Evidence Base for the DIRFloortime® Approach

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DIRFloortime® is an approach to the treatment of autistic children and those with other neurodiversity and developmental challenges. In DIRFloortime, a parent or other adult interacts with a child in a way that is sensitive to the subtleties of the child's actions, humanistically infers emotion and intent, and seeks to understand and respond to their ideas. Through reciprocal interactions, adult and child create shared meanings. The adult is always respectful of the child and tailors interactions with an appreciation of the child's individual differences in sensory, motor, language and cognitive challenges, strengths and preferences. Through many such interactions the child forms a warm, trusting relationship with the adult, and through that relationship can be challenged to reach higher levels of communication, social relating, and cognitive abilities.

DIRFloortime is derived from over 50 years of study and research about child development from the fields of psychology, medicine, and education, including the study of language, attention, mental health, infant development, sensory processing, and motor development. This paper annotates some of the relevant research on the effectiveness of DIRFloortime® as well as research that supports the 3 main components of DIR, developmental, individual differences, and relationship-based approaches to therapeutic supports and services. Research forms one part of evidence-based practice.

> *"Evidence-based practice" means a decision making process which integrates the best available scientifically rigorous research, clinical expertise, and individual's characteristics. Evidence-based practice is an approach to treatment rather than a specific treatment. Evidence-based practice promotes the collection, interpretation, integration, and continuous evaluation of valid, important, and applicable individual- or family-reported, clinically-observed, and research-supported evidence. The best available evidence, matched to infant or toddler circumstances and preferences, is applied to ensure the quality of clinical judgments and facilitates the most cost-effective care. [California Welfare and Institutions Code 4686.2 (d) (3)]*

DIRFloortime® is an approach in the broader category of Developmental Relationship-Based Interventions (DRBI). In 2025, a paper was published that presents the defining features of DRBI and distinguishes these approaches from Naturalistic Developmental Behavioral Interventions: "The defining features of DRBI are: (a) a developmental framework based on a child's innate motivation for social engagement and learning, and (b) a primary focus on supporting parent-child and other social interactions and relationships. Four strategies consistently used in DRBI are: Social Play, Sensitive Responding, Following the Child's Lead, and Presenting Challenges."

Cullinane, D. A., Binns, A. V., Feder, J. D., Graham, T., Mahoney, G. J., Naber, F. B., ... & Wieder, S. (2024). Developmental Relationship-Based Interventions for Autistic Children. *Topics in Early Childhood Special Education*, 02711214241303695. https://doi.org/10.1177/02711214241303

Which outcomes to measure?

A starting point to measure effectiveness of intervention is to determine the goals of the intervention and the factors to be measured as outcomes. This is a major challenge in the field of developmental disabilities. Developmental interventions have two targets of intervention: 1) to improve adults' sensitivity and responsiveness to the child and 2) to increase the child's functional development reflected in communication, social interaction, and cognitive abilities. Developmental approaches are founded upon the science of the correlation between the adults' interactive support and the child's progression through key developmental stages. In contrast to behavioral approaches, which tend to select specific skill targets and use intervention methodologies based on compliance with adult directions), the goals of developmental interventions are broad based and aim to help children improve the core diagnostic features of autism.

Typical outcome measures evaluate:

- *Socialization, social interaction, social-emotional function*
- *Social communication*
- *Joint attention*
- *Initiation*
- *Spontaneous communication*
- *Reciprocal interaction; parent-child interaction*
- *Autism severity*
- *Language*
- *Functional development (using the FEAS Functional Emotional Assessment Scale and the FEDQ Functional Emotional Development Questionnaire)*

These developmental outcome indicators are more closely aligned to the diagnostic criteria for autism spectrum disorder than those often used in older research such as IQ, performance on early academic skills, and ability to follow commands. The National Research Council stated in 2001: "More appropriate outcome measures are improvement in initiation of spontaneous communication in functional activities, and generalization of language across activities people, and settings"

Lord, Catherine; McGee, James (Editors) (2001). Committee on Educational Interventions for Children with Autism. *Educating Children with Autism.* Division of Behavioral and Social Sciences and Education, National Research Council. Washington, DC: National Academy Press, p. 217.

The DIRFloortime approach provides a developmental framework that has been studied and found to be accurate and effective in understanding behavior. The widely used *Bayley Scales of Infant and Toddler Development™,* the gold standard of early developmental assessment measures, has adopted the DIR milestones to measure children's social-emotional development through a process of careful standardization across populations.

Developmental models emphasize individual differences and the need to tailor intervention to the unique biological profile of the child and to the unique characteristics of the caregiver-child interaction. Outcome research is extremely challengingbecause the outcome factors being measured are complex, because each child's array of therapeutic

and educational services is so unique in intensity, delivery model, and duration, and because of the wide range of individual differences in the population. In considering the evidence for DIRFloortime, it is important to appreciate the challenges to studying a complex model, and to consider the long history of study on the effectiveness of various facets of a developmental framework. The following presents research regarding the three major aspects of the DIRFloortime approach: "D"- developmental framework, "I"-individual differences, and "R"-relationship and affective interactions.

"D" Developmental

A developmental approach is founded on work by major developmental theorists such as Piaget, Vygotsky, Erikson, and Kohlberg. A developmental approach considers behavior and learning in the greater context of a developmental or changing process.DIR theory was first described by Stanley Greenspan, M.D. in 1975 and was further developed over the next 20 years, especially through his collaboration with Serena Wieder, Ph.D.. He received high honors and acclaim for his work including the American Psychiatric Association's highest award for child psychiatry research.

Greenspan, S.I, A Consideration of Some Learning Variables in the Context of Psychoanalytic Theory, (1975)
Greenspan, S.I. Intelligence and Adaptation, (1979)
Greenspan, S.I. Psychopathology and Adaptation in Infancy and Early Childhood (1981)
Greenspan, S.I. First Feelings (1985),
Greenspan, S.I. The Essential Partnership (1989)
Greenspan, S.I. The Development of the Ego (1989)
Greenspan, S.I. Infancy and Early Childhood (1992)

In 1997, Drs. Greenspan and Serena Wieder published, The Child with Special Needs: Encouraging Intellectual and Emotional Growth and in 2006 they published Engaging Autism.

Greenspan, S. I., & Wieder, S. (2006). *Engaging autism: Using the Floortime approach to help children relate, communicate, and think.* Da Capo Press

Their description of the DIR model can also be found in this 1999 publication.

> Greenspan, S. I., & Wieder, S. (1999). A functional developmental approach to autism spectrum disorders. *Journal of the Association for Persons with Severe Handicaps, 24*(3), 147-161.

In 1997, they reported the results of an extensive chart review of 200 children with autism who had received DIRFloortime. This showed the promise of the DIR approach: the goal of the review was to reveal patterns in presenting symptoms, underlying processing difficulties, early development, and response to intervention in order to generate hypotheses for future studies. The chart review suggests that a number of children with autistic spectrum diagnoses are, with an appropriate intervention program, capable of empathy, affective reciprocity, creative thinking, and healthy peer relationships; it suggests that an intervention approach that focuses on individual differences, developmental level, and affective interaction may be especially promising.

Greenspan, S.I. and Wieder, S. (1997) Developmental patterns and outcomes in infants and children with disorders in relating and communicating: A chart review of 200 cases of children with autistic spectrum diagnoses. *Journal of Developmental and Learning Disorders*, *1*, 87-141.

8 years later, they reported the follow-up of a subgroup of the children studied in the chart review, showing that it is possible for children with autism to become empathetic, creative, and reflective thinkers.

Greenspan, S.I. and Wieder, S. (2005) Can Children with Autism Master the Core Deficits and Become Empathetic, Creative and Reflective? A Ten to Fifteen Year Follow-up of a Subgroup of Children with Autism Spectrum Disorders (ASD) Who Received a Comprehensive Developmental, Individual-Difference, Relationship-Based (DIR) Approach. *The Journal of Developmental and Learning Disorders, 9,* 1-29.

