EARLY START DENVER MODEL
A NATURALISTIC DEVELOPMENTAL BEHAVIORAL INTERVENTION
DESIGNED FOR PRESCHOOLERS WITH AUTISM SPECTRUM DISORDER

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EARLY DETECTION AND INTERVENTION PROGRAM
Goal: understanding how early detection and early intervention practices improve outcomes in ASD
Focus on characteristics of the:

Child
Program
Context

THE EVOLVING LANDSCAPE OF ASD EARLY INTERVENTION RESEARCH – CHANGES IN QUANTITY

Published Autism Early intervention studies (pubmed)
THE EVOLVING LANDSCAPE OF ASD EARLY INTERVENTION RESEARCH – CHANGES IN QUANTITY

Published Autism Early Intervention studies (pubmed)

More studies published between 2013 and 2017 than in the previous 3 decades combined

THE EVOLVING LANDSCAPE OF ASD EARLY INTERVENTION RESEARCH – CHANGES IN QUALITY

MODELS SUPPORTED BY AT LEAST ONE RANDOMIZED CONTROLLED TRIAL

ABA/DTT (Smith et al., 2000)
LEAP (Smith & Browzy, 2011)
ESI/SCERTS (Wetherby et al., 2014)
JASPER (Kasari et al., 2010, 2014)
PLAY (Solomon et al., 2014)
PACT (Pickles et al., 2016)
ESDM (Dawson et al., 2010)
TEACCH (Turner-Brown et al., 2016)
PRT (Hardan et al., 2015)
IMPACT (Ingersoll et al., 2016)
Adapted Responsive Teaching (Resnick et al., 2006)
Joint Attention Mediated Learning (Schertz et al., 2012)
Those who fall in love with practice without science are like a sailor who enters a ship without a helm or a compass, and who never can be certain whither he is going (Leonardo Da Vinci, circa 1490)
Early intervention focuses on facilitating the acquisition (learning) of novel skills in children with ASD.

Therefore, interventions should evolve as our knowledge on how children with ASD learn changes.

Lack of cross-fertilization between research and practice—80% of applied research in ASD fails to cite basic science research, and vice versa.

NEED TO EXPAND RESEARCH KNOWLEDGE TO INFORM EFFECTIVE INTERVENTIONS

- Early intervention driven by Selective responsivity to:
  1. Extensive pedagogical cues, including:
     - Verbal Labels (Baldwin & Markman, 1989; Bloom, 2002)
     - Eye-Contact and gaze cues (Csibra & Gergely, 2011; Wang et al., 2010)
     - Affect (Nielsen et al., 2008; Brand & Shallcross, 2008)
     - Goals (Over & Carpenter, 2012)
  2. Novelty versus repetition (Dweck & Pepitone, 2013; Dweck, 2015)

EARLY LEARNING IN AUTISM SPECTRUM DISORDER

Children with ASD can and do learn—not a learning disability
- Intact ability to learn from own actions via trial & error (Vivanti et al. 2016, Mol. Autism)
- Intact implicit learning (Pet, Vivanti et al. 2015, Psych Med)

However, difficulties in social learning—learning from (and about) actions and communication of other people

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Early differences in emerging preferences and responses that support social learning
- System preferences facilitating learning in typical development are reversed
- More independent as children, but in most cases more dependent as adults

Vivanti & Rogers, 2016; Vivanti, Dawson & Rogers, 2017
Autism and the mirror neuron system: insights from learning and teaching

Giancarlo Vicari and Sally J. Rogers

Ability for Social Learning
Motivation for Social Learning
Social Modulation of Learning

Mechanisms of Imitation Impairment in Autism Spectrum Disorder

Giancarlo Vicari - David Travers - Cheryl Menapace

Attention to the demonstration

F (2, 54)=4.55; p=0.01, η²= 0.15
Attention to novelty versus repetition: Contrasting habituation profiles in Autism and Williams syndrome

Giancarlo Visconti\textsuperscript{1,2,3}, Darren K. Hocking\textsuperscript{1}, Peter A.J. Emmings\textsuperscript{1}, Michko Uijarevic\textsuperscript{1,4}, Valentina Pomecini\textsuperscript{1,5}, Luigi Mazzone\textsuperscript{1,5}, Cheryl DeSouza\textsuperscript{1,5}

