-standard”**
 - ▶ No single model acceptable for ALL families
 - ▶ All families should have options, matched to needs/priorities

Questions & Future Directions

- ▶ For whom does tele-assessment work best - and for whom does it not work?
- ▶ How can tele-assessment best support service entry and access?

VIDEO EXAMPLES

The background features abstract, overlapping geometric shapes in various shades of blue, ranging from light to dark. The shapes are primarily triangles and polygons, creating a dynamic, layered effect. The colors transition from a pale, almost white blue on the left to a deep, dark blue on the right.

Video #1

Research
Administration

Tucker

21 months old

Concerns included
head banging
when upset,
delayed language
milestones, not
answering to
name

No previous ASD
evaluations

Enrolled in
Alabama Early
Intervention
System -
developmental
therapy only

Child age: mos

Gender: M F

TELE-ASD-PEDS Rating Form

Dichotomous score: Is the symptom present or not (1 vs. 3)

Likert score: 1 = symptom not present; 2 = symptom present but at subclinical levels; 3 = symptom obviously consistent with AS

Item	1	2	3	Dichotomous 1/3	Likert 1/2/3
Socially directed speech and sounds	Child often uses words or other vocalizations for a variety of social purposes (e.g. requesting, protesting, directing attention, sharing enjoyment).	Inconsistent socially directed speech.	Most of the child's sounds are self-directed. May make atypical non-word noises (e.g., "digga digga").	<input type="checkbox"/>	<input type="checkbox"/>
Frequent and flexible eye contact	Child frequently makes eye contact with others and across a variety of activities.	Child's eye contact seems inconsistent. Gaze seems less flexible and harder to catch than expected.	Child infrequently makes eye contact. Might only make eye contact during one activity (e.g., asking for help).	<input type="checkbox"/>	<input type="checkbox"/>
Unusual vocalizations	No unusual qualities of speech/language observed. Most of child's speech is appropriate for the child's age and developmental level.	Speech is not clearly unusual, but there are some differences (e.g., volume, slight repetitive quality of speech/language, unclear echoing, some occasional sounds that are unusual).	Child produces unusual jargon, sounds, or speech/language (e.g., undirected jargon, speech of peculiar intonation, unusual sounds, repetitive vocalizations, echoing or repetitive speech/language).	<input type="checkbox"/>	<input type="checkbox"/>
Unusual or repetitive play	Child plays with toys in appropriate ways (uses toys as expected).	Child's play is not clearly unusual, but child is strongly focused on some toys, routines, or activities. May sometimes be hard to shift child's attention to something new.	Child shows clearly repetitive or unusual play, such as repeatedly pushing buttons, watching how objects move, lining things up, or scrambling/dropping toys.	<input type="checkbox"/>	<input type="checkbox"/>
Unusual or repetitive body movements	No unusual or repetitive body movements seen.	Unclear unusual/repetitive body movements. Some repetitive jumping or very brief posturing of fingers, hands, or arms that is not clearly atypical.	Child clearly shows unusual or repetitive (e.g., hand-flapping, posturing or tensing upper body, toe-walking, facial grimacing, hand/finger mannerisms) repetitive running/walking/spinning/jumping.	<input type="checkbox"/>	<input type="checkbox"/>
Combines gestures, eye contact, and speech/vocalization	Child frequently points and uses other gestures to communicate. Child's gestures are usually combined with vocalizations and eye contact.	Child may sometimes point or use other gestures, but less than expected. Child does not always look at you or make a sound when gesturing.	Child does not usually gesture to communicate. May sometimes reach or point, but does not usually combine these with eye gaze or sounds. May move your hand or push on your body to get help.	<input type="checkbox"/>	<input type="checkbox"/>
Unusual sensory exploration or reaction	No unusual sensory behavior observed.	Unclear sensory exploration or reaction. May have a brief response to a sound, smell, or how something feels or moves.	Child shows sensory differences. May closely inspect objects, overreact to sounds, show intense interest or dislike to textures (e.g., touching, licking, biting, refusing to touch specific toys), or clear self-injurious behavior.	<input type="checkbox"/>	<input type="checkbox"/>
ASD if forced to choose? <input checked="" type="radio"/> Absent <input type="radio"/> Unsure <input type="radio"/> Present	Did you recommend in person evaluation for diagnostic clarification? <input checked="" type="radio"/> Yes <input type="radio"/> No	How certain are you of your diagnostic impression? <input checked="" type="radio"/> 1 Completely uncertain <input type="radio"/> 2 Somewhat uncertain <input type="radio"/> 3 Somewhat certain <input type="radio"/> 4 Completely certain			Total Score
Diagnosis issued: <input type="text"/>				0	