Previous approaches using behavioral principles relied upon outside motivators on the premise that children with autism did not have their own motivation to participate in social interaction or to learn. The DIRFloortime® approach revealed that all children will show purpose and initiative and will seek close social relationships when provided with interactions which respect their interests and are tailored to their individual differences.

In 2009, 20 authors, representing 17 major institutions and 3 countries, collaborated to write a paper which outlines principles of assessment and effective intervention for children with suspected autism under the age of 2. They concluded "Interventions should ultimately be directed toward specific functional concerns and be informed by key developmental principles, including the child's role as an active learner, the social contexts of learning, and the pivotal role of the parent-child relationship."

Zwaigenbaum, L. et al. (2009), Clinical assessment and management of toddlers with suspected autism spectrum disorder: insights from studies of high-risk infants, *Pediatrics, 123*(5), 1383-1391 https://doi.org/10.1542/peds.2008-1606

In 2010, Wallace and Rogers published a review of controlled studies which identified four factors which were most important for effective intervention for infants with autism. These were: "(1) parent involvement in intervention, including ongoing parent coaching that focused both on parental responsivity and sensitivity to child cues and on teaching families to provide the infant interventions, (2) individualization to each infant's developmental profile, (3) focusing on a broad rather than a narrow range of learning targets, and (4) temporal characteristics involving beginning as early as the risk is detected and providing greater intensity and duration of the intervention."

Wallace, K. S. and Rogers, S. J. (2010) Intervening in infancy: implications for autism spectrum disorders. *Journal of Child Psychology and Psychiatry, 51*(12), 1300-1320. https://doi.org/10.1111/j.1469-7610.2010.02308.x

Developmental intervention models incorporate these elements, which are all fundamental features of the DIRFloortime approach.

The following are some of the research studies on the effectiveness of the developmental approach since 2000:

In 2002, a report of a developmentally based early intervention program for children with autism in Scotland showed significant improvement in children.

Salt, J., Shemilt, J., Sellars, V. Boyd, S., Coulson, T., & McCool, S. (2002). The Scottish Centre for Autism preschool treatment programme: II: The results of a treatment outcome study.. *Autism*, *6*(1), 33-46. https://doi.org/10.1177/13623613020060010

See Salt et al. 2001 for a description of the program:

Salt, J., Sellars, V., Shemilt, J., Boyd, S., Coulson, T., & McCool, S. (2001). The Scottish Centre for Autism preschool treatment programme: I: A developmental approach to early intervention. *Autism*, *5*(4), 362-373. https://doi.org/10.1177/1362361301005004003

In 2004, Aldred et al. conducted a pilot randomized controlled trial of an intervention that focused on sensitive adult responses and promoting parent-child communication. The active treatment group showed significant improvement on ADOS total score, social interaction, language, and parent-child interaction.

Aldred, C., Green, J., & Adams, C. (2004). A new social communication intervention for children with autism: pilot randomised controlled treatment study suggesting effectiveness. *Journal of Child Psychology and Psychiatry*, *45*(8), 1420-1430. https://doi.org/10.1111/j.1469-7610.2004.00848.x

See the following for a description of the intervention:

Aldred, C., Phillips, R., Pollard, C., & Adams, C. (2001). Multidisciplinary social communication intervention for children with autism and pervasive developmental disorder: the Child's Talk project. *Educational and Child Psychology*, *18*(2), 76-87. https://doi.org/10.53841/bpsecp.2001.18.2.76

In 2012, Aldred et al. published an analysis of the 2004 study showing the mediational effects of the intervention.

Aldred, C., Green, J., Emsley, R., & McConachie, H. (2012). Brief report: Mediation of treatment effect in a communication intervention for pre-school children with autism. *Journal of Autism and Developmental Disorders, 42*, 447-454. https://doi.org/10.1007/s10803-011-1248-3

In 2003 and 2005 Mahoney reported positive outcomes for an approach called Responsive Teaching. This approach focused on parent responsivity resulting in improved child outcomes. In 2009, Mahoney further described "Relationship-Focused Intervention" as a "key element in early intervention."

Mahoney, G., & Perales, F. (2003). Using relationship-focused intervention to enhance the social-emotional functioning of young children with autism spectrum disorders. *Topics in Early Childhood Special Education*, *23*(2), 74-86. https://doi.org/10.1177/02711214030230020301

Mahoney, G., & Perales, F. (2005). Relationship-focused early intervention with children with pervasive developmental disorders and other disabilities: A comparative study. *Journal of Developmental & Behavioral Pediatrics*, *26*(2), 77-85. DOI: 10.1097/00004703-200504000-00002

Mahoney, G. (2009). Relationship Focused Intervention (RFI): Enhancing the Role of Parents in Children's Developmental Intervention. *International Journal of Early Childhood Special Education*, *1*(1). https://doi.org/10.20489/intjecse.107978

In 2018, Alquraini et al. published an RCT showing positive effects of the Responsive Teaching approach for children with autism in social language and fine motor areas.

Alquraini, T., Al-Odaib, A., Al-Dhalaan, H., Merza, H., & Mahoney, G. (2018). Feasibility of Responsive Teaching with mothers and young children with autism in Saudi Arabia. *Journal of Early Intervention*, *40*(4), 304-316. https://doi.org/10.1177/105381511878

In 2019, a secondary analysis of that study showed that parents showed improvement in stress and depression.

Alquraini, T, Al-Adaib, A., Al-Dhalaan, H., Merza, H., & Mahoney, G. (2019). Relationship-based intervention with young children with autism in Saudi Arabia: Impediments and consequences of parenting stress and depression. *International Journal of Disability Development and Education, 66*, 233-248. https://doi.org/10.1080/1034912X.2018.1487042

In 2007, Schertz and Odom reported positive outcomes on a developmental intervention called Joint Attention Mediated Learning (JAML) with parent-mediated intervention for toddlers with autism.

Schertz, H. H., & Odom, S. L. (2007). Promoting joint attention in toddlers with autism: A parent-mediated developmental model. *Journal of Autism and Developmental Disorders*, *37*(8), 1562-1575. https://doi.org/10.1007/s10803-006-0290-z

In 2013, Schertz et al. reported an initial RCT of JAML and in 2018, Schertz et al. reported a subsequent RCT of JAML showing positive effects on social communication.

Schertz, H. H., Odom, S. L., Baggett, K. M., & Sideris, J. H. (2013). Effects of joint attention mediated learning for toddlers with autism spectrum disorders: An initial randomized controlled study. *Early Childhood Research Quarterly*, *28*(2), 249-258. https://doi.org/10.1016/j.ecresq.2012.06.006

Schertz, H. H., Odom, S. L., Baggett, K. M., & Sideris, J. H. (2018). Mediating parent learning to promote social communication for toddlers with autism: Effects from a randomized controlled trial. *Journal of Autism and Developmental Disorders*, *48*, 853-867. https://doi.org/10.1007/s10803-017-3386-8

In 2007, Solomon reported a pilot study on the Play Project, which is based on DIRFloortime®, showing significant increases in child subscale scores on the FEAS after an 8-12 month program.

Solomon, R., J. Necheles, C. Ferch, and D. Bruckman (2007). "Pilot study of a parent training program for young children with autism: The P.L.A.Y. Project Home Consultation program." *Autism, 11*(3),205-224. https://doi.org/10.1177/1362361307076842

In 2014, Solomon et al. reported their findings on a large randomized controlled trial (RCT) conducted with 128 children with autism enrolled in the PLAY Project a manualized, parent-mediated intervention program is based on the DIRFloortime® approach. Parents showed marked improvement in the ability to read their child's cues, follow their child's lead, and obtain reciprocal social exchanges. Children showed marked improvement in engagement,initiation, and functional development.

Solomon R, Van Egeren L, Mahoney G, Quon-Huber M, Zimmerman P. (2014). PLAY Project Home Consultation Intervention Program for Young Children with Autism Spectrum Disorders: A Randomized Controlled Trial. *Journal of Developmental and Behavioral Pediatr*ics, *35*(8), 475-485. https://doi.org/10.1097/DBP.0000000000000096

In June 2011, Pajareya published a pilot RCT of DIRFloortime with preschool children with ASD. Results showed improvements in scores on the FEAS (Functional Emotional Assessment Scale), CARS (Childhood Autism Rating Scale), and FEDQ (Functional

Emotional Development Questionnaire) confirming the results of the Solomon 2007 study. She then conducted a second study over 12 months, also with positive outcomes.