Number of Trials

Fixation Duration

\textbf{Group X Condition interaction} $F(2, 74) = 4.61, p = .01, \eta^2_p = .11$

Visual Attention Performance

\begin{itemize}
  \item \textit{DD}
  \item \textit{ASD}
\end{itemize}

\textbf{Proportion to Imitate in Autism Is Not Modulated by the Model's Gaze Direction: An Eye-Tracking Study}

Giancarlo Visconti and Cheryl DeSouza

\textbf{Performance}

\begin{itemize}
  \item Performance
  \item Visual Attention
\end{itemize}
No Evidence of Emotional Dysregulation or Aversion to Mutual Gaze in Preschoolers with Autism Spectrum Disorder: An Eye-Tracking Pupilometry Study

Group X Condition interaction (F(1,38) = 9.42, p = .004, η² = .20)

Playful vs Neutral Model - WS

Others’ emotions teach, but not in autism: an eye-tracking pupilometry study

Group X Condition interaction (P(1,38) = 0.42, p = .004, η² = .20)

Social affiliation motives modulate spontaneous learning in Williams syndrome but not in autism

Social vs Instrumental Imitation
Learning by watching vs learning by doing

No group differences between ASD and WS.
TD at ceiling.

Playful vs Non-Playful Imitation

Group
F(2, 52) = 12.61, p < 0.001, η² = 0.2

Group X Condition Interaction -
F(2, 52) = 5.5, p = 0.02, η² = 0.1
Visual attention

Group X Condition Interaction - F (2, 60) = 4.23; p = 0.01, η^2 = 0.13

Visual attention (Vivanti et al., 2016b, JNDD)

Importance of individual differences

Atypical monitoring and responsiveness to goal-directed gaze in autism spectrum disorder

Goal understanding

Goal understanding (Vivanti et al., 2014, Exp. Brain Research)

RESEARCH ARTICLE

The Action Observation System when Observing Hand Actions in Autism and Typical Development

Jennifer J. Pusser, Naomi V. Hart, Contanza Colombi, Giacomo Vivanti, Sally J. Rogers, and Susan M. Evers

Figure 2. Location of 10 areas of interest on right hand, left and right hemisphere. Center coordinates were taken from Van et al., 2011 and can be found in the text. Red, right handed group; TV, right temporoparietal junction; PMc, middle parietal cortex; PPC, posterior parietal cortex; IFG, inferior frontal gyrus; IFGpars, inferior frontal gyrus pars opercularis; PMC, premotor cortex; STG, superior temporal gyrus; STGpars, superior temporal gyrus pars opercularis.

Same response to goal-directed and non-goal-directed actions (in TD p < 0.001)

Implications for teaching practices

- Visual attention and learning less modulated by pedagogical cues and novelty
- Relevance of goals
- Individual differences
- Implication for teaching

Implications for teaching practices
• RESEARCH INFORMING ESDM

• ESDM PRACTICES

• ESDM OUTCOME RESEARCH

Early Start Denver Model
Comprehensive comprehensive early intervention for toddlers with autism ages 12–48 months.

“Denver Model”
Sally Rogers and colleagues, 1984

“Early Start Denver Model”
Rogers & Dawson, 2010

CRITICAL TREATMENT TARGETS
Behaviors that enable social learning and engagement in naturalistic social interaction and cooperative activities

ESDM - DEVELOPMENTAL APPROACH
Curriculum follows Developmental Sequences

Scaffolding, shared control, use of child-preferred activities for meaning, motivation and reward
**ESDM PRINCIPLES**

- Teaching episodes are embedded in daily routines and playful social interaction (Joint Activity Routines)
- Active experiential learning promoted by following children’s preferences and motivation
- Social-pragmatic view of language development
- ABA strategies (ABC, fading, prompting etc.)
- Data-driven (including, individualized goals, fidelity, decision tree)

