Early Development of Social Reciprocity: Developmental social neuroscience meets public health challenge:

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Emory Center for Translational Social Neuroscience
Thank You

• The children and families who support our clinical and research activities
• Warren Jones and many wonderful colleagues and students
• My colleagues and students
• The National Institute of Mental Health
• The Marcus Foundation
• The JB Whitehead and Woodruff Foundations
• The Children’s Healthcare of Atlanta Foundation
• The Georgia Research Alliance
  as well as
• The National Institute of Child Health and Human Development
• The Autism Science Foundation
Conflicts of Interest

No conflicts of interest associated with this presentation
Marcus Autism Center at a glance

- >5,000 unique patients/yr
- >3,500 in the community
- Tx: set protocols (x visits)
- >60% on Medicaid
- ~35% minorities/under-served

Clinical Assessment/Diagnosis
- Treatment Programs
  - Center/Home/School/Community
- Care Coordination Program
- Educational Outreach Program

The Science of Clinical Care

- Translation
- Impact
- Clinical Resources

- Science
- Faculty Advancement
- Research Resources

- Translation
- Impact
- Clinical Resources

- Science
- Faculty Advancement
- Research Resources

Center-Based Model Program

Community-Viable Outreach Model

CLINICAL
- RESEARCH
- TRAINING
- ADVOCACY
Autism and other developmental delays are a Public Health Challenge

★ Prevalence: 1:59 autism; 1:10 developmental delays
★ Autism Societal Cost/Year in the US: $ 136 billion
★ Autism Lifetime Cost of Care Per Child: $ 2.4 - 3.6 million
★ Importance of early diagnosis and intervention for lifelong outcome and cost of care
★ American Academy of Pediatrics recommends screening for autism at 18 and 24 months
★ Autism Median age of diagnosis in US: 4-0 to 5.7 years
★ % of primary care providers who routinely screen not known
★ <20% of children identified before age 3 years

CDC, 2014; Peacock et al., 2012; Cidav et al., 2012; Mandell et al., 2015; 2009; 2013; 2014; Wang et al., 2013; Buescher et al., 2014; Wiggins et al., 2006; Shattuck et al., 2009; Honigfeld et al., 2012; Heidgerken et al., 2005; Dosreis et al., 2006; Johnson & Myers, 2007;
ASD symptoms RESULT from deviations from normative socialization

Universal Principle: the Platform for Development of Social Brain

Born to Socially Orient

Reciprocal Social Interaction

Neuroplasticity

WHITE MATTER DEVELOPMENT

Preterm (6 months)  Infant (4 weeks)  Adult (25 years)

H-J Park PhD

MH Johnson PhD
The co-creation of social experience
Anthropomorphizing
Sociality: the evolutionary roots of our social brain
Social Interaction is the Platform for Brain Development

“Our brains become who we are.” (J LeDoux)

Brain structure and function are physical instantiations of lived experience.
FORWARD IN TIME
Autism is ... in 1943 as in 2019

Leo Kanner
1894-1981

Autism is ...

- Difficulty with social relationships
- Difficulty with verbal communication
- Difficulty with non-verbal communication
- Difficulty in the development of play and imagination
- Resistance to change in routine

But some can do some things very well, very quickly but not tasks involving social understanding.
TEST
Autism Without Help
The Images of Abilities
Autism Spectrum Disorder
Core Challenges of Older Individuals with Autism Spectrum Disorder

- **SOCIAL SKILLS**: the intangibles, the unstructured, the novel, the implicit, the intuitive, the “common sense”, the mentalistic
- **COMMUNICATION SKILLS**: the informal, the conversational, the reciprocal, the ‘other-directed’, the polite, the ‘untrue’, the ‘chatty’
- **ADAPTIVE SKILLS**: grooming and self-care, domestic chores, ‘survival skills’, living in the community, functioning in bureaucracies, groups and relationships, legal concerns
- **LEARNING SKILLS**: rote & sequential, not conceptual & integrative; learning ABOUT not learning HOW TO
- **ORGANIZATIONAL SKILLS**: repetitive schedules, ‘to do’ lists, planning ahead, learning form feedback, adjusting to variants of situations, recognizing novelty, knowing when and how to seek assistance, breaking down big tasks into stepwise plans
- **OBSTACLES TO ADAPTATION**: anxiety, panic, fears and phobias, depression and despondency, motivational issues, rigidities
Core Challenges aka Realities