Pajareya, K., & Nopmaneejumruslers, K. (2011). A pilot randomized controlled trial of DIR/Floortime™ parent training intervention for pre-school children with autistic spectrum disorders. *Autism*, *15*(5), 563-577. https://doi.org/10.1177/1362361310386502

Pajareya, K., & Nopmaneejumruslers, K. (2012). A one-year prospective follow-up study of a DIR/Floortime™ parent training intervention for preschool children with autistic spectrum disorders. *Journal of the Medical Association of Thailand*, *95*(9), 1184.

In 2019 Pajareya et al. reported an RCT using DIR with children with developmental disabilities, showing improvements in attention and initiation.

Pajareya, K., Sutchritpongsa, S., & Kongkasuwan, R. (2019). DIR/Floortime® parent training intervention for children with developmental disabilities: a randomized controlled trial. *Siriraj Medical Journal*, *71*(5), 331-338. DOI:10.33192/Smj.2019.51

Elder et. al (2010) demonstrated significant changes in child and parent behaviors as a result of training fathers in following their child's lead, imitating with animation, commenting on the child's actions, and expectant waiting. There were significant changes in the child's behaviors, including increase in child initiating and child's non-speech vocalizations.

Elder, J.; O'Donaldson, S.; Kairella; J; Valcante, G; Bendixon, R; Ferdig, R; Self, E; Walker, J; Palau, C & Serrano, M. (published online 2010). In-home training for fathers of children with autism: A follow up study evaluation of four individual training components. *Journal of Child Family Study*. *20*(3); 263-271. https://doi.org/10.1007/s10826-010-9387-2

In 2010, building on the earlier study by Aldred et al., Green et.al. reported positive results from the PACT program (Preschool Autism Communication Trial), a parent-mediated training program, which was effective in increasing parental sensitivity and responsiveness, with increased child initiations and parent-child attention.

Green, J.; Charman, T.; McConachie, H.; Aldred, C.; Slonims, V.; Howlin, O.; Le Couteur, A.; Leadbitter, K.; Hudry, K.; Byford, S.; Barrett, B.; Temple, K.; MacDonald, W.; Pickles,A.; & the PACT Consortium (2010). Parent mediated communication-focused treatment in children with autism (PACT): A randomized controlled trial. *Lancet*. *375*(9732), 2152–2160. https://doi.org/10.1016/S0140-6736(10)60587-9

In 2016, Pickles et al. did a follow-up of the PACT study, which showed long term benefitof this model of early intervention with the parents, showing improved outcomes for the children 5.75 years later

Pickles, A., Le Couteur, A., Leadbitter, K., Salomone, E., Cole-Fletcher, R., Tobin, H., ... & Aldred, C. (2016). Parent-mediated social communication therapy for young children with autism (PACT): long-term follow-up of a randomised controlled trial. *The Lancet*, *388*(10059), 2501-2509. https://doi.org/10.1016/S0140-6736(16)31229-6

In 2023, Carruthers et al. found that child initiations mediated the majority of the treatment effect in the above long-term study.

Carruthers, S., Pickles, A., Charman, T., McConachie, H., Le Couteur, A., Slonims, V., Howlin, P., Collum, R., Salomone, E., Tobin, H., Gammer, I., Maxwell, J., Aldred, C., Parr, J., Leadbitter, K., & Green, J. (2023). Mediation of 6-year mid-childhood follow-up outcomes after pre-school social communication (PACT) therapy for autistic children: randomised controlled trial. *Journal of Child Psychology and Psychiatry, 65*(2*)*, 233-244. https://doi.org/10.1111/jcpp.13798

Also in 2016, Rahman utilized the same treatment in India and Pakistan with positive effects.

Rahman, A., Divan, G., Hamdani, S. U., Vajaratkar, V., Taylor, C., Leadbitter, K., Aldred C., Minhas, A., Cardozo, P., Emsley, R., Patel, V., & Green, J. (2016). Effectiveness of the parent-mediated intervention for children with autism spectrum disorder in south Asia in India and Pakistan (PASS): a randomised controlled trial. *The Lancet Psychiatry*, *3*(2), 128-136. https://doi.org/10.1016/S2215-0366(15)00388-0

A developmental treatment called SPEIC, Scheme to Promote Early Interactive Conversation, was studied over a 12-month period in 10 children either with ASD orat risk for ASD. The outcomes included increases in attention, joint attention, and communication.

Smith, C., & Bohane, L. (2010). Isle of Wight study: a neuro-developmental therapy to promote social attention and shared emotion in young children with high-functioning autistic spectrum difficulties. *Procedia - Social and Behavioral Sciences*, *5*(1), 698-706. https://doi.org/10.1016/j.sbspro.2010.07.168

For further information about this approach see:

Smith, C., Goddard, S., & Fluck, M. (2004). A scheme to promote social attention and functional language in young children with communication difficulties and autistic spectrum disorder. *Educational Psychology in Practice*, *20*(4), 319-333. https://doi.org/10.1080/0266736042000314268

In 2011, a single subject study design was used to evaluate the effectiveness of Floor Time Play (based on DIRFloortime) with a 3.6-year-old boy with autism. The study used an observation and intervention phase and utilized circles of communication as the measure of change. Results showed a significant improvement using Floor Time play strategies, and mother's journal included insights on the changes observed.

Dionne, M. and Martini, R. (2011). Floor time play with a child with autism: a single-subject study. *Canadian Journal of Occupational Therapy, 78*(3), 196-203. https://doi.org/10.2182/cjot.2011.78.3.8

In a randomized controlled trial, Casenhiser et al. (2011-online date) presented the results of a DIRFloortime®-based, social-communication intervention. A significant association was found between improvements in caregiver behaviors and improvements in children's social-communicative measures. Results indicate that the treatment group showed significantly greater enjoyment in interactions with their parents, were significantly more attentive and involved in interactions with their parents, and initiated more joint attention. Initiation of joint attention and involvement were predictive of the child's increase in language skills.

Casenhiser, D. M., Shanker, S. G., & Stieben, J. (2013). Learning through interaction in children with autism: Preliminary data from asocial-communication-based intervention. *Autism*, *17*(2), 220-241. https://doi.org/10.1177/1362361311422052

Casenhiser et al. (2015) reanalyzed their data from their 2011 research and documented that the children in the treatment group outperformed the community treatment group on measures of language including number of utterances produced and various speech act categories such as sharing, commenting, rejecting/protesting, social conventions and responses to comments.

Casenhiser, D. M., Binns, A., McGill, F., Morderer, O., & Shanker, S. G. (2015). Measuring and supporting language function for children with autism: Evidence from a randomized control trial of a social-interaction-based therapy. *Journal of Autism and Developmental Disorders*, 45, 846-857. https://doi.org/10.1007/s10803-014-2242-3

In 2013, Siller et al. conducted a randomized, clinical trial with 70 children with ASD, 6 years of age or younger, using Focused Playtime Intervention (FPI). The intervention was designed to promote responsive parental behaviors in a family-centered intervention. The intervention focused on play, social engagement, and encouraging increasingly complex child communication and play. Results showed a significant treatment effect on responsive parental behaviors and a conditional effect on children's expressive language outcomes, showing that children with baseline language skills below 12 months are most likely to benefit from FPI.

Siller, M; Hutman, T & Sigman, M. (2013). A parent-mediated intervention to increase responsive parental behaviors and child communication in children with ASD: A randomized, clinical trial. *Journal of Autism and Developmental Disorders*, *43*(3), 540-550. https://doi.org/10.1007/s10803-012-1584-y

In 2014, Siller et.al. reported that Focused Playtime Intervention (FPI), also increases attachment-related behaviors.