**ESDM – TREATMENT PRACTICES**

<table>
<thead>
<tr>
<th>Shared Principles and Strategies</th>
<th>Differences in Teaching Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individualization of treatment goals</td>
<td>DTT</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>Adult-directed</td>
</tr>
<tr>
<td>Intensity</td>
<td>adult selects teaching materials, settings, activity and reinforcers</td>
</tr>
<tr>
<td>Manualized teaching practices and fidelity systems</td>
<td>Contingent Reinforcers</td>
</tr>
<tr>
<td>Data-based monitoring of progress</td>
<td>consequence of the desired behavior is an internal reward, (e.g. token, edible)</td>
</tr>
<tr>
<td>Three-part contingency structure (Antecedent, Behavior, Consequence)</td>
<td>Motivational Reinforcer</td>
</tr>
<tr>
<td>Use of behavioral techniques (e.g. prompting, fading, shaping)</td>
<td>Immediate visual adult delivers stripped-down, concise, and unambiguous instructional cues</td>
</tr>
<tr>
<td>ESDM – TREATMENT PRACTICES</td>
<td>Adult Activity Routine format</td>
</tr>
<tr>
<td>Three-part contingency structure</td>
<td>adult displays animated/playful facial emotions and body language when delivering instructional cues</td>
</tr>
</tbody>
</table>

**THE STARTING POINT – EVALUATION: ESDM CURRICULUM CHECKLIST**

- ESDM Curriculum Checklist: Criterion-referenced tool which provides developmental sequences of skills in 8 domains
- 480 items organized in 4 levels:
  - 9-12 up to 48 month period
- Placement of items across levels reflects typical child development research and clinical experience

**FRAMEWORK FOR TEACHING: JOINT ACTIVITY ROUTINES**

- Follows child choice or interest
- Both partners engage in activity
- Targets multiple objectives from different domains
- Brief, 2-4 minutes in length

- **Step 1:** Set Up (Develop a theme)
- **Step 2:** Theme (Take turns, collaborate)
- **Step 3:** Add variations (increase play complexity, expand child repertoire, target multiple objectives, build up flexibility)
- **Step 4:** Close the activity and transition to new one
EARLY START DENVER MODEL (ROGERS AND COLLEAGUES)

An Early Start for Your Child with Autism
Using Everyday Activities to Promote Language, Learning, and Engagement
Sally J. Rogers and Geraldine Dawson

Implementing the Group-Based Early Start Denver Model for Preschoolers with Autism
Sally J. Rogers and Geraldine Dawson

GROUP-BASED EARLY START DENVER MODEL

Focused on facilitating learning within small groups through guided peer interaction (1:3/1:4)
Target: community childcare/preschool programs

Rationales:
- Small group environments more consistent with common cultural practices
- Peers and childcare teachers - untapped resources
- Concerns with sustainability of 1:1
- Concerns with parent-implemented programs
- More opportunities to target goals needed in the next learning environment, including:
  - Following shared daily routines
  - Participating in group activities
  - Social engagement and play with peers
  - Daily living and safety skills (e.g., hat!)

FROM ESDM TO G-ESDM – KEY ADAPTATIONS

- Low staff-to-child ratios (1:3 – 1:4)
- Individual goals are targeted within small group activities
- Activity centers
- Different levels of training in the team

Fostering peer interactions

Set Up:
- Physical positioning
- Parallel play with double toy sets
- Materials as magnets
- Adults as “invisible supports”

Circle games

Goals:
- Giving materials to peers
- Taking materials from peers
- Showing objects
- Asking for a turn
- Asking for an object
- Saying “no”, “mine”, “not yet” or “in a minute”
- Responding to peer greetings

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• RESEARCH INFORMING ESDM

• ESDM PRACTICES

• ESDM OUTCOME RESEARCH

Randomized, Controlled Trial of an Intervention for Toddlers With Autism: The Early Start Denver Model
Geraldine Dawson, Sally Rogers, Jeffrey M. Munson, Milani Smith, Jamie Winter, Jessica Greenman, Amy Doulos and Jennifer Varley
48 Children < 2.5 years of age
ESDM vs. Community, 2 year intervention – 25 hr/week

Effects of Intervention on Expressive Language
Dawson, et al., Pediatrics 2010

Severity of ASD moderates outcomes, but those with more severe ASD improve in ESDM
Dawson, et al., Pediatrics, 2010
Long-Term Outcomes of Early Intervention in 6-Year-Old Children With Autism Spectrum Disorder

• Follow-up of the same children, two years after

During treatment, costs for children in the ESDM group was higher by about $14,000 than those of children who received community-based treatment.