- **SOCIAL SKILLS**: the intangibles, the unstructured, the novel, the implicit, the intuitive, the “common sense”, the mentalistic
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\[ \frac{1}{9} x^2 - \frac{1}{4} x + \frac{1}{4} \quad \text{Monday} \quad \text{Dec. 9th} \quad 7:30 \]

\[ \frac{1}{9} \pm \sqrt{\left(\frac{1}{4}\right)^2 - 4 \left(\frac{1}{9}\right) \left(\frac{1}{4}\right)} \quad \frac{1}{9} \left( \frac{9}{22} + \frac{3}{22} \sqrt{491} \right) \]

\[ \frac{1}{2} \left( \frac{1}{9} \pm \sqrt{\left(\frac{1}{4}\right)^2 - 4 \left(\frac{1}{9}\right) \left(\frac{1}{4}\right)} \right) \]

\[ \frac{1}{11} \pm \frac{\sqrt{121 - 9 \times 3}}{3} \quad \frac{1}{9} \left( \frac{21}{121} + \frac{27}{121} \sqrt{121} - \frac{9}{121} \left(\frac{121}{4}\right) \right) \]

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X. Y > Z

X = I find out there is no God
Y = I find out that I can't get a girlfriend
Z = I kill myself
“... What happened was that the larger triangle -- which was like a bigger kid or a bully, and he had isolated himself from everything else until two new kids come along and the little one was a bit more shy, scared, and the smaller triangle more like stood up for himself and protected the little one. The big triangle got jealous of them, came out, and started to pick on the smaller triangle. The little triangle got upset and said like “what’s up”? “why are doing this?’ ...
“The big triangle went into the rectangle. There were a small triangle and a circle. The big triangle went out. The shapes bounce off each other. The small circle went inside the rectangle. The big triangle was in the box with the circle. The small triangle and the circle went around each other a few times. They were kind of oscillating around each other, maybe because of a magnetic field. After tha they go off the screen. The big triangle turned like a star - like a Star of David - and broke the rectangle ...”
Thinking about things and thinking about people
Searching for Social Meaning in Real-life Situations
Looking at People
Adolescents & Adults

It is a social disability
Looking at People Interacting
Standing behind a person’s eyes
Focus on mouths vs focus on eyes

Klin et al. (2002). Arch Gen Psychiat
Tracing the Shape of a Social Triangle

Viewer with Autism
Typically Developing Viewer
Core Challenges

• SOCIAL SKILLS: the intangibles, the unstructured, the novel, the implicit, the intuitive, the “common sense”, the mentalistic

• COMMUNICATION SKILLS: the informal, the conversational, the reciprocal, the ‘other-directed’, the polite, the ‘untrue’, the ‘chatty’

• ADAPTIVE SKILLS: grooming and self-care, domestic chores, ‘survival skills’, living in the community, functioning in bureaucracies, groups and relationships, legal concerns

• ORGANIZATIONAL SKILLS: repetitive schedules, ‘to do’ lists, planning ahead, learning from feedback, adjusting to variants of situations, recognizing novelty, knowing when and how to seek assistance, breaking down big tasks into stepwise plans

• OBSTACLES TO ADAPTATION: anxiety, panic, fears and phobias, depression and despondency, motivational issues, rigidities
Self-help: a non-exhaustive list

• Personal hygiene
• Grooming
• Minor or annoying health issues
• Major health issues
• Clothing: purchasing, care, choice, when and how
• Mores and regulations
• The private vs. the public
• Puberty related
• Sexuality
• …
Community and survival skills: a non-exhaustive list

- Going to places, transportation
- Emergencies
- Dealing with social annoyances (e.g., panhandlers, manipulators, exploitative companions)
- Dealing with people in position of authority
- POLICE
- Rules, the law, the novel, the unexpected
- The private, the public, the acceptable, the seemingly criminal, the self-incriminating, the poor self-advocate
- The bureaucracies, the forms, the scheduled commitments
- The telemarketers, the soliciting, the “too good to be true” invitations and offers, ‘junk’ mail, INTERNET
- …
Core Challenges aka Realities