Siller, M., Swanson, M., Gerber, A., Hutman, T., Sigman, M. (2014). A parent-mediated intervention that targets responsive parental behaviors increases attachment behaviors in children with ASD: Results from a randomized clinical trial. *Journal of Autism and Developmental Disorders*, *44*(7), 1720-1732. https://doi.org/10.1007/s10803-014-2049-2

In 2014, Liao and colleagues conducted a study on the effects of DIRFloortime intervention with eleven children with autism (ages 45-69 months). The mothers were trained in DIRFloortime during pre-intervention 1:1 counseling sessions and a three-hour lecture. Each parent conducted the intervention for at least 10 hours a week for ten weeks. There were significant improvements in each child's two-way communication, behavioral organization, problem-solving, and daily living skills with medium to large effect sizes.

Liao, S.; Hwang, Y; Chen, Y.; Lee, P.; Chen, S & YiLin. (2014). Home-based DIR/Floortime intervention program for preschoolers with autism spectrum disorders: Preliminary findings. *Physical and Occupational Therapy in Pediatrics*, *34*(4), 356-367. https://doi.org/10.3109/01942638.2014.918074.

In 2015, a report of an intervention program in Iran using family therapy and Floortime showed good results.

Aali, S., Yazdi, S. A. A., Abdekhodaei, M. S., Chamanabad, A. G., & Moharreri, F. (2015). Developing a mixed family-focused therapy based on integrated human development model and comparing its effectiveness with Floortime play-therapy on the developmental family functioning and the functional-emotional development of children with autism spectrum disorder. *Journal of Fundamentals of Mental Health*, *17*(2), 87-97. 10.22038/jfmh.2015.4030

A 40-year program, called the Turtle Project, conducted a 4-year study of a comprehensive developmental relationship-based intervention, with input from DIRFloortime, for children with autism. Positive outcomes were found for autistic symptoms and cognitive development.

Di Renzo, M., Di Castelbianco, F. B., Petrillo, M., Racinaro, L., & Rea, M. (2015). Assessment of a long-term developmental relationship-based approach in children with autism spectrum disorder. *Psychological reports*, *117*(1), 26-49. https://doi.org/10.2466/15.10.PR0.117c15z8

Di Renzo, M., Bianchi di Castelbianco, F., Vanadia, E., Petrillo, M., Racinaro, L., & Rea, M. (2016). From the emotional integration to the cognitive construction: the developmental approach of turtle project in children with autism spectrum disorder. *Autism Open Access*, *6*(1), 160-9. https://doi.org/10.4172/2165-7890.1000188

A 2020 report on the Turtle Project, now called DERBBI, (Developmental, Emotional Regulation and Body-Based Intervention**)** updates this developmental approach, showing results for autistic children and those at risk who participated between 2-4 years in the program.

Di Renzo, M., Vanadia, E., Petrillo, M., Trapolino, D., Racinaro, L., Rea, M., & di Castelbianco, F. B. (2020). A therapeutic approach for ASD: Method and outcome of the DERBBI–Developmental, Emotional Regulation and Body-Based Intervention. *International Journal of Psychoanalysis and Education*, *12*(1), 59-75. https://doaj.org/article/0e0a481f25fe4577be41b0ddca37968e

In 2016, Salman reportedimprovement in attachment behaviors of 7 children enrolled in a Floortime intervention program in Egypt.

Salman, A. (2016). Using DIR-Floor time based program to promote attachment behaviors in children with Autism Spectrum Disorders. *IOSR Journal of Humanities and Social Science*, *21*, 11-21. DOI:10.9790/0837-2109111121

In 2017, Sindelar published a brief report showing the effectiveness of DIR for a group of autistic children with severe challenges.

Sindelar MT, Furland N. (2017). Outcomes in a group of 7–8-year-old children in a developmental-based intervention in Autism Spectrum Disorder. *European Psychiatry*, *41*(S1), 304.. https://doi.org/10.1016/j.eurpsy.2017.02.192

In 2018, Reis et.al. reported the outcome of an intervention based on DIRFloortime for 25 children, 3-6 years of age, over 10 months. Positive effects were found on social communication and sensory processing.

Reis, H. I., Pereira, A. P., & Almeida, L. S. (2018). Intervention effects on communication skills and sensory regulation on children with ASD. *Journal of Occupational Therapy, Schools, & Early Intervention*, *11*(3), 346-359. https://doi.org/10.1080/19411243.2018.1455552

In 2019, Ho and Lin reported an RCT of a DIR program in Taiwan, conducted over 14 weeks. They report benefits in emotional development and parenting skills.

Ho, M. H., & Lin, L. Y. (2020). Efficacy of parent-training programs for preschool children with autism spectrum disorder: A randomized controlled trial. *Research in Autism Spectrum Disorders*, *71*, 101495. https://doi.org/10.1016/j.rasd.2019.101495

In 2023, Hamid et al. reported on the use of a DIR based parent mediated intervention in Malaysia. This pilot study showed significant improvement in FEAS scores.

Hamid, N., Sabri, M. Q. M., Sundaraj, C., Lim, B. C., Al-Sabbah, S., & Daud, A. Z. C. (2023). The effect of parent-mediated intervention on social-emotional skills in children with autism spectrum disorder. *Journal of Health and Translational Medicine (JUMMEC)*, 301-308. https://doi.org/10.22452/jummec.sp2023no2.33

In 2023, a brief report on the Positive Development Model, one of the developmental relationship-based (DRBI) approaches, showed significant improvements in adaptive behaviors and ASD symptomology over a 6-month intervention with 45 children ages 2-18 years.

Davis, Z. & Feder, J., (2023). Six-Month outcomes of a scalable developmental relationship-based intervention for ASD. *Journal of the American Academy of Child & Adolescent Psychiatry*, *62*(10), S289. DOI: 10.1016/j.jaac.2023.09.418

In 2024, Feder & Thayer submitted a brief report on the Positive Development Model showing reduction in overall symptom severity in 21 children after a 1-year period.

Feder, J. & Thayer, F. (2024). One-year symptom outcomes of a scalable developmental relationship-based Intervention for autistic children and teens.. *Journal of the American Academy of Child & Adolescent Psychiatry,* 63(10),, S306. https://doi.org/10.1016/j.jaac.2024.08.479

"I" Individual Difference

In the 1970s Jean Ayres pioneered discoveries about innate sensory processing differences. This provided a new way of understanding movement and regulatory behaviors. In addition, this work showed that these biological differences could be influenced and changed by specific therapeutic interventions.

Ayres, A. J. (1979). *Sensory Integration and the Child.* Western Psychological Services. Los Angeles, CA.

In 2001, Greenspan explained how sensory processing differences could derail development. This concept of biological susceptibilities derailing development is now widely described.

Greenspan, S. I. (2001). The affect diathesis hypothesis: The role of emotions in the core deficit in autism and in the development of intelligence and social skills. *Journal of Developmental and Learning Disorders*, *5*(1), 1–45.

Over the past 40 years, a large body of research has further described biological differences in sensory-motor processing in children with autism and other developmental challenges and the effects of sensory-based treatment.

The National Research Council of the National Academy of Sciences, in their 2001 landmark report, "Educating Children with Autism," called for tailoring the treatment approach to the unique features of the individual child.

Lord, C. & McGee, J. (Editors) (2001). Committee on Educational Interventions for Children with Autism. *Educating Children with Autism.* Division of Behavioral and Social Sciences and Education, National Research Council. Washington, D.C.: National Academy Press, p. 217. https://doi.org/10.17226/10017

A 2011 pilot randomized control study showed the effectiveness of sensory integration treatment for children with autism. Results showed improvement in social responsiveness, sensory processing, functional motor skills, and social-emotional factors, with a significant decrease in autistic mannerisms.

Pfeiffer, B. A., Koenig, K., Kinnealey, M., Sheppard, M., & Henderson, L. (2011). Effectiveness of sensory integration interventions in children with autism spectrum disorders: A pilot study. *American Journal of Occupational Therapy*, *65*(1), 76–85 https://doi.org/10.5014/ajot.2011.09205

In 2014, an RCT showed benefits of sensory based occupational therapy:

Schaaf, R. C., Benevides, T., Mailloux, Z., Faller, P., Hunt, J., Van Hooydonk, E., Freeman, R., Leiby, B., Sendecki, J., & Kelly, D. (2014). An intervention for sensory difficulties in children with autism: A randomized trial. *Journal of Autism and Developmental Disorders, 44*(7), 1493-1506. https://doi.org/10.1007/s10803-013-1983-8

Sensory processing has been deemed as evidence-based in reviews of autism treatment.