Child age: mos
 Gender: M F

TELE-ASD-PEDS Rating Form

Dichotomous score: Is the symptom present or not (1 vs. 3)
 Likert score: 1 = symptom not present; 2 = symptom present but at subclinical levels; 3 = symptom obviously consistent with AS

Item	1	2	3	Dichotomous 1/3	Likert 1/2/3
Socially directed speech and sounds	Child often uses words or other vocalizations for a variety of social purposes (e.g. requesting, protesting, directing attention, sharing enjoyment).	Inconsistent socially directed speech.	Most of the child's sounds are self-directed. May make atypical non-word noises (e.g., "digga digga").	3	3
Frequent and flexible eye contact	Child frequently makes eye contact with others and across a variety of activities.	Child's eye contact seems inconsistent. Gaze seems less flexible and harder to catch than expected.	Child infrequently makes eye contact. Might only make eye contact during one activity (e.g., asking for help).	3	2
Unusual vocalizations	No unusual qualities of speech/language observed. Most of child's speech is appropriate for the child's age and developmental level.	Speech is not clearly unusual, but there are some differences (e.g., volume, slight repetitive quality of speech/language, unclear echoing, some occasional sounds that are unusual).	Child produces unusual jargon, sounds, or speech/language (e.g., undirected jargoning, speech of peculiar intonation, unusual sounds, repetitive vocalizations, echoing or repetitive speech/language).	3	3
Unusual or repetitive play	Child plays with toys in appropriate ways (uses toys as expected).	Child's play is not clearly unusual, but child is strongly focused on some toys, routines, or activities. May sometimes be hard to shift child's attention to something new.	Child shows clearly repetitive or unusual play, such as repeatedly pushing buttons, watching how objects move, lining things up, or scrambling/dropping toys.	1	2
Unusual or repetitive body movements	No unusual or repetitive body movements seen.	Unclear unusual/repetitive body movements. Some repetitive jumping or very brief posturing of fingers, hands, or arms that is not clearly atypical.	Child clearly shows unusual or repetitive (e.g., hand-flapping, posturing or tensing upper body, toe-walking, facial grimacing, hand/finger mannerisms) repetitive running/walking/spinning/jumping.	3	3
Combines gestures, eye contact, and speech/vocalization	Child frequently points and uses other gestures to communicate. Child's gestures are usually combined with vocalizations and eye contact.	Child may sometimes point or use other gestures, but less than expected. Child does not always look at you or make a sound when gesturing.	Child does not usually gesture to communicate. May sometimes reach or point, but does not usually combine these with eye gaze or sounds. May move your hand or push on your body to get help.	3	3
Unusual sensory exploration or reaction	No unusual sensory behavior observed.	Unclear sensory exploration or reaction. May have a brief response to a sound, smell, or how something feels or moves.	Child shows sensory differences. May closely inspect objects, overreact to sounds, show intense interest or dislike to textures (e.g., touching, licking, biting, refusing to touch specific toys), or clear self-injurious behavior.	1	2
ASD if forced to choose? <input type="checkbox"/> Absent <input type="checkbox"/> Unsure <input checked="" type="checkbox"/> Present	Did you recommend in person evaluation for diagnostic clarification? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	How certain are you of your diagnostic impression? <input type="checkbox"/> 1 Completely uncertain <input type="checkbox"/> 2 Somewhat uncertain <input type="checkbox"/> 3 Somewhat certain <input checked="" type="checkbox"/> 4 Completely certain		Total Score	18
Diagnosis issued: Autism Spectrum Disorder F84.0					

Video #2

Home
Administration

Zavana

30 months old

Concerns included
delayed speech,
inconsistent social
interactions,
atypical motor
movements,

No previous ASD
evaluations

Enrolled in
Tennessee Early
Intervention
System - speech,
occupational, and
developmental
therapies since
age 2

Child age: mos

Gender: M F

TELE-ASD-PEDS Rating Form

Dichotomous score: Is the symptom present or not (1 vs. 3)

Likert score: 1 = symptom not present; 2 = symptom present but at subclinical levels; 3 = symptom obviously consistent with AS