- **SOCIAL SKILLS**: the intangibles, the unstructured, the novel, the implicit, the intuitive, the “common sense”, the mentalistic
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Circumscribed interests

- Frequent and highly visible manifestation of the condition
- Monopolizes learning
- Monopolizes thinking
- Monopolizes conversation and relationships
Some examples

• on snakes
• Writings of incarcerated people
• On death and dying
• Religion
• Cul-de-sacs
• Deep-fat-fryers
• Shakespeare’s plays
• Telephone pole insulators

• Pokemon
• Digimon
• Weather
• TV/radio stations
• Electrical fans
• Photographing people
• Computer serial numbers
• Large numbers
• Algebraic equations
Potential for catastrophic consequences

- DANGER!! Interests and repetitive behaviors get caught together (e.g., touching, shoes, fetish)
- DANGER!! Internet, solitary and unmonitored use of computer, pornography on the web
- The dangerous combination of computer technical skills and naivety + lack of street smarts may lead to problems with the law
- Not potential victimizers, but the law often does not make that distinction (mandatory sentences)
Importance for Self-Identity and Self-Esteem

- Circumscribed interest may be important pillar of self-identity
- Very important to take this very seriously
- Examples:
  - Cul de sacs
  - Gaining insight into people through mathematics (e.g., algebraic equations)
BACK IN TIME
What does the baby see
Neonates preferentially orient towards stimuli that...

More Preferred
- mother’s voice
- stranger’s voice

Less Preferred
- complex non-speech
- pure tone, structured noise
- silence

...sound like caregivers.

DeCasper & Fifer, 1980.
Butterfield & Siperstein, 1970
Eisenberg, 1976.
Neonates preferentially orient towards stimuli that...

More Preferred

- mother’s scent

Less Preferred

- stranger’s scent

...**sound** like caregivers.
...**smell** like caregivers.

Macfarlane, 1975.
Neonates preferentially orient towards stimuli that...

More Preferred

Less Preferred

...sound like caregivers.
...smell like caregivers.
...move like caregivers.

Simion, Regolin, & Bulf, 2008.
Neonates preferentially orient towards stimuli that...

More Preferred

Less Preferred

...**sound** like caregivers.

...**smell** like caregivers.

...**move** like caregivers.

...**look** like caregivers.

Valenza, Simion, Cassia, & Umiltà, 1996.
Farroni et al, 2005.
Neonates preferentially orient towards stimuli that...

More Preferred
- mother, engaging
- stranger, eyes open

Less Preferred
- stranger, eyes averted
- stranger, eyes closed

...**sound** like caregivers.
...**smell** like caregivers.
...**move** like caregivers.
...**look** like caregivers.
...**interact** like caregivers.

Farroni, Cibra, Simion, & Johnson, 2002.
Sai, 2005.
Unifying Principle in Development: Autism and other conditions

Reciprocal Social Interaction
Autism:

Unlike in typical development, predispositions to orient to, and engage with people are absent or significantly reduced.
Developmental Trajectories

- Developing expertise about the Social World
- Developing expertise about the Physical World
Attention to Biological Motion

Not significantly different from chance, $p > .05$

Attention to Biological Motion

Two-year-olds with autism orient to non-social contingencies rather than biological motion

Ami Klin\textsuperscript{1}, David J. Lin\textsuperscript{1,\dagger}, Phillip Gorrindo\textsuperscript{1,\dagger}, Gordon Ramsay\textsuperscript{1,2} & Warren Jones\textsuperscript{1,3}.

![Graph showing fixation time comparison between typically-developing children and children with autism.](image)

Typically-Developing Children

% of Fixation Time

UP | INV

0 | 25 | 50 | 75
Two-year-olds with autism orient to non-social contingencies rather than biological motion


Preference in Autism Only When Clapping Happens

Typically- Developing Children

Developmentally- Delayed Children

Children with Autism

Physical, rather than social, cues guide looking in toddlers with autism

audiovisual synchrony, playback at 1/2 speed
Cumulative Audiovisual Synchrony

Pat-a-cake

Feeding

Relative Audio-Visual Synchrony = Normalized Peak Difference

Clap Location

Max Synchrony

No Synchrony
Patterns of visual fixation to approaching caregiver

How do 2-year-olds with autism watch the face of a caregiver?