Miller-Kuhaneck, H., & Watling, R. (2018). Parental or teacher education and coaching to support function and participation of children and youth with sensory processing and sensory integration challenges: A systematic review. *American Journal of Occupational Therapy*, *72*(1), 7201190030p1-7201190030p11. https://doi.org/10.5014/ajot.2018.029017

Schaaf, R. C., Dumont, R. L., Arbesman, M., & May-Benson, T. A. (2018). Efficacy of occupational therapy using Ayres Sensory Integration®: A systematic review. *American Journal of Occupational Therapy*, *72*(1), 7201190010p1-7201190010p10. https://doi.org/10.5014/ajot.2018.028431

Schoen, S. A., Lane, S. J., Mailloux, Z., May-Benson, T., Parham, L. D., Smith Roley, S., & Schaaf, R. C. (2019). A systematic review of Ayres Sensory Integration intervention for children with autism. *Autism Research*, *12*(1), 6-19. https://doi.org/10.1002/aur.2046

Hume, K., Steinbrenner, J. R., Odom, S. L., Morin, K. L., Nowell, S. W., Tomaszewski, B., Szendrey, S., McIntyre, N. S., Yücesoy-Özkan, S., & Savage, M. N. (2021). Evidence-based practices for children, youth, and young adults with autism: Third generation review. *Journal of Autism and Developmental Disorders*, *51*(11), 4013–4032. https://doi.org/10.1007/s10803-020-04844-2

Differences in sensory processing, sensory reactivity, and sensory integration as well as differences in praxis and motor abilities have now been more thoroughly described in autistic children.

Zampella, C. J., Wang, L. A., Haley, M., Hutchinson, A. G., & de Marchena, A. (2021). Motor skill differences in autism spectrum disorder: A clinically focused review. *Current Psychiatry Reports*, *23*(10), 1–11. https://doi.org/10.1007/s11920-021-01280-6

Schaaf, R. C., Mailloux, Z., Ridgway, E., Berruti, A. S., Dumont, R. L., Jones, E. A., Leiby, B.E., Sancimino, C., Yi, M., & Molholm, S. (2022). Sensory phenotypes in autism: Making a case for the inclusion of sensory integration functions. *Journal of Autism and Developmental Disorders*, 1-13. https://doi.org/10.1007/s10803-022-05763-0

Williams, Z. J., Schaaf, R., Ausderau, K. K., Baranek, G. T., Barrett, D. J., Cascio, C. J., ... & Woynaroski, T. G. (2023). Examining the latent structure and correlates of sensory reactivity in autism: A multi-site integrative data analysis by the Autism Sensory Research Consortium. https://doi.org/10.21203/rs.3.rs-2447849/v1

Daniel et al. report on the neuroscience of social-motor-synchrony and propose an intervention integrating rhythm, movement and social timing in a developmental intervention.

Daniel, S., Wimpory, D., Delafield-Butt, J. T., Malloch, S., Holck, U., Geretsegger, M., Tortora, S., Osborne, N., Schögler, B., Koch, S., Elias-Masiques, J., Howorth, M-C, Dunbar, P., Swan, K., Rochat, M.J., Schlochtermeier, R., Forster, K., & Amos, P. (2022). Rhythmic relating: Bidirectional support for social timing in autism therapies. *Frontiers in Psychology*, *13*, 793258. https://doi.org/10.3389/fpsyg.2022.793258

Anjana Bhat at the University of Delaware has reported the high percentage of autistic children that have motor impairments. She argues that motor impairment should be part of the definition of ASD. Her findings show that motor impairment is related to social communication, language, repetitive behavior and overall function.

Bhat, A. (2023). Multidimensional motor performance in children with autism mostly remains stable with age and predicts social communication delay, language delay, functional delay, and repetitive behavior severity after accounting for intellectual disability or cognitive delay: A SPARK dataset analysis. *Autism Research*, *16*(1), 208-229. https://doi.org/10.1002/aur.2870

Special interests are often related to differences in children's sensory processing profiles. These studies noted the benefit of honoring the child's interests:

In 2012, a meta-analysis of studies which incorporate the interest of the child showed effectiveness in influencing child outcomes.

Dunst, C. J., Trivette, C. M., & Hamby, D. W. (2012). Meta-analysis of studies incorporating the interests of young children with autism spectrum disorders into early intervention practices. *Autism research and treatment*, 2012. https://doi.org/10.1155/2012/462531

In 2019, Harrop et al. submitted a systematic review showing the benefit of including a child's special interests in intervention.

Harrop, C., Amsbary, J., Towner-Wright, S., Reichow, B., & Boyd, B. A. (2019). That's what I like: The use of circumscribed interests within interventions for individuals with autism spectrum disorder. A systematic review. *Research in Autism Spectrum Disorders*, *57*, 63-86. https://doi.org/10.1016/j.rasd.2018.09.008

"R" Relationship and Affect

Developmental models have evolved from many years of discovery in the field of infant mental health. Beginning in the 1950s, there was a new understanding of the importance of parent-infant interaction, known as attachment theory.

Bowlby, J. (1951). *Maternal care and mental health*. World Health Organization (WHO). Monograph Series, no. 51. Geneva: World Health Organization. https://iris.who.int/handle/10665/40724

Ainsworth, M., Bell, S.M., & Stayton, D. (1974). Infant-mother attachment and social development: Socialization as a product of reciprocal responsiveness to signals. In M. Richards, ed., *The Integration of the Child into a Social World.* Cambridge: Cambridge University Press, 99-135. https://awspntest.apa.org/record/1975-07118-004

Stern, D. (1974). Mother and infant at play: The dyadic interaction involving facial, vocal, and gaze behaviors. In M. Lewis and L. Rosenblum, eds., *The Effect of the Infant on its Caregiver*. New York: John Wiley & Sons, Inc. https://psycnet.apa.org/record/1987-97591-000

Drs. Stanley Greenspan and Serena Wieder contributed to the field with their study of the importance of mother-child interactions in high-risk infants.

National Center for Clinical Infant Programs (1987). *Infants in Multirisk Families. Case Studies in Preventive Intervention*. Stanley I. Greenspan, Serena Wieder, Robert A. Nover, Alicia Lieberman, Reginald S. Lourie, Mary E. Robinson, eds. Clinical infant Reports, Number three. International Universities Press. https://psycnet.apa.org/record/1987-97591-000

Other researchers have contributed to the appreciation of parent-child interaction for child development:

Mundi, P., Sigman M., Kasari C. (1990). A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and developmental Disorders* 20:115-128. https://doi.org/10.1007/BF02206861

Alan Fogel (1993). *Developing Through Relationships*, The University of Chicago Press. Synopsis available at http://www.press.uchicago.edu/presssite/metadata.epl?mode=synopsis&bookkey=52786

Gernsbacher M.A., (2006). Toward a behavior of reciprocity. *Journal of Developmental Processes, 1*, 139-152. http://psych.wisc.edu/lang/pdf/gernsbacher_reciprocity.pdf

Relationship based intervention includes not only the parent-child relationship, but other important relationships with family members, peers, caregivers, and clinicians.

SCERTS (Social Communication, Emotional Regulation, Transactional Support) is a comprehensive developmental model that includes a focus on interactions between a child, parents, peers, teachers, and other clinicians. The SCERTS model was developed over many years of study of language and learning and has multiple research studies documenting effectiveness.

Yi J, Kim W, Lee J. (2022) Effectiveness of the SCERTS Model-Based interventions for autistic children: A systematic review. *Journal of Speech, Language, and Hearing Research*, *65*(7), 2662-2676. https://doi.org/10.1044/2022_JSLHR-21-00518

In 2002, Bradberry & Feder reported the use of DIR with adolescents and graduate students functioning in ‘big brother’ roles.

Bradberry, T., & Feder, J. (2002). Case Studies of Graduate Students Implementing DIR Programs. *The Journal of Developmental and Learning Disorders*, 49.

"Parent mediated" or "parent implemented" interventions are now recognized as evidence based on recent reviews. There are many studies that find correlations between the strength of parental sensitivity and responsiveness and child outcomes, including:

Mahoney, G., Perales, F., Wiggers, B., & Herman, B. (2006). Responsive Teaching: Early Intervention for Children with Down Syndrome and Other Disabilities. *Down Syndrome Research and Practice*, *11*(1), 18-28. DOI: 10.3104/perspectives.311

Solomon, R., Necheles, J., Ferch, C., & Bruckman, D. (2007). Pilot study of a parent training program for young children with autism: The PLAY Project Home Consultation program. *Autism*, *11*(3), 205-224. https://doi.org/10.1177/1362361307076842

Siller, M., & Sigman, M. (2008). Modeling longitudinal change in the language abilities of children with autism: Parent behaviors and child characteristics as predictors of change. *Developmental psychology*, *44*(6), 1691. https://doi.org/10.1037/a0013771

Ingersoll, B., & Wainer, A. (2013). Initial efficacy of Project ImPACT: A parent-mediated social communication intervention for young children with ASD. *Journal of autism and developmental disorders*, *43*(12), 2943-2952. https://doi.org/10.1007/s10803-013-1840-9

Siller, M., Swanson, M., Gerber, A., Hutman, T., & Sigman, M. (2014). A parent-mediated intervention that targets responsive parental behaviors increases attachment behaviors in children with ASD: Results from a randomized clinical trial. *Journal of autism and developmental disorders*, *44*(7), 1720-1732. https://doi.org/10.1007/s10803-014-2049-2

Bottema-Beutel, K., Yoder, P. J., Hochman, J. M., & Watson, L. R. (2014). The role of supported joint engagement and parent utterances in language and social communication development in children with autism spectrum disorder. *Journal of autism and developmental disorders*, *44*(9), 2162-2174. https://doi.org/10.1007/s10803-014-2092-z

Patterson, S. Y., Elder, L., Gulsrud, A., & Kasari, C. (2014). The association between parental interaction style and children's joint engagement in families with toddlers with autism. *Autism*, *18*(5), 511-518. https://doi.org/10.1177/1362361313483595

Pajareya, K., Sutchritpongsa, S., & Kongkasuwan, R. (2019). DIR/Floortime® Parent Training Intervention for Children with Developmental Disabilities: a Randomized Controlled Trial. *Siriraj Medical Journal*, *71*(5), 331-338. https://doi.org/10.33192/Smj.2019.51

Schertz et al. used a qualitative analysis to describe factors affecting parent self-efficacy, showing the value of their involvement.

Schertz, H. H., Lester, J. N., Erden, E., Safran, S., & Githens, P. (2020). Challenges and contributors to self-efficacy for caregivers of toddlers with autism. *Autism*, 24(5), 1260-1272. https://doi.org/10.1177/1362361319899761

Liu and Schertz reported parents' outcomes using JAML (Joint Attention Mediated Learning), and its effects on child outcomes.

Liu, X., & Schertz, H. H. (2022). Parents outcomes of parent-mediated intervention for toddlers with autism. *Topics in Early Childhood Special Education*, 42(3), 259-268. https://doi.org/10.1177/02711214211019117

Schertz, H. H., Liu, X., Odom, S. L., & Baggett, K. M. (2022). Parents' application of mediated learning principles as predictors of toddler social initiations. *Autism*, 26(6), 1536-1549. https://doi.org/10.1177/1362361321106111

Mahoney and Solomon analyzed how parent's interaction mediated the effects on children's outcomes in the study of PLAY Project.

Mahoney, G., & Solomon, R. (2016). Mechanism of developmental change in the PLAY project home consultation program: Evidence from a randomized control trial. *Journal of autism and developmental disorders*, 46, 1860-1871. https://doi.org/10.1007/s10803-016-2720-x

In 2020 Mahoney and Solomon again analyzed the 2014 study regarding the effects of parental depression on outcome. They found that levels of parental depression did not affect parents' interaction or child engagement and that those with more depression at the onset had the greatest improvement in their depression symptoms.

Mahoney, G. J., & Solomon, R. M. (2020). Effects of parental depression symptoms on parents and children with autism spectrum disorder in the play project home consultation program. *International Journal of Early Childhood Special Education*, 12(1), 28-40. https://doi.org/10.20489/intjecse.722333

Karaaslan and Mahony analyze how maternal responsiveness mediated pivotal behaviors, which contributed to outcomes in a program using Responsive Teaching.

Karaaslan, O., Diken, I., & Mahoney, G. (2013). A randomized control study of Responsive Teaching with young Turkish Children and their mothers. *Topics in Early Childhood Special Education, 33,* 18-27. https://doi.org/10.1177/0271121411429749

Karaaslan, O., & Mahoney, G. (2015). Mediational analyses of the effects of responsive teaching on the developmental functioning of preschool children with disabilities. *Journal of Early Intervention*, 37(4), 286-299. https://doi.org/10.1177/1053815115617294

In 2016, a randomized controlled trial demonstrated a "significant and large effect" of a 12-session course of DIR to increase "parental reflexive function capacities."

Sealy, J. & Glovinsky, I. P (2016). "Strengthening the reflective functioning capacities of parents who have a child with a neurodevelopmental disability through a brief, relationship-focused intervention." *Infant Mental Health Journal,* 37(2),115-124. https://doi.org/10.1002/imhj.21557

In 2020, Shamsudin et al. reported a qualitative study using semi-structured interviews to elicit parents' perceptions of implementing a DIRFloortime® program in Malaysia. Results showed benefits for children and parents as well as describing their challenges.

Shamsudin, I. D., Brown, T., Yu, M. L., & Lentin, P. (2021). Parents of children with autism spectrum disorder's perception on parent-implemented home-based developmental, individual-difference and relationship (DIR)/Floortime® intervention. *Advances in Autism*, *7*(4), 294-310. DOI:10.1108/AIA-05-2020-0032

In 2020, Leadbitter et al. published a qualitative study showing that parents who participated in PACT experienced improvements in the quality of the relationships and interactions with their children.

Leadbitter, K., Macdonald, W., Taylor, C., Buckle, K. L., & PACT Consortium. (2020). Parent perceptions of participation in a parent-mediated communication-focused intervention with their young child with autism spectrum disorder. *Autism, 24*(8), 2129-2141. https://doi.org/10.1177/1362361320936394

The following 6 articles are reports about Video Interaction to Promote Positive Parenting (VIPP). VIPP uses video feedback to increase caregivers' awareness of their

infant's social communication and guide their responses to build infant social engagement and interaction. These studies illustrate the impact of caregivers' relationship on the developmental course of high risk children and children with a diagnosis of autism.

Green et al. (2013) reported an initial pilot case series of iBASIS-VIPP with infants 8-10 months of age at high risk for autism.

Green, J., Wan, M. W., Guiraud, J., Holsgrove, S., McNally, J., Slonims, V., ... & BASIS team. (2013). Intervention for infants at risk of developing autism: a case series. *Journal of autism and developmental disorders*, *43*, 2502-2514. https://doi.org/10.1007/s10803-013-1797-8

In 2015, Green et al. showed broad effects in an RCT using iBASIS-VIPP with high-risk infants, and a follow-up study showed extended treatment effects (Green 2017).

Green, J., Charman, T., Pickles, A., Wan, M. W., Elsabbagh, M., Slonims, V., ... & Johnson, M. H. (2015). Parent-mediated intervention versus no intervention for infants at high risk of autism: a parallel, single-blind, randomised trial. *The Lancet Psychiatry*, 2(2), 133-140. DOI: 10.1016/S2215-0366(14)00091-1

Green, J., Pickles, A., Pasco, G., Bedford, R., Wan, M. W., Elsabbagh, M., ... & McNally, J. (2017). Randomised trial of a parent-mediated intervention for infants at high risk for autism: Longitudinal outcomes to age 3 years. *Journal of Child Psychology and Psychiatry*, 58(12), 1330-1340. https://doi.org/10.1111/jcpp.12728

In 2015, an RCT reported effects of a version of VIPP, called VIPP-AUTI, adapted for young children with a diagnosis of autism.

Poslawsky, I. E., Naber, F. B., Bakermans-Kranenburg, M. J., De Jonge, M. V., Van Engeland, H., & Van IJzendoorn, M. H. (2014). Development of a video-feedback intervention to promote positive parenting for children with autism (VIPP-AUTI). *Attachment & Human Development*, *16*(4), 343-355. https://doi.org/10.1080/14616734.2014.912487

Poslawsky, I. E., Naber, F. B., Bakermans-Kranenburg, M. J., Van Daalen, E., Van Engeland, H., & Van Ijzendoorn, M. H. (2015). Video-feedback Intervention to promote Positive Parenting adapted to Autism (VIPP-AUTI): A randomized controlled trial. *Autism*, *19*(5), 588-603. https://doi.org/10.1177/1362361314537124

In 2021, an RCT reported decreased symptom severity with infants showing early signs of autism (Whitehouse et al., 2021).

Whitehouse, A. J., Varcin, K. J., Pillar, S., Billingham, W., Alvares, G. A., Barbaro, J., ... & Hudry, K. (2021). Effect of preemptive intervention on developmental outcomes among infants showing early signs of autism: A randomized clinical trial of outcomes to diagnosis. *JAMA Pediatrics*, 175(11), e213298-e213298. doi:10.1001/jamapediatrics.2021.3298Also, an adapted version of Responsive Teaching was reported in 2015 for children at high risk of autism.

Baranek, G. T., Watson, L. R., Turner-Brown, L., Field, S. H., Crais, E. R., Wakeford, L., ... & Reznick, J. S. (2015). Preliminary efficacy of adapted responsive teaching for infants at risk of autism spectrum disorder in a community sample. *Autism Research and Treatment*, *2015*, 386951. https://doi.org/10.1155/2015/386951

Increasingly, the emergence of autistic symptomatology is considered to be a process of derailing development with both constitutional and transactional causes.

Klin, A., Micheletti, M., Klaiman, C., Shultz, S., Constantino, J. N., & Jones, W. (2020). Affording autism an early brain development re-definition. *Development and Psychopathology*, *32*(4), 1175-1189. https://doi.org/10.1017/S0954579420000802

Green, J. (2022). Autism as emergent and transactional. *Frontiers in Psychiatry, 13*, 988755. https://doi.org/10.3389/fpsyt.2022.988755

Developmental approaches consider the parent's insight and parental stress to be core areas for intervention. Numerous studies have explored the issue of reducing parental stress and improving parental insightfulness, including:

Di Renzo, M., Guerriero, V., Zavattini, G. C., Petrillo, M., Racinaro, L., & Bianchi di Castelbianco, F. (2020). Parental attunement, insightfulness, and acceptance of child diagnosis in parents of children with autism: Clinical implications. *Frontiers in Psychology*, *11*, 1849. https://doi.org/10.3389/fpsyg.2020.01849

Di Renzo, M., Guerriero, V., Petrillo, M., & Bianchi di Castelbianco, F. (2022). What is parental stress connected to in families of children with autism spectrum disorder? Implications for parents' interventions. *Journal of Family Issues*, *43*(9), 2456-2479. https://doi.org/10.1177/0192513X211030735

The changes in early parent-infant interaction for infants at elevated likelihood of autism are explored in this 2024 study:

Papageorgopoulou, E., Jones, E. J., Johnson, M. H., Charman, T., Green, J., Wan, M. W., & BASIS-STAARS Team. (2024). Parent–infant interaction trajectories in infants with an elevated likelihood for autism in relation to 3-year clinical outcome. *Autism Research*, *17*(10), 2018-2029. https://doi.org/10.1002/aur.3190

In 2024, a systematic review found that parental insightfulness was associated with higher parental sensitivity and attachment security in autistic children.

Lee, J. Y. S., Whittingham, K., & Mitchell, A. E. (2024). Parental Insightfulness, Parental Sensitivity, Parent and Child Mental Health, and Attachment in Autistic Children: A Systematic Review. *Review Journal of Autism and Developmental Disorders*, 1-16. https://doi.org/10.1007/s40489-024-00482-x

Recent Reviews

Several recent reviews provide consensus regarding the research support for developmental interventions, including DIRFloortime.

1. In 2019, a systematic review was conducted on developmental interventions. The review exclusively evaluated randomized controlled trials and covered six interventions. Ten studies reported outcomes of 716 preschool-aged children with autism spectrum disorder. "This review suggests the developmental social pragmatic treatments positively impact children's foundational communication capacities (i.e. attention, social referencing, joint attention, initiative, and reciprocity)."

Binns, A. V., & Oram Cardy, J. (2019). Developmental social pragmatic interventions for preschoolers with autism spectrum disorder: A systematic review. *Autism & Developmental Language Impairments*, *4*, 2396941518824497. https://doi.org/10.1177/2396941518824497

2. In 2020, a meta-analysis was conducted on autism interventions for young children. This study "suggests that naturalistic developmental behavioral interventions and developmental intervention approaches have amassed enough quality evidence to be considered promising for supporting children with ASD in achieving a range of developmental outcomes."

Sandbank, M., Bottema-Beutel, K., Crowley, S., Cassidy, M., Dunham, K., Feldman, J. I., ... & Woynaroski, T. G. (2020). Project AIM: Autism intervention meta-analysis for studies of young children. *Psychological Bulletin*, *146*(1), 1-29. https://doi.org/10.1037/bul0000215

3. In 2020, a review was conducted in Spain, gathering evidence on early intervention programs for autistic children.

Rojas-Torres, L. P., Alonso-Esteban, Y., & Alcantud-Marín, F. (2020). Early intervention with parents of children with autism spectrum disorders: A review of programs. *Children*, *7*(12), 294. https://doi.org/10.3390/children7120294

4. In 2020, The National Clearinghouse on Autism Treatment at the University of North Carolina, looked at "Evidence-based practices for children, youth, and young adults with autism." The report names as evidence-based 'naturalistic interventions' "which emerge from behavioral and/or developmental approaches to learning." The report also names as evidence-based parent-implemented interventions. Many recognized developmental approaches are included in these two categories.

Steinbrenner, J. R., Hume, K., Odom, S. L., Morin, K. L., Nowell, S. W., Tomaszewski, B., ... & Savage, M. N. (2020). Evidence-based practices for children, youth, and young adults with autism. The University of North Carolina at Chapel Hill, Frank Porter Graham Child Development Institute, National Clearinghouse on Autism Evidence and Practice Review Team.

5. In 2020 a systematic review was conducted of specifically DIRFloortime programs. The conclusion was that "the evidence-base for this model is emerging." "The most prominent positive outcome is social-emotional."

Boshoff, K., Bowen, H., Paton, H., Cameron-Smith, S., Graetz, S., Young, A., & Lane, K. (2020). Child development outcomes of DIR/Floortime™-based programs: A systematic review. *Canadian Journal of Occupational Therapy, 87*(2), 153-164. https://doi.org/10.1177/0008417419899224

6. In 2020, a systematic review and meta-analysis showed positive treatment effects for parent training, specifically DIRFloortime.

Deb, S., Retzer, A., Roy, M., Acharya, R., Limbu, B., & Roy, A. (2020). The effectiveness of parent training for children with autism spectrum disorder: a systematic review and meta-analyses. *BMC Psychiatry*, *20*, 1-24. https://doi.org/10.1186/s12888-020-02973-7

7. In 2021, a systematic review (the third iteration of previous reviews by Wong et. al.) from interventions in the categories of parent-implemented interventions and

naturalistic interventions, including developmental approaches, met criteria for evidence-based practice.

Hume, K., Steinbrenner, J. R., Odom, S. L., Morin, K. L., Nowell, S. W., Tomaszewski, B., ... & Savage, M. N. (2021). Evidence-based practices for children, youth, and young adults with autism: Third generation review. *Journal of autism and developmental disorders*. *51*(11), 4013–4032. https://doi.org/10.1007/s10803-020-04844-2

8. In 2022, A meta-analysis of randomized controlled trials of parent-implemented interventions for children with autismwhich included many developmental interventions, including DIR, showed benefits.

Cheng, W. M., Smith, T. B., Butler, M., Taylor, T. M., & Clayton, D. (2022). Effects of parent-implemented interventions on outcomes of children with autism: A meta-analysis. *Journal of Autism and Developmental Disorders*, 1-17. https://doi.org/10.1007/s10803-022-05688-8

9. In 2022, Francis et al. published a review of play-based interventions and their impact on mental health for autistic children. They found 10 studies, (3 using DIR), concluding there are beneficial effects on positive mental health outcomes.

Francis, G., Deniz, E., Torgerson, C., & Toseeb, U. (2022). Play-based interventions for mental health: A systematic review and meta-analysis focused on children and adolescents with autism spectrum disorder and developmental language disorder. *Autism & Developmental Language Impairments, 7,* 23969415211073118. https://doi.org/10.1177/23969415211073118

10. In 2023, an umbrella review of 58 systematic reviews identified "positive therapeutic effects" for developmental interventions.

Trembath, D., Varcin, K., Waddington, H., Sulek, R., Bent, C., Ashburner, J., ... & Whitehouse, A. (2023). Non-pharmacological interventions for autistic children: An umbrella review. *Autism*, *27*(2), 275-295. https://doi.org/10.1177/13623613221119368

11. In 2023, Dijkstra-de Neijs et.al. published a systematic review of play-based interventions, which included several DIR studies. The review showed evidence of effectiveness of play-based interventions and the authors hypothesized that the benefits may have been due to parent and child playing together which lead to an increase in social behavior.

Dijkstra-de Neijs, L., Tisseur, C., Kluwen, L. A., Van Berckelaer-Onnes, I. A., Swaab, H., & Ester, W. A. (2023). Effectivity of play-based interventions in children with autism spectrum disorder and their parents: a systematic review. *Journal of Autism and Developmental Disorders, 53*(4), 1588-1617. https://doi.org/10.1007/s10803-021-05357-2

12. In 2024, Deniz et al. reported a systematic review and meta-analysis of parent mediated play-based interventions. Two of the twenty-one studies were based on DIRFloortime® interventions. The study reported the effectiveness of this type of intervention.

Deniz, E., Francis, G., Torgerson, C., & Toseeb, U. (2024). Parent-mediated play-based interventions to improve social communication and language skills of preschool autistic children: A systematic review and meta-analysis. *Review Journal of Autism and Developmental Disorders*, 1-21. https://doi.org/10.1007/s40489-024-00463-0

Future Research

There is a need for continued research to evaluate the effectiveness of treatment. Current needs include studies which are long term, evaluate children based on individual profiles in addition to diagnosis, include older children, and include children at all levels of function. Studies would benefit from further description of treatment strategies, differences in parent styles, as well as differences in children's abilities.

Future research will also be informed by genetics, new technologies to track complex patterns of interaction, and direct measurements of brain function. Autism is now understood to involve differences in the integration of various distinct brain functions. Developmental intervention is based upon the use of affective interactions to enhance integration of sensory-regulatory, communication, and motor systems. Neuro-imaging techniques may be used more extensively to show how intervention changes brain function.

Undoubtedly, researchers will continue to refine our understanding of developmental differences and how to best support child development to achieve the optimal long-term outcome.

Claims & Questions

Sweeping claims have been made about the effectiveness of behavioral approaches, specifically ABA. However, there continues to be reservation about the quality of research, the strength of evidence for addressing the core features of autism, and long-term success. The 2020 meta-analysis by Sandbank et al. referenced above states, "Behavioral intervention approaches also show evidence of effectiveness, but methodological rigor remains a pressing concern in the area of research."

Eric Shyman authored a book, Besieged by Behavior Analysis for Autism Spectrum, which details the history of use and concerns with ABA for autism.

Shyman, E. (2014). *Besieged by Behavior Analysis for Autism Spectrum Disorder: A Treatise for Comprehensive Educational Approaches*. Lexington Books.

In 2017, Laurent Mottron in Quebec, Canada authored an article that questions the underlying basis of ABA and the efficacy of ABA approaches in early intervention. The article provides references to other articles that raise concerns about ABA and offers recommendations for alternative approaches.

Mottron, L. (2017) Should we change targets and methods of early intervention in autism, in favor of a strengths-based education? *European Child and Adolescent Psychiatry*, *26*, 815–825. https://doi.org/10.1007/s00787-017-0955-5

Researchers have questioned the criteria used to determine evidence-based practice, and in particular note that when rigorous criteria are used, there is inadequate support for ABA.

Bottema-Beutel, K. (2023). We must improve the low standards underlying "evidence-based practice". *Autism, 27*(2), 269-274. https://doi.org/10.1177/13623613221146441

The 2024 annual report of the Autism Comprehensive Care Demonstration Program, provided through Tricare, the insurance program for the US Department of Defense, reported the results of their monitoring of ABA services. At the end of 2022 they had 16,156 children enrolled and studied a sample of 497. Tricare submits annual reports which provide a detailed analysis of the ABA services that are provided.
Of note:

Previous annual reports have discussed the status of the research literature regarding ABA services. While DHA continues to monitor the literature, there have been no significant advances in the ABA research with regards to defining dose-response (including intensity, frequency, or duration), for whom ABA is most effective, and what clinical outcomes could be expected as a result of ABA interventions. As of now, ABA services do not meet the TRICARE hierarchy of reliable evidence standard for proven medical care.

https://health.mil/Reference-Center/Reports/2024/01/08/Annual-Report-on-Autism-Care-Demonstration

As insurance companies are questioning the time, cost, and effectiveness of behavioral approaches, academic scholars are also increasingly reconsidering the basis and outcome of accepted practice. The voices of adults with autism have contributed to this reexamination of behavioral intervention methods, with questions about ethics, values, and self-identity.

Parent choice

Part of the definition of "evidence base" is clinical experience and expertise. While research efforts continue to explore the etiology, biology, and efficacy of treatment approaches for autism, clinical experience also continues to accumulate. DIRFloortime® programs have high family satisfaction ratings and are widely utilized throughout the world as an effective framework for assessment and intervention.

A review by the National Institute of Mental Health (NIMH) states, "There is no single best treatment package for all children with ASD. Decisions about the best treatment, or combination of treatments, should be made by the parents with the assistance of a trusted expert diagnostic team."

NIMH. (June 2, 2009). *Autism Spectrum Disorders (Pervasive Developmental Disorders.* Retrieved June 8, 2009, from http://www.nimh.nih.gov/health/topics/autism-spectrum-disorders-pervasive-developmental-disorders/index.shtml

Because of the wide range of individual differences in children with autism, and the many unique relationships within families, it is necessary and proper for parents to have the information and options necessary to make informed choices about the type of services their child will receive. DIRFloortime has a solid base of empirical evidence and is widely used for children of all ages and abilities. Evidence based practice means the

clinician should utilize all types of information including clinical expertise and a family's individual values and preferences, in addition to published research. There is ample evidence for the effectiveness of DIRFloortime to support an informed parent choice.

Sandbank states, "States with insurance mandates that explicitly cover traditional behavioral interventions should furthermore revise their policies to also include NDBI and developmental approaches given that these approaches have now accrued substantial evidence for effects in young children on the autism spectrum from recently published RCTs."

Sandbank, M., Bottema-Beutel, K., Crowley, S., Cassidy, M., Dunham, K., Feldman, J. I., ... & Woynaroski, T. G. (2020). Project AIM: Autism intervention meta-analysis for studies of young children. *Psychological Bulletin*, *146*(1), 1-29. https://doi.org/10.1037/bul0000215

There is sufficient evidence from academic research, clinical practice, and family values and preferences for professionals to recommend DIRFloortime as a viable choice of therapeutic approach for children with autism. There is also a sufficient evidence base for states and insurance companies to include DIRFloortime programs in their covered benefits so that developmental approaches are accessible.

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