Item	1	2	3	Dichotomous 1/3	Likert 1/2/3	
Socially directed speech and sounds	Child often uses words or other vocalizations for a variety of social purposes (e.g. requesting, protesting, directing attention, sharing enjoyment).	Inconsistent socially directed speech.	Most of the child's sounds are self-directed. May make atypical non-word noises (e.g., "digga digga").	<input type="checkbox"/>	<input type="checkbox"/>	
Frequent and flexible eye contact	Child frequently makes eye contact with others and across a variety of activities.	Child's eye contact seems inconsistent. Gaze seems less flexible and harder to catch than expected.	Child infrequently makes eye contact. Might only make eye contact during one activity (e.g., asking for help).	<input type="checkbox"/>	<input type="checkbox"/>	
Unusual vocalizations	No unusual qualities of speech/language observed. Most of child's speech is appropriate for the child's age and developmental level.	Speech is not clearly unusual, but there are some differences (e.g., volume, slight repetitive quality of speech/language, unclear echoing, some occasional sounds that are unusual).	Child produces unusual jargon, sounds, or speech/language (e.g., undirected jargon, speech of peculiar intonation, unusual sounds, repetitive vocalizations, echoing or repetitive speech/language).	<input type="checkbox"/>	<input type="checkbox"/>	
Unusual or repetitive play	Child plays with toys in appropriate ways (uses toys as expected).	Child's play is not clearly unusual, but child is strongly focused on some toys, routines, or activities. May sometimes be hard to shift child's attention to something new.	Child shows clearly repetitive or unusual play, such as repeatedly pushing buttons, watching how objects move, lining things up, or scrambling/dropping toys.	<input type="checkbox"/>	<input type="checkbox"/>	
Unusual or repetitive body movements	No unusual or repetitive body movements seen.	Unclear unusual/repetitive body movements. Some repetitive jumping or very brief posturing of fingers, hands, or arms that is not clearly atypical.	Child clearly shows unusual or repetitive (e.g., hand-flapping, posturing or tensing upper body, toe-walking, facial grimacing, hand/finger mannerisms) repetitive running/walking/spinning/jumping.	<input type="checkbox"/>	<input type="checkbox"/>	
Combines gestures, eye contact, and speech/vocalization	Child frequently points and uses other gestures to communicate. Child's gestures are usually combined with vocalizations and eye contact.	Child may sometimes point or use other gestures, but less than expected. Child does not always look at you or make a sound when gesturing.	Child does not usually gesture to communicate. May sometimes reach or point, but does not usually combine these with eye gaze or sounds. May move your hand or push on your body to get help.	<input type="checkbox"/>	<input type="checkbox"/>	
Unusual sensory exploration or reaction	No unusual sensory behavior observed.	Unclear sensory exploration or reaction. May have a brief response to a sound, smell, or how something feels or moves.	Child shows sensory differences. May closely inspect objects, overreact to sounds, show intense interest or dislike to textures (e.g., touching, licking, biting, refusing to touch specific toys), or clear self-injurious behavior.	<input type="checkbox"/>	<input type="checkbox"/>	
ASD if forced to choose? <input checked="" type="radio"/> Absent <input type="radio"/> Unsure <input type="radio"/> Present	Did you recommend in person evaluation for diagnostic clarification? <input checked="" type="radio"/> Yes <input type="radio"/> No	How certain are you of your diagnostic impression? <input checked="" type="radio"/> 1 Completely uncertain <input type="radio"/> 2 Somewhat uncertain <input type="radio"/> 3 Somewhat certain <input type="radio"/> 4 Completely certain			Total Score	0
Diagnosis issued: <input style="width: 100%;" type="text"/>						

Child age: mos

Gender: M F

TELE-ASD-PEDS Rating Form

VANDERBILT KENNEDY CENTER
TREATMENT & RESEARCH INSTITUTE FOR AUTISM SPECTRUM DISORDERS

Dichotomous score: Is the symptom present or not (1 vs. 3)

Likert score: 1 = symptom not present; 2 = symptom present but at subclinical levels; 3 = symptom obviously consistent with AS