Why the draw to the speaking mouth?

Watching a Face…
But Seeing Physical Contingencies?

Caregiver

Audiovisual Synchrony
Looking at Eyes and Mouth As a Function of Audiovisual Synchrony

- **TD**

- **ASD**

<table>
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<th>R²</th>
<th>p</th>
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<tbody>
<tr>
<td>Eye</td>
<td>0.111</td>
<td>0.164</td>
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<tr>
<td>Mouth</td>
<td>0.161</td>
<td>0.089</td>
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<tr>
<td>Both</td>
<td>0.0003</td>
<td>0.919</td>
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</table>

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<th></th>
<th>R²</th>
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<tr>
<td>Eye</td>
<td>0.296</td>
<td>0.016</td>
</tr>
<tr>
<td>Mouth</td>
<td>0.302</td>
<td>0.015</td>
</tr>
<tr>
<td>Both</td>
<td>0.685</td>
<td>&lt;1.5e-10</td>
</tr>
</tbody>
</table>
Brain size doubles in the 1st year of a baby’s life, synaptic density quadruples.

(Gilmore et al, 2007; Pfefferbaum et al, 1994; Huttenlocher, 1979; Petanjek et al, 2011)
Eye-tracking measures of Social Visual Engagement

Typically-Developing 5-Month-Old
Growth Charts: of Social Visual Engagement
Normative Growth Charts of Social Visual Engagement

TD eyes

TD, N=63
Growth Charts

Fixation Time (%)

Change in Fixation (% per month)

% of Children Who...

Smile

Laugh

Say "Mama" / "Dada"

Interpersonal Pretend Play (Feed Doll)

Regard Caregiver's Face

Increasing

Decreasing
Growth Charts

- Fixation Time (%)
- Change in Fixation (% per month)
- % of Children Who...
  - Imitate Speech Sounds
  - Babble
  - Produce 1 Word
  - Produce >6 Words

---

[Image of growth charts]
5-Month-Old with Autism
Eye-Looking in Typically-Developing Infants and Infants Later Diagnosed with ASD

![Graph showing fixation time and change in fixation over age](image)

**TD, N=63**

**Dt TD eyes**

- Increasing
- Decreasing
Attention to eyes is present but in decline in 2–6-month-old infants later diagnosed with autism

Warren Jones¹,²,³ & Ami Klin¹,²,³

TD, N=63
ASD1, N=11

Growth curves for normative social engagement show broad developmental processes, see Methods and Supplementary Information. Longitudinal analyses were conducted by functional data analysis (FDA) to examine typical and atypical trajectories. TJ and AJ oversaw project development, data acquisition, and analysis. TJ oversaw research design and interpretation. AJ oversaw data interpretation and review. All authors contributed to the writing and review of the manuscript.

Fixation Time (%)

Age (in months)

mean
95% CI

TD eyes
ASD1 eyes

Change in Fixation (% per month)

Age (in months)

$D_t$ TD eyes
$D_t$ ASD1 eyes

TD, N=63
ASD1, N=11

Attention to eyes is present but in decline in 2–6-month-old infants later diagnosed with autism

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TD eyes

ASD1 eyes

$D_t$ TD eyes

$D_t$ ASD1 eyes

TD, N=63
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First Replication Cohort

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<th>Fixation Time (%)</th>
<th>Change in Fixation (% per month)</th>
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<td>ASD1, N=11</td>
<td>ASD2, N=13</td>
</tr>
<tr>
<td>TD, N=63</td>
<td></td>
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Mean and 95% CI for each cohort are plotted against age (in months) from 2 to 24 months.

- TD eyes
- ASD1 eyes
- ASD2 eyes

$D_t$ TD eyes
$D_t$ ASD1 eyes
$D_t$ ASD2 eyes

TD, N=63
ASD1, N=11
ASD2, N=13
First Replication Cohort

Fixation Time (%)

Age (in months)

Change in Fixation (% per month)

Age (in months)

TD, N=63
ASD1, N=11
ASD2, N=13
Eye Fixation in the first 6 months of life

- Markers of ASD in the first 6 months of life
- Predictive of individual child’s diagnostic classification at outcome (24-36 months)
- Internal and external validation of results
Decline in eye fixation (2-12 through 2-24 months) predictive of outcome levels of ASD severity at 36 months
Growth Charts

Quantifying Disruption of Early-Emerging, Highly-Conserved Mechanisms of Social Adaptive Action
How to link these quantifications of behavior to the genetic bases of autism?

Measuring the genetic structure of social visual engagement

250 toddlers:
- **82 monozygotic** twins  
  (41 MZ pairs)
- **84 dizygotic** twins  
  (42 DZ pairs)
- **84 non-sibling comparison children**  
  (42 non-sib control pairs)
- **age 21.3(4.3) months**
- **non-sibs matched <1 day**

The genetic basis of Social Visual Engagement

Concordance in social visual engagement as a function of zygosity.

DZ males
Constantino & Colleagues
MZ males
Constantino & Colleagues
Social visual engagement when viewing scenes of dyadic caregiver interaction

Concordance in social visual engagement as a function of zygosity.

Individual variation in eye-looking is strongly influenced by genetics.

Strong genetic influence persists across development.

Twins tested again 15 months later, at 36 months.
(N=22 MZ, N=44DZ)
Strong genetic influence persists whether twins watch the same or different videos.

Presentation order of video stimuli was randomized, so each twin saw separate videos, the majority of which were the same (M(SD)=86.4(19.3)%) but some of which were different (13.6(19.3)%), seen by only one among the pair.
Genetic influence persists whether twins watch the same or different videos.

Presentation order of video stimuli was randomized, so each twin saw separate videos, the majority of which were the same (M(SD)=86.4(19.3)%) but some of which were different (13.6(19.3)%), seen by only one among the pair.
Genetic influence exerts effects on a moment-by-moment basis.
MZ twins are more likely to... move their eyes at the same moments in time.
MZ twins are more likely to... move their eyes **in the same directions.**
MZ twins are more likely to...

...fixate on the same semantic content at the same moments in time.
The markers of social visual engagement that are most highly heritable…

…are also those that most clearly distinguish typically-developing children from those with autism.
The markers of social visual engagement that are most highly heritable...

...are also those that most clearly distinguish typically-developing children from those with autism.
The markers of social visual engagement that are most highly heritable...

...are also those that most clearly distinguish typically-developing children from those with autism.
high *Heritability* (eye- & mouth-looking)

+ high *Probability* (shifting eyes at same moments, in same directions, towards same content)

= profound influence on

human biological niche construction

Scarr & McCartney, 1983.
Social Interaction is the Platform for Brain Development

“Our brains become who we are.” (J LeDoux)

Brain structure and function are physical instantiations of lived experience.
Derivation of Attentional Funnel
The majority of typically-developing 2-year-olds fixate on the same locations, at the same moments, during 80% of viewing time.
Objective, Quantitative Measures

Experimental Presses
Hundreds of natural experiments within a 5-minute free viewing video experiment

- In ASD: ~570 divergences in 5 minutes of video
- ~13,680 divergences in a 2-hour period of real-life social experience
- 6 hour social exposure/day results in ~15,000,000 divergences over the course of one year of real-life exposure to social environments

TD normative funnels =
ASD comparison scanpaths =
Scenes of Social Action

Toddlers with Autism

Typically Developing
Scenes of Social Interaction

Toddlers with Autism

Typically-Developing
Scenes of Social Interaction

Toddlers with Autism

Typically Developing
Probability of looking at the same locations at the same times as typical control children is significantly correlated with levels of autistic social disability, both contemporaneously and 1.5 years after initial testing.
Outcome Time I: 24 months
Outcome Time II: 36-40 months

Time 1 relative entrainment is a stronger predictor of social functioning at Time 2 than either verbal or non-verbal function at Time 1:

\[ X^2 = 2.38, \ p < .05 \ (NV) \]
\[ X^2 = 1.06, \ p < .05 \ (V) \]

Time 1 relative entrainment is a stronger predictor of verbal function at Time 2 than verbal function at Time 1:

\[ X^2 = 1.03, \ p < .05 \]
Utility of our eye-tracking assays to diagnostic and developmental characterization

Moment-by-moment entrainment to socialization “hot spots”
Non-ASD data from the discovery cohort defined benchmark normative data against which all other comparisons were made.
Quantitative Indices for Assessing Presence of ASD