In the post-intervention period, compared with children who had earlier received treatment as usual in community settings, children in the ESDM group needed less services, resulting in cost savings of about $19,000 per year per child.

Costs associated with ESDM treatment were fully offset within a few years after the intervention due to reductions in other service use and associated costs.

Early Behavioral Intervention is Associated With Normalized Brain Activity in Young Children With Autism

Outcome study
TD=17
ESDM=24
Comm=24

Effects of a Brief Early Start Denver Model (ESDM)–Based Parent Intervention on Toddlers at Risk for Autism Spectrum Disorders: A Randomized Controlled Trial

12 wks, 1 hr clinic sessions involving collaborative parent coaching

Change in Parent Fidelity Scores

Figure 3. Differences in peak latency of components P200 responses to faces and objects for children treated with the Early Start Denver Model (ESDM) intervention, and community intervention. Note: Negative scores represent faster response to face than objects.
Autism Treatment in the First Year of Life: A Pilot Study of Infant Start, a Parent-Implemented Intervention for Symptomatic Infants

S. J. Rogers - L. Vismara - A. L. Wagner - C. McCannick - G. Young - S. Ostroff

7 infants (7-15 month olds) symptomatic of ASD: sibs, clinical referrals
Consistently elevated scores and parent and expert clinician concerns

Parent coaching model
12 weeks, 1 session per week
Post-treatment fewer ASD symptoms compared to controls,
But more than typical children
All children except for 1 in the typical cognitive range

Developmental Rate:
Individual Gains in Mullen Overall AE (n=96)

10% Limited gains
Developmental Rate:
Individual Gains in Mullen Overall AE (n=96)

- 10% Limited gains
- 38% Significant progress but developmental rate not in keeping with typical dev. norms
- 31% ‘Normal’ developmental rate
- 21% Acceleration of developmental rate

Which Factors drive outcomes?
ARISTOTLE (340 BC)
"IT IS EASY TO KNOW THE EFFECTS OF HONEY, WINE AND OTHER REMEDIES, BUT TO KNOW HOW, FOR WHOM, AND WHEN WE SHOULD APPLY THESE AS REMEDIES IS NO LESS AN UNDERTAKING THAN BEING A PHYSICIAN."

Impact of setting – inclusive vs segregated
- Pilot RCT - 16 children receiving Group-ESDM in a mainstream (inclusive) setting and 16 in an ASD-only (segregated) setting
- Sustained Shared Thinking and Emotional Well-Being scale (Shin et al., 2015)

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>1.0</th>
<th>2.0</th>
<th>3.0</th>
<th>4.0</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
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<tr>
<td>ASD only</td>
<td>4.9</td>
<td>6.3</td>
<td>3.3</td>
<td>4.0</td>
<td>5.0</td>
<td>5.5</td>
<td>5.5</td>
<td>5.0</td>
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<tr>
<td>Inclusive</td>
<td>4.2</td>
<td>6.7</td>
<td>6.3</td>
<td>4.0</td>
<td>5.0</td>
<td>3.0</td>
<td>2.8</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Outcome for Children Receiving the Early Start Denver Model Before and After 48 Months
Giovanni Vismara1 - Cheryl Howazadeh1 - The Victorian SRECC Team2

Language gains predicted by the combined effect of age and initial language level (R square increase due to interaction F=4.52, p<.05)
Thank you for your attention!
The Victorian ASECC team, OTARC team and Drexel EDI team
Sally J Rogers
Cheryl Dissanayake
Tristram Smith
Lynn Koegel
David Mandell
Connie Kasari
Heather Nuske
Darren Hocking
Peter Fanning
All the children who took part in their research and their families!

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