Item	1	2	3	Dichotomous 1/3	Likert 1/2/3
Socially directed speech and sounds	Child often uses words or other vocalizations for a variety of social purposes (e.g. requesting, protesting, directing attention, sharing enjoyment).	Inconsistent socially directed speech.	Most of the child's sounds are self-directed. May make atypical non-word noises (e.g., "digga digga").	3	3
Frequent and flexible eye contact	Child frequently makes eye contact with others and across a variety of activities.	Child's eye contact seems inconsistent. Gaze seems less flexible and harder to catch than expected.	Child infrequently makes eye contact. Might only make eye contact during one activity (e.g., asking for help).	3	3
Unusual vocalizations	No unusual qualities of speech/language observed. Most of child's speech is appropriate for the child's age and developmental level.	Speech is not clearly unusual, but there are some differences (e.g., volume, slight repetitive quality of speech/language, unclear echoing, some occasional sounds that are unusual).	Child produces unusual jargon, sounds, or speech/language (e.g., undirected jargon, speech of peculiar intonation, unusual sounds, repetitive vocalizations, echoing or repetitive speech/language).	3	2
Unusual or repetitive play	Child plays with toys in appropriate ways (uses toys as expected).	Child's play is not clearly unusual, but child is strongly focused on some toys, routines, or activities. May sometimes be hard to shift child's attention to something new.	Child shows clearly repetitive or unusual play, such as repeatedly pushing buttons, watching how objects move, lining things up, or scrambling/dropping toys.	3	2
Unusual or repetitive body movements	No unusual or repetitive body movements seen.	Unclear unusual/repetitive body movements. Some repetitive jumping or very brief posturing of fingers, hands, or arms that is not clearly atypical.	Child clearly shows unusual or repetitive (e.g., hand-flapping, posturing or tensing upper body, toe-walking, facial grimacing, hand/finger mannerisms) repetitive running/walking/spinning/jumping.	3	3
Combines gestures, eye contact, and speech/vocalization	Child frequently points and uses other gestures to communicate. Child's gestures are usually combined with vocalizations and eye contact.	Child may sometimes point or use other gestures, but less than expected. Child does not always look at you or make a sound when gesturing.	Child does not usually gesture to communicate. May sometimes reach or point, but does not usually combine these with eye gaze or sounds. May move your hand or push on your body to get help.	3	3
Unusual sensory exploration or reaction	No unusual sensory behavior observed.	Unclear sensory exploration or reaction. May have a brief response to a sound, smell, or how something feels or moves.	Child shows sensory differences. May closely inspect objects, overreact to sounds, show intense interest or dislike to textures (e.g., touching, licking, biting, refusing to touch specific toys), or clear self-injurious behavior.	3	3
ASD if forced to choose? <input type="radio"/> Absent <input type="radio"/> Unsure <input checked="" type="radio"/> Present	Did you recommend in person evaluation for diagnostic clarification? <input type="radio"/> Yes <input checked="" type="radio"/> No	How certain are you of your diagnostic impression? <input type="radio"/> 1 Completely uncertain <input type="radio"/> 2 Somewhat uncertain <input type="radio"/> 3 Somewhat certain <input checked="" type="radio"/> 4 Completely certain			Total Score
Diagnosis issued: Autism Spectrum Disorder F84.0					19

Challenges and Trouble-shooting

- Telemedicine is not an option for everyone.
- Complexity - We will not be able to confidently make a diagnosis for all children via telemedicine. That's OK!
 - Language
 - Medical complexity
 - Significant developmental delays
 - Comorbidity

Challenges and Trouble-shooting

- You and parent will mess up. That's OK.
- TELE-ASD-PEDS allows:
 - Ability to repeat items or clarify your instructions.
 - Materials to be substituted or altered
 - Ask parent what they saw
- **Meant to be a guide that can facilitate meaningful assessment of core social communication challenges and atypical behaviors**
- **If you saw it, you can count it**

Challenges and Trouble-shooting

- Make a plan for technology challenges. Know it won't be perfect.
- Be mindful of the impact of giving a diagnosis in a home setting - particularly a setting where resources may be sparse.
- Figure out how you will get resources to families - email? EHR? And have them ready to send as promptly as possible

Publications and Additional Information

- ▶ Corona, L.L., Weitlauf, A.S., Hine, J., Berman, A., Miceli, A., Nicholson, A., Stone, C., Broderick, N., Francis, S., Juárez, A.P., Vehorn, A., Wagner, L., & Warren, Z. (2020). Parent perceptions of caregiver-mediated telemedicine tools for assessing autism risk in toddlers. *Journal of Autism and Developmental Disorders*, 51, 476-487. DOI: 10.1007/s10803-020-04554-9
- ▶ Wagner, L., Corona, L.L., Weitlauf, A.S., Marsh, K.L., Berman, A.F., Broderick, N.A., Francis, S., Hine, J., Nicholson, A., Stone, C., & Warren, Z. (2020). Use of the TELE-ASD-PEDS for autism evaluations in response to COVID-19: Preliminary outcomes and clinician acceptability. *Journal of Autism and Developmental Disorders*. Online first, DOI: 10.1007/s10803-020-04767-y
- ▶ Corona, L.L., Wagner, L., Wade, J., Weitlauf, A.S., Hine, J., Nicholson, A., Stone, A., Vehorn, A., & Warren, Z. (2021). Toward novel tools for autism identification: Fusing computational and clinical expertise. *Journal of Autism and Developmental Disorders*. Online first, DOI: 10.1007/s10803-020-04857-x
- ▶ <https://vkc.vumc.org/vkc/triad/tele-asd-peds>