TD normative funnels =
ASD comparison scanpaths =
Quantitative Indices for Assessing Presence of ASD

TD normative funnels =
ASD comparison scanpaths =
Quantitative Indices for Assessing Severity of ASD Symptoms

TD normative funnels =
ASD comparison scanpaths =
Translational Opportunities

- High-throughput, low-cost, deployment of universal screening in the community
- Early detection, early intervention, optimal outcome
- Prevention or attenuation of intellectual disability in ASD
Public Health Opportunities

• Support a system that does not have sufficient expert clinicians

• A new, promising view of autism, with universal design implications

• Genetic influence informs modality of early treatment

• Reduce the child, family, health, education, and societal costs of autism
Massive Challenge - Massive Opportunity

• 66,000 children born every year will have autism (1:59); societal cost of autism is $126B/year in US alone; early detection and intervention is a game changer (NIH)

• A cohort of children with autism followed from birth reaching 3 years of age without developmental delays: diversity, not disability

• 700,000 children with autism in schools; annual cost $37B/year; median age of diagnosis of autism in the US: 4.5 - 5.5 years

• 6,600,00 special education children (13% of all students); 9% with autism; 20% language impairment; 12% with developmental delays or intellectual disability

• These are all conditions originating in disrupted early brain development due to genetic, medical or environmental vulnerabilities

• Maybe ~10% are “inevitable”; in ~90%, burdens can be significantly attenuated if not prevented altogether

• Neurodevelopmental Medicine of the 21st century: optimizing outcomes
We are genetically programmed to be social beings
This programming is altered in autism
But social experiences are co-created by environment
We can engineer these experiences via parent-delivered treatment
Parent-Implemented Social Intervention for Toddlers With Autism: An RCT

WHAT'S KNOWN ON THIS SUBJECT: Randomized controlled trials (RCTs) of intensive clinician-implemented interventions have demonstrated significant improvements in outcomes of toddlers and preschool children with autism spectrum disorder. RCTs of parent-implemented interventions have demonstrated improvements in parent skills, but generally they have not demonstrated effects on children's outcomes.

WHAT THIS STUDY ADDS: This RCT found significantly greater improvements with individual home coaching on child outcome measures of social communication, adaptive behavior, and developmental level. These findings support the efficacy of a parent-implemented intervention using little professional time, which increases potential community viability.

AUTHORS: Amy M. Wetherby, PhD,1,2,3 Whitney Guthrie, MS,1,4 Juliann Woods, PhD,5,6 Christopher Schatschneider, PhD,7 Renee D. Holland, MS,1,8 Lindee Morgan, PhD,8 and Catherine Lord, PhD,1

Departments of 1Clinical Sciences, 2Autism Institute, 3School of Communication Sciences and Disorders, and 4Psychology, Florida State University, Tallahassee, Florida; and 5Department of Psychiatry, Weill Cornell Medical College, New York, New York

KEY WORDS: autism, early intervention, toddlers, parent-implemented; outcomes

ABBREVIATIONS: ADOS—Autism Diagnostic Observation Schedule; ASD—autism spectrum disorder; CSBS—Communication and Symbolic Behavior Scales; EI—early intervention; FSQ—Early Social Interaction
Providing the social experiences children are missing

Augmenting access to early intervention services: parent-mediated treatment
Autism Navigator™ increases the capacity of healthcare and early intervention providers, educators, and families to improve outcomes of young children with autism spectrum disorder (ASD).

About Autism

Early Intervention Providers

Primary Care Physicians

Family Collection

Autism Navigator™ is a unique collection of web-based tools that uses extensive video footage to bridge the gap between science and community practice.

About Autism is a tool for families, professionals, or anyone interested in learning about autism spectrum disorder (ASD). It is available free of charge. Just register and login.

Launch About Autism

OUR PARTNERS

Our partners are helping us make an impact on community practice.

- www.autismnavigator.com
- www.firstwordsproject.com
the Community: Families, Pediatricians, Early Intervention Providers

Parent-Delivered Early Social Interaction

Wetherby et al., 2014
Teaching Strategies & Supports to Promote Active Engagement

Supports for better skills
- Model and expand language and play skills
- Extend activity, child’s roles, & transitions
- Balance demands and supports

Supports for social reciprocity
- Natural reinforcers
- Waiting for initiation and balance of turns
- Clear message to ensure comprehension

Supports for a common agenda
- Positioning
- Follow child’s attentional focus
- Motivating activity with clear roles & turns
Goals for Early Treatment:

Every waking hour in the home and in the community

<table>
<thead>
<tr>
<th>Child Behaviors</th>
<th>Parent Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACTIVE ENGAGEMENT</strong></td>
<td><strong>TRANSACTIONAL SUPPORTS</strong></td>
</tr>
<tr>
<td>1. Emotional Regulation</td>
<td>1. Participation &amp; Role</td>
</tr>
<tr>
<td>2. Productivity</td>
<td>2. Make Activity</td>
</tr>
<tr>
<td>3. Social Connectedness</td>
<td>3. Follow Child’s Attention</td>
</tr>
<tr>
<td>4. Gaze to Face</td>
<td>4. Promote Initiations</td>
</tr>
<tr>
<td>5. Response to Verbal</td>
<td>5. Balance of Turns</td>
</tr>
<tr>
<td>7. Flexibility</td>
<td>7. Modeling</td>
</tr>
<tr>
<td>8. Generative Ideas</td>
<td>8. Expectations &amp; Demands</td>
</tr>
</tbody>
</table>
## Everyday Activities

<table>
<thead>
<tr>
<th>Play with Toys</th>
<th>Play with People</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocks, Puzzles, Sand box, Playdough, Cars and Trucks, Ball Games, Baby Dolls</td>
<td>Social Games like Peek-a-boo, Rough and Tumble, Songs &amp; Rhymes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Meals and Snacks</th>
<th>Caregiving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation, Eating, Cleanup</td>
<td>Dressing, Diaper Change, Bath, Washing Hands, Brushing Teeth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Book Sharing</th>
<th>Family Chores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mailbox, Laundry, Care for Pets, Plants</td>
</tr>
</tbody>
</table>
Universal design because there is only one platform for early brain development

• For children with complex genetic burden: Autism, Williams syndrome
• For children with compromising medical conditions: Extremely Preterm, Congenital Heart Disease
• For children from disadvantaged backgrounds
Pediatric Medicine of the 21st century: The criticality of Public Health considerations

• Not necessarily curing “diseases”
• BUT OPTIMIZING OUTCOMES
• Universal screening, accessing identification, increasing access to early intervention
• Cost-effective, community-viable
• Value Proposition!
5 Steps for Brain-Building
Serve and Return

[Image: Center on the Developing Child
HARVARD UNIVERSITY]

Dr. Jack Shonkoff

Dr. David Willis

[Image: An Early Brain and Child Development Focus]
Dr. Brenda Fitzgerald

**Talk with Me Baby**

**Brain Trust 4 Babies**

*The more words you speak, sing or read to your baby the faster they will learn to talk and read. Learn more at dph.georgia.gov/talkwithmebaby.*

**Georgia Department of Public Health**

**CDC**
Take Away Messages - 1

• Autism is a massive public health challenge and an enormous public health opportunity

• Children’s lifetime outcomes can be optimized with
  ✦ Early Detection, Access to Diagnostic Services, Access to Early Intervention

• The greatest burdens of autism are not inevitable and be significantly ameliorated
  ✦ Intellectual Disability, Language Disability, Severe Behavior Challenges

• What moves early brain development is reciprocal social engagement, and early experiences shape the trajectories of social and communication skills and social-communicative brain

• Infants & toddlers create their own social environment: these behaviors are under stringent genetic control and disrupted (and diagnostic) in the case of young children with autism
Take Away Messages - 2

• But we can engineer social learning experiences via manipulation of children’s environment - via parent-delivered treatments

• We need cost-effective and community-viable solutions for
  ✦ Universal Screening, Diagnosis, and Early Treatment

• Solutions for screening and diagnosis are not far off

• Solutions for early treatment are being studied at a grand scale right now

• Solutions for optimizing the development of children with autism are relevant to a much broader group of children

• The future of neurodevelopmental medicine is likely to be focused on optimizing the outcome of children born with genetic, medical or environmental challenges rather than on the “cure” of these complex conditions
To make autism an issue of diversity, not of disability