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**Communication Development and
Down Syndrome: Strengths and
Challenges, Patterns of Change,
and Potential Interventions**

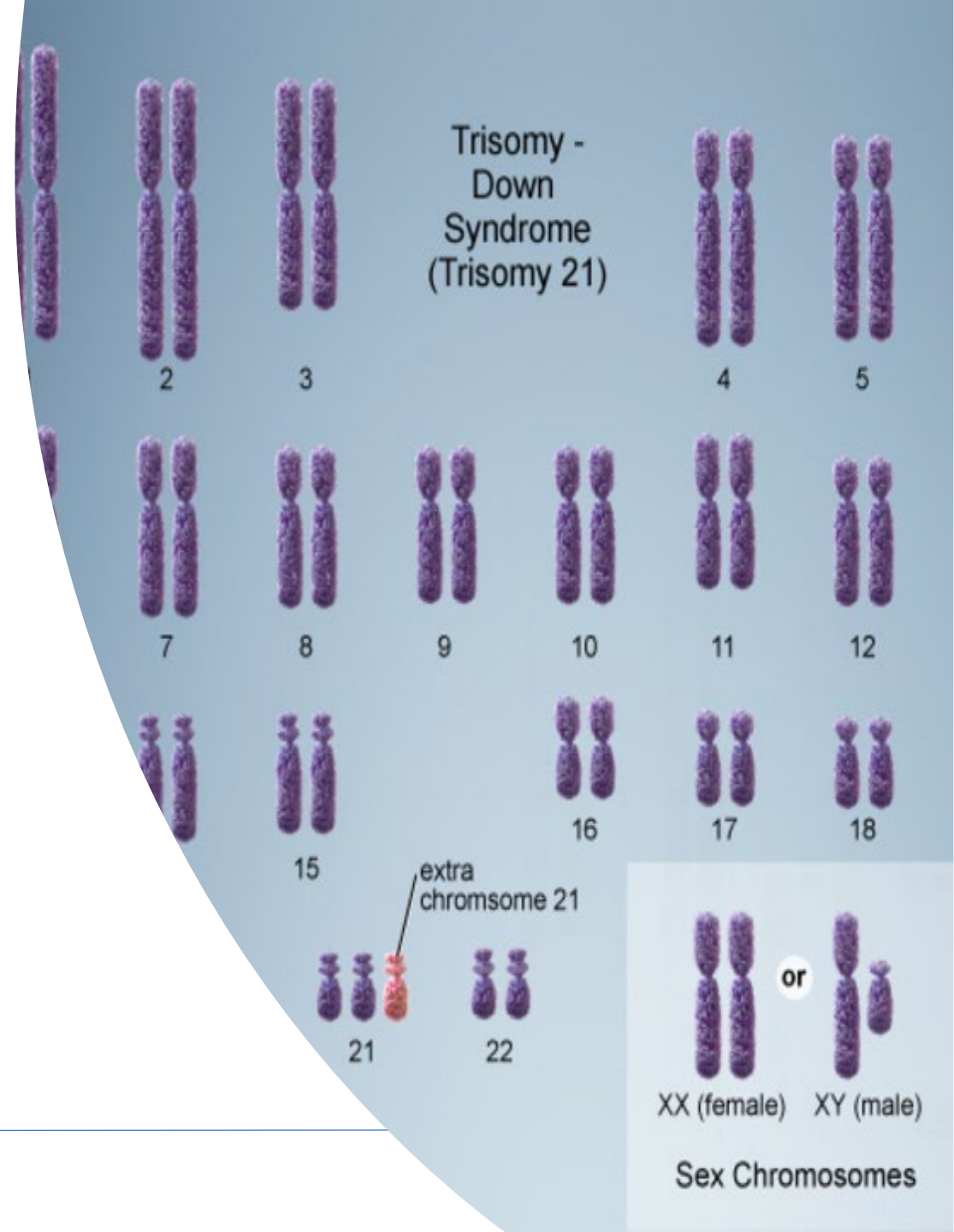
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Outline

- What do we know about early communication and language development in children with Down syndrome?
- How do we measure communication and language development?
- What do we know about later language development and decline?
- How can we support communication and language development across the life span?
- Some take aways

Early Communication Development



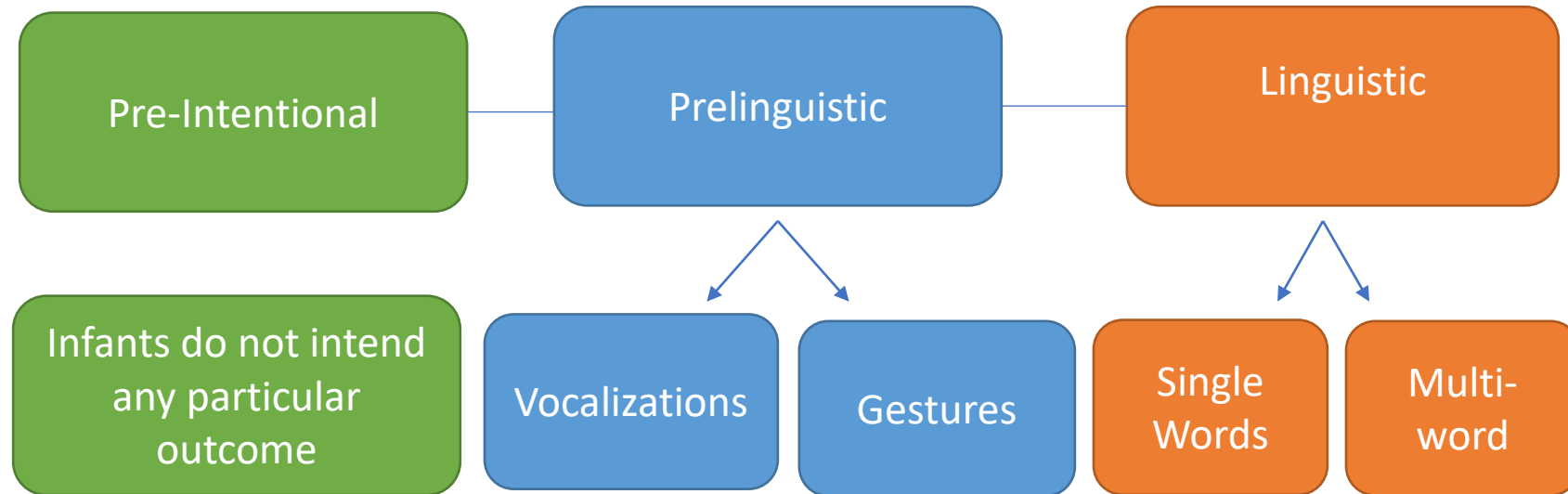
Communication Development - Overall

- Development of communication skills varies greatly among individuals with Down syndrome
- Multiple factors can influence communication development
- As a group:
 - Development is delayed relative to peers with typical development
 - The rate of growth may be slower, but growth is often observed
 - Learning in some areas of communication may be easier than others
 - Learning new words (vocabulary) is often easier than learning how to combine words into sentences (syntax)

Communication Development - Stages

- Children begin communicating long before they start talking in words
 - Vocalizations
 - Gestures
- Alternate forms of spoken words may also develop before spoken communication skills
 - Manual Signs (ASL)
 - PECS

Communication Development - Stages



Communication Development - Vocalizations

- Before children can produce and combine words, they must first learn how to articulate and form the sounds (phonology)
- Some forms of vocalizations (canonical babbling: babababa) may be delayed or less frequent than is observed in peers without Down syndrome
- Multiple factors make the perception and production of speech more challenging
- As a result, phonological skills remain an area of clinical focus often into adulthood.

Communication Development - Gestures

- Gestures are often described as an area of relative strength
- Gesture use predicts later language development
 - A bridge to the development of linguistic communication (words)
- Children with Down syndrome may continue to use gestures frequently, even after starting to transition to using words to communicate
- Skills often emerge in gesture form before linguistic communication forms
 - Gesture word combinations -> Two-word combinations

Communication Development - Linguistic

- First words
 - May be observed between 12 and 24 months
 - Growing the number of words said occurs more slowly
- Word Combinations
 - Typically emerges after a period of vocabulary growth
 - Delays observed due to time needed to gain enough first words
 - Common to observe delays in transitioning to word combination even with a relatively robust vocabulary of single words

Communication Development - Linguistic

	Children with Typical Development	Children with Down Syndrome
First Words	10 - 15 months	12% of kids by 23 months 80% of kids by 35 months
50-Word Vocabulary Size	18 – 24 months	50% of kids by 4 years 75% of kids by 5 years
Two-Word Combinations	18 – 24 months	> 3.5 years

Measuring Communication and Language in Individuals with Down Syndrome



Context and Early Communication Development

- Familiarity/Demand
- Communicative Partner
- Communicative Context



Indicators of Growth in Early Communication

- Indicators of progress vary across developmental stages

Prelinguistic	
Vocalizations	Reflexive sounds – cooing – expansions – canonical babbling - meaningful speech
Gestures	Deictic – representational/symbolic gestures – word + gesture combinations
Linguistic	
Words	# Words Used – Types of Words Used
Combinations	Sentence Length – Word Endings – Sentence Types

- Prelinguistic skills often steadily increase and then gradually decrease as children shift to more mature acts
- Are we measuring growth within and across communication levels?

Measuring Language

- Standardized Tests
 - Clinical Evaluation of Language Fundamentals, 5th edition
 - Preschool Language Scales, 5th edition
 - Goldman-Fristoe Test of Articulation, 4th edition
- Caregiver Report
 - MacArthur-Bates Communicative Development Inventories, 3rd edition
 - Children's Communication Checklist, 2nd edition



- Experimental/Laboratory Measures
- Technology-based
 - Eye-tracking
- Expressive language sampling

Measuring Language Through Expressive Language Sampling (ELS)

- Long history of use in clinical contexts and research describing the development of, and impairments in, spoken language
- Collect a brief but “**representative**” sample of spoken language
- Transcribe and analyze sample along various dimensions
- Make inferences about the speaker’s language abilities

ELS Contexts

Free play with
parent

Structured play
with examiner

Conversation
with peers

Storytelling
(narration)

Picture
description

Communication
probes

ELS: Conversation and Narration

Conversation

- Introduction: What did you do *after school* yesterday? Tell me everything you did.
- Possible follow-ups: What's your absolute favorite thing to do after school? Tell me all about it.

Narration

- Mercer Mayer's "Frog Goes to Dinner"



Parents as Examiners in ELS

TABLE 4 | Percent of fidelity scoring rubric (FSR) elements scored correct in each session for the 22 parents who participated in the study.

Parent ID	Homework 1	Homework 2	Homework 3	Homework 4	Homework 5	Test	Re-Test
NSSP-1	37.7%	78.3%	52.2%	61.6%	59.6% ^{FNR}	65.7%	83.0%
NSSP-2	60.0%	84.3%	74.0%	83.0%	91.6% ⁵	91.0%	96.6%
NSSP-3	68.0%	68.3%	92.6%	90.0% ⁴	NN	96.4%	91.0%
NSSP-4	71.0%	83.0%	81.0%	87.0%	68.0%	95.0%	100.0%
NSSP-5	72.0%	89.8%	100.0% ³	NN	NN	72.7%	91.0%
NSSP-6	73.4%	91.8%	88.4% ²	NN	NN	90.9%	82.2%
NSSP-7	43.8%	23.4%	38.0%	47.0%	54.6% ^{FNR}	54.5%	28.4%
NSSP-8	94.7%	89.5% ²	98.0%	NN	NN	100.0%	91.2%
NSSP-9	42.8%	68.4%	100%	98.2% ⁴	NN	96.4%	95.5%
NSSP-10 ^D	51.9%	40.0%	49.8%	-	-	-	-
NSSP-11	17.0%	41.7%	28.8%	55.2%	76.6% ^{FNR}	83.1%	80.0%
NESP-1	71.0%	90.0%	86.0% ³	NN	NN	94.0%	78.0%
NESP-2	73.0%	86.0%	93.0% ³	NN	NN	85.0%	81.0%
NESP-3	82.0%	80.7%	91.0% ³	NN	NN	95.5%	62.9%
NESP-4 ^D	90.0%	-	-	-	-	-	-
NESP-5	96.0%	87.7% ²	88.0%	NN	NN	98.2%	69.6%
NESP-6	72.0%	98.0%	88.0% ³	NN	NN	91.8%	91.2%
NESP-7	78.1%	84.7%	88.0%	93.0% ⁴	NN	96.7%	89.3%
NESP-8	88.0%	84.0%	90.7% ³	NN	NN	82.7%	95.1%
NESP-9	92.0%	95.7% ²	74.5%	NN	NN	96.6%	99.1%
NESP-10	97.3%	90.4% ²	88.5%	NN	NN	98.2%	100.0%
NESP-11 ^D	94.7%	92.9% ²	98.0%	NN	NN	-	-

Percentages correspond to the score achieved by each parent in the FSR for each ELS-N administration. Proficiency during homework was predetermined as achieving at least one FNR > 80 in one session + a > 90 in another session. In order to be cleared for Test-retest all parents were required to conduct at least 3 homework administrations even if they achieved proficiency in two sessions. The exponent number on the last homework session corresponds to the number of homework sessions in which parents reached proficiency (e.g., 2, 3, 4, or 5). Parents with both Test and Re-test shadowed are those who maintained fidelity (i.e., >80%) in both sessions. NSSP, native Spanish-speaking parents; NESP, native English-speaking parents; D, family dropped; -, sessions not completed due to family dropping; NN, sessions not needed; FNR, fidelity not reached.

Del Hoyo Soriano et al.
2021 Front Rehab

Later Stages of Language Development: Older Children, Adolescents, Young Adults

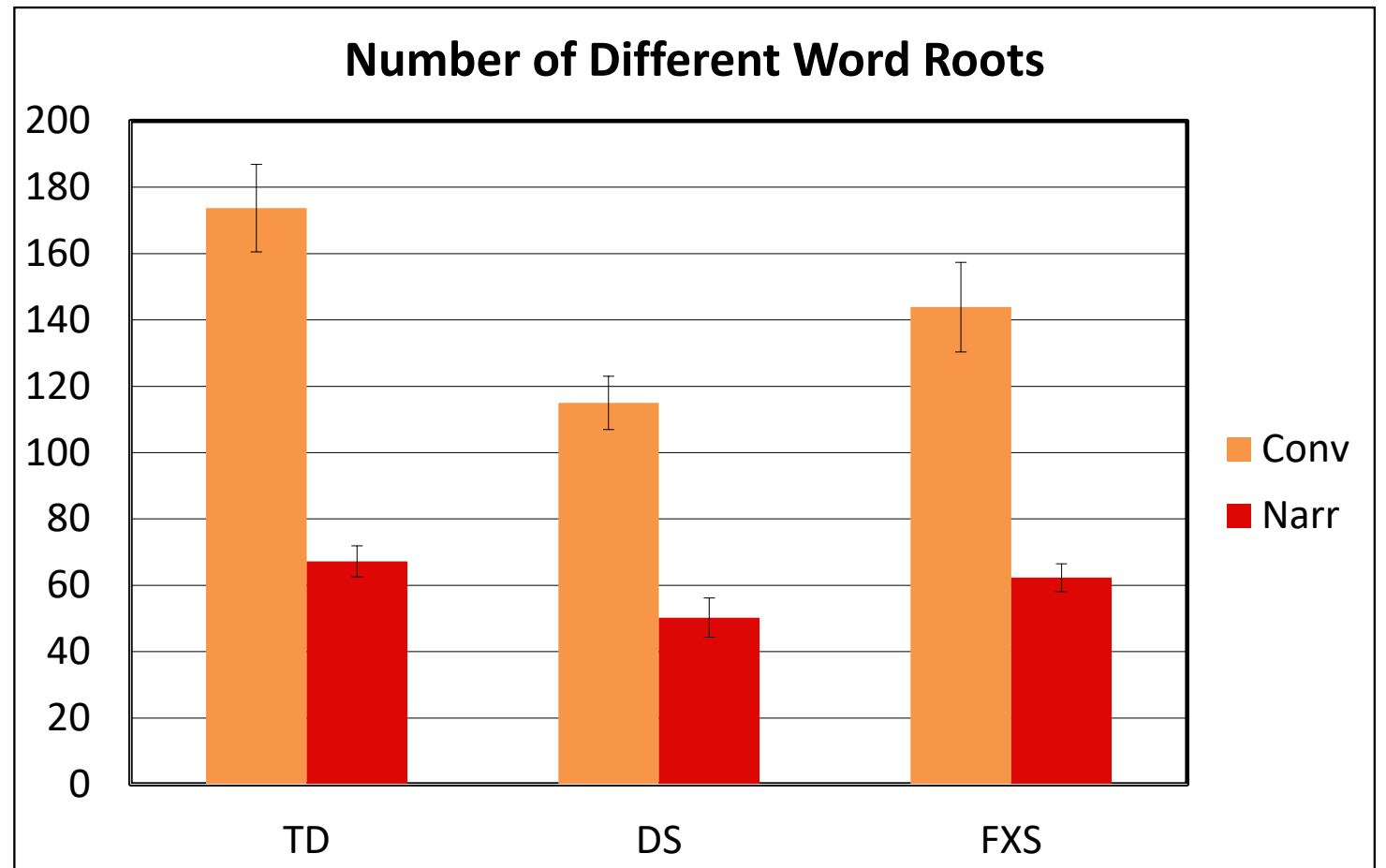


An Important Caveat

- General trends but considerable variation in language development among people with Down syndrome
- Variation in language development related to...
 - Age
 - Nonverbal cognitive ability
 - Auditory memory
 - Hearing
 - Parent education
 - Parent-child relationship and parent behavior in interactions with child

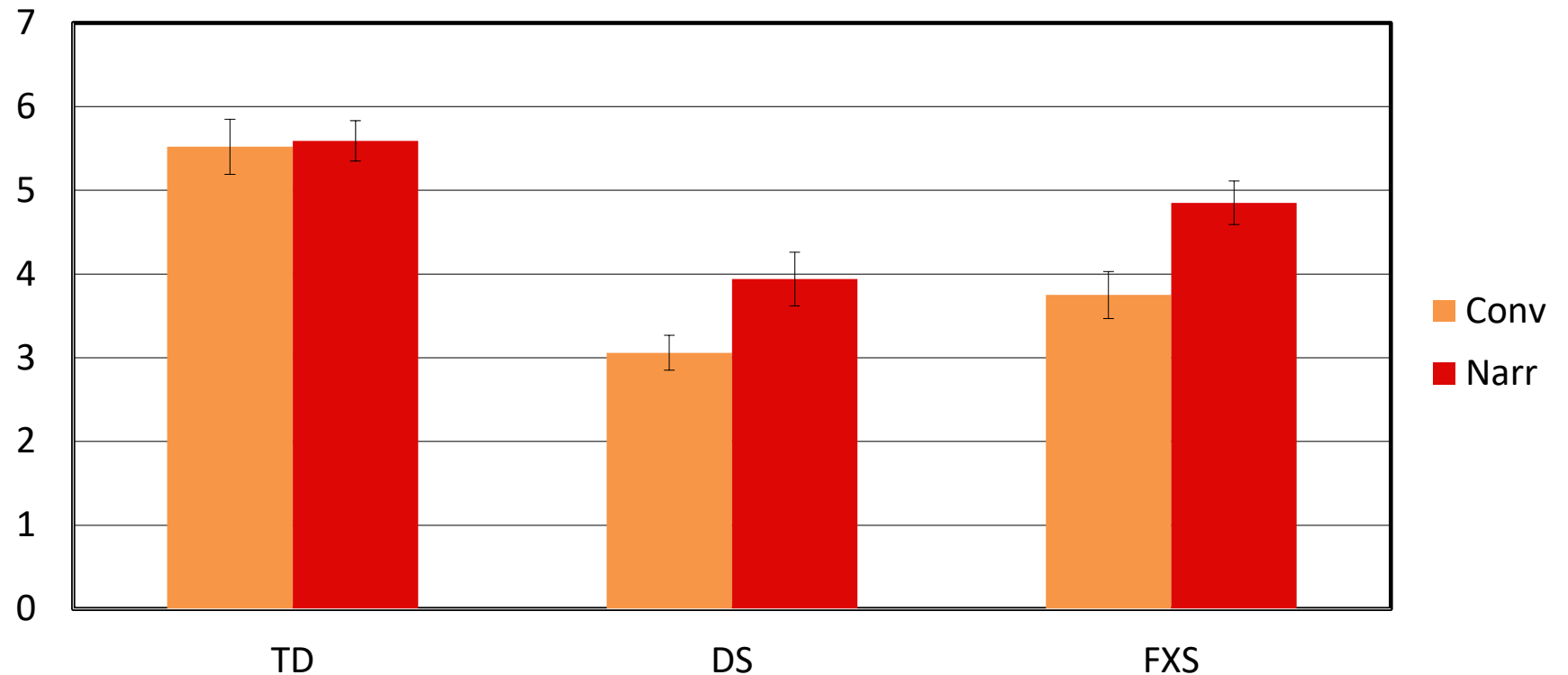
Expressive Vocabulary

Kover et al. J Speech,
Lang, Hear Res (2012)



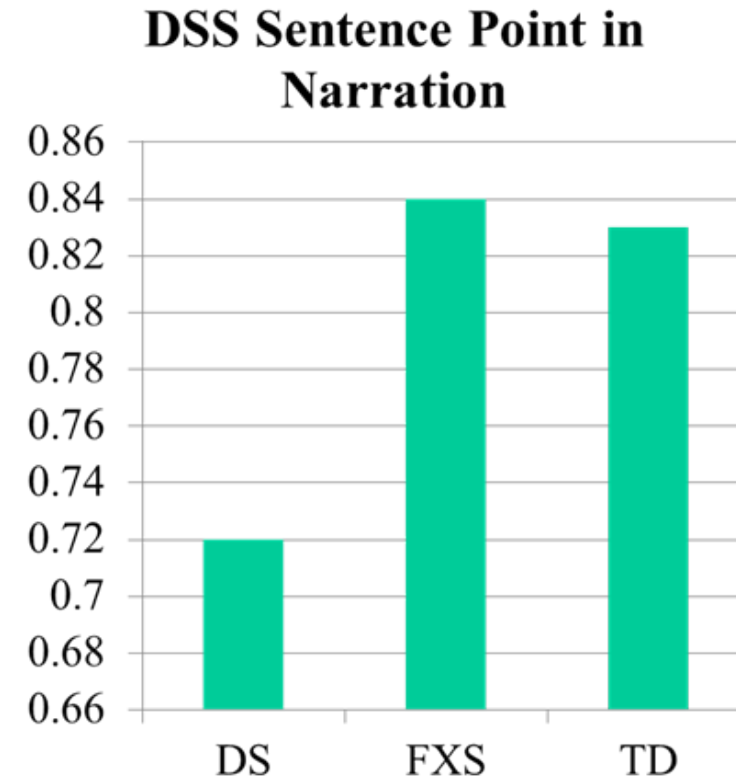
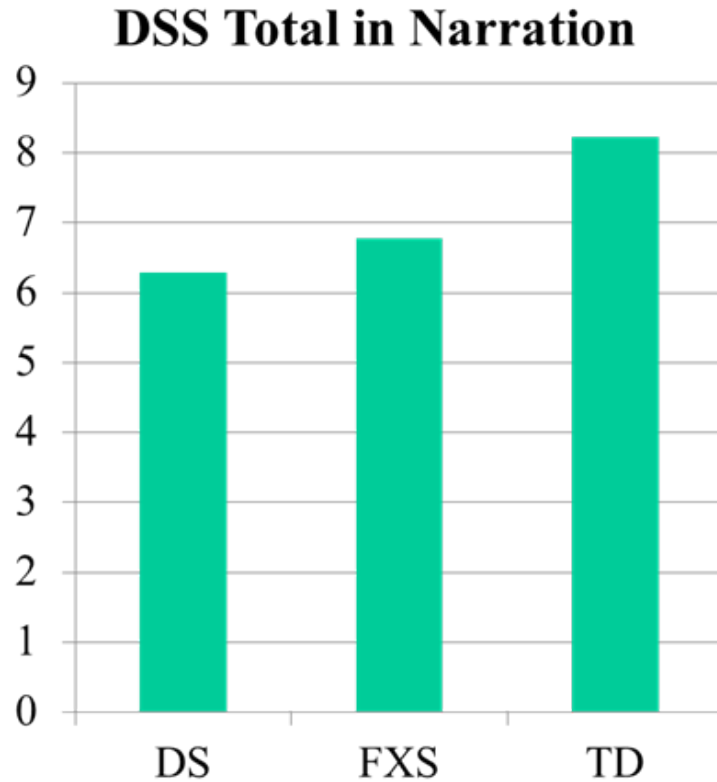
Expressive Syntax

Mean Length of Utterance (Morphemes)



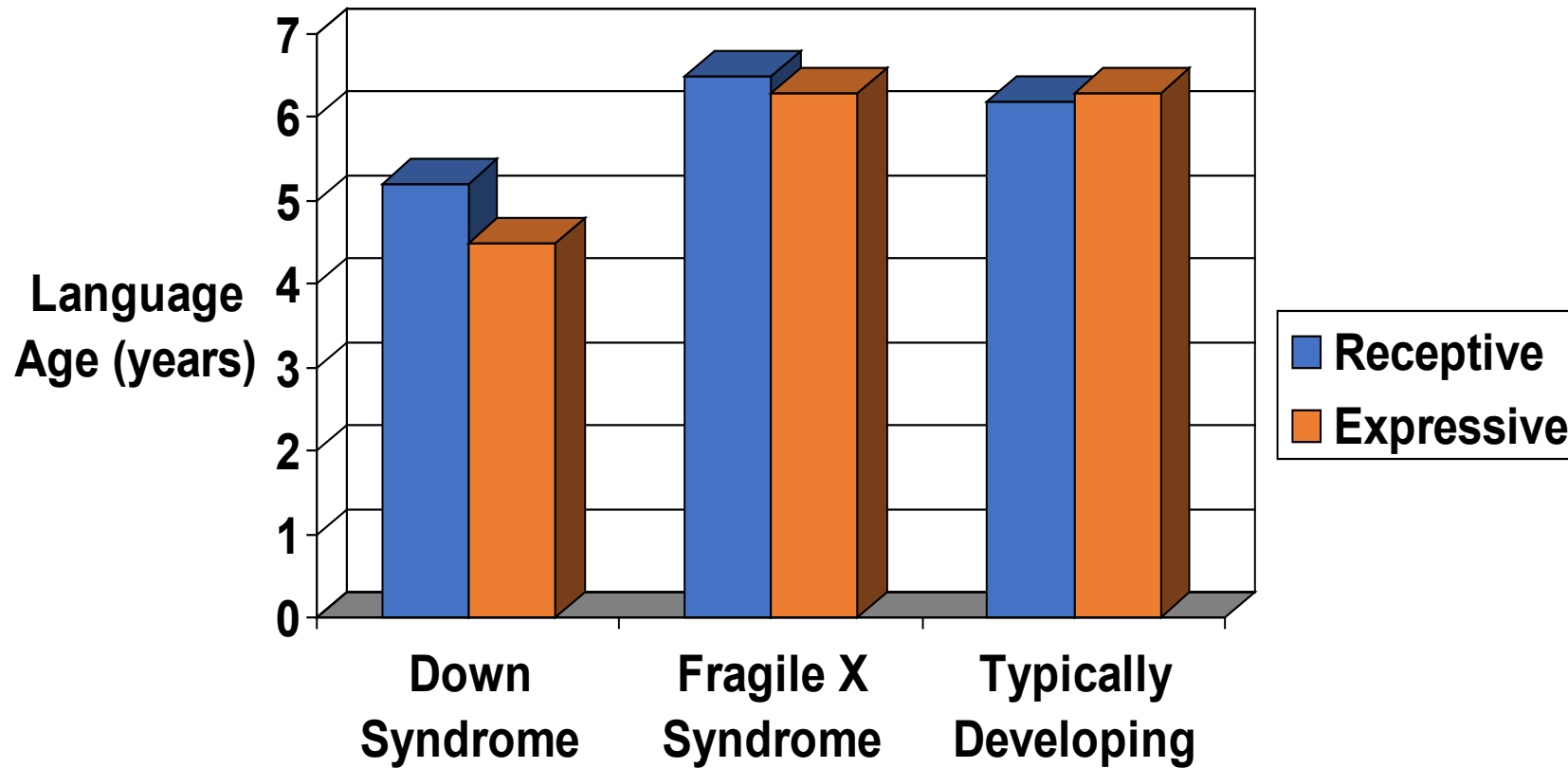
Kover et al. J Speech,
Lang, Hear Res (2012)

Expressive Syntax

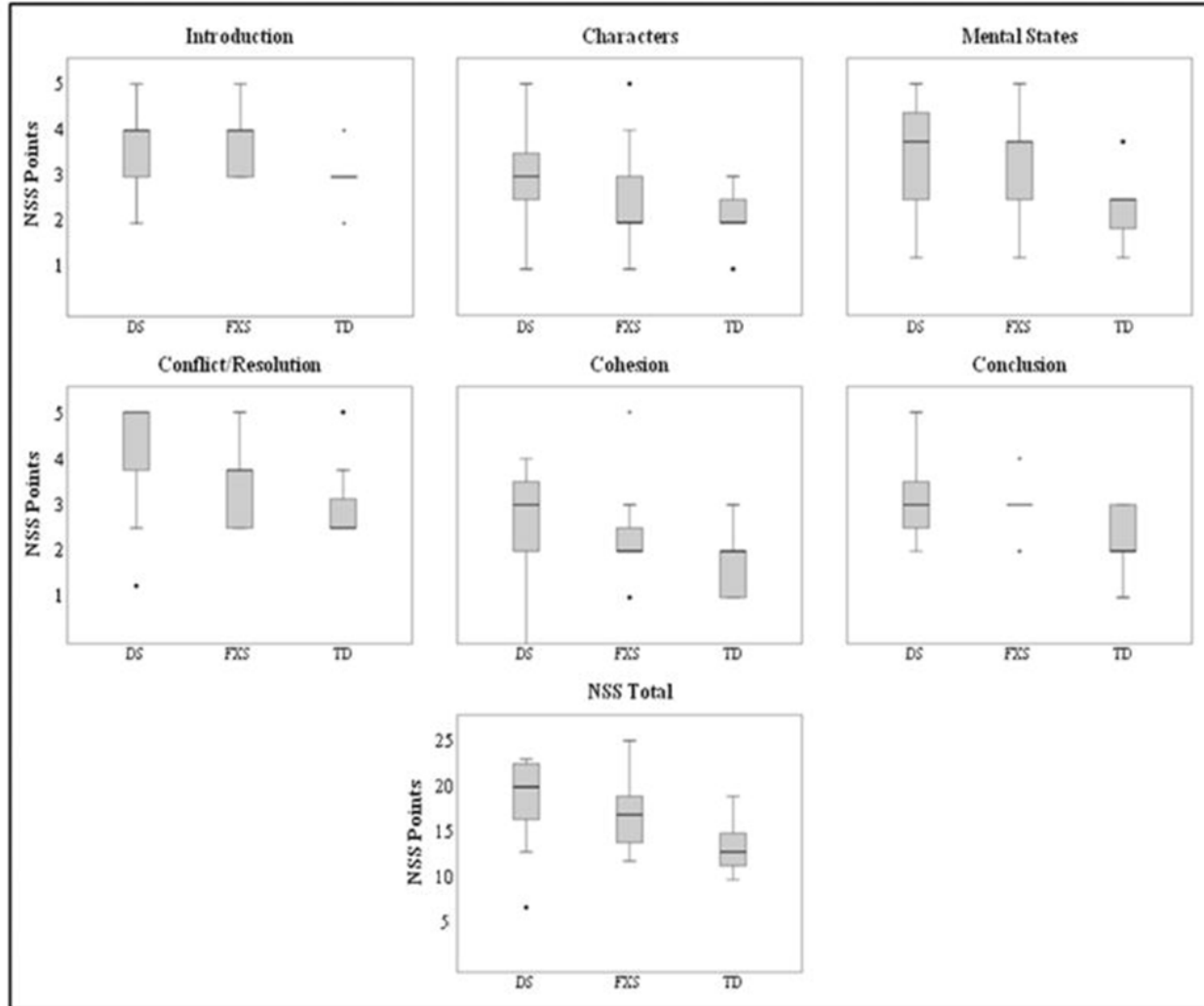


Finestack & Abbeduto
J Speech Hear Lang Res 2010

Expressive vs. Receptive Language



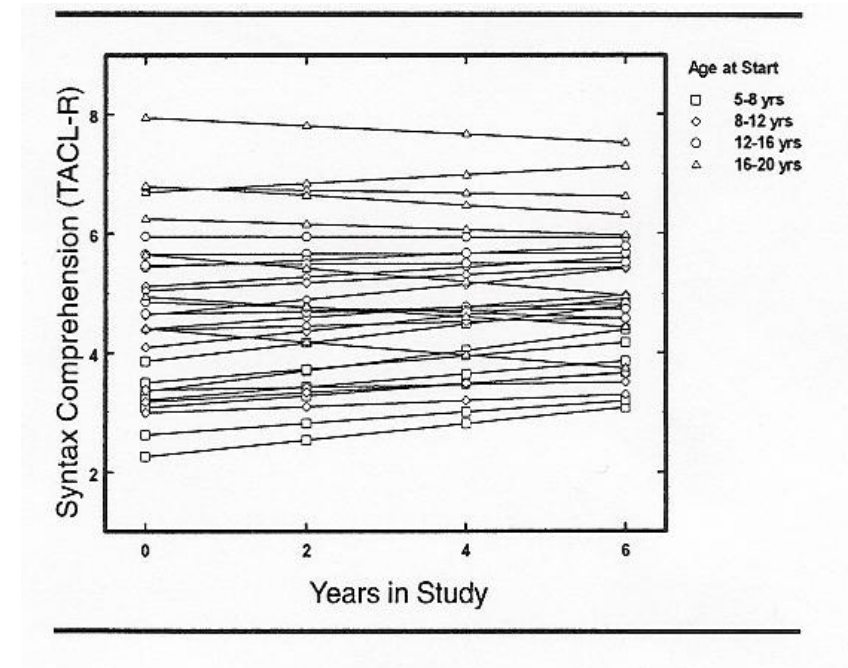
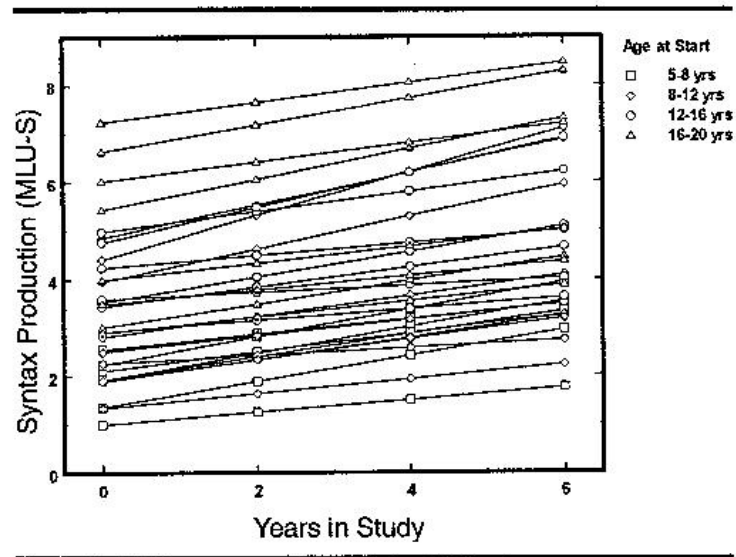
An Area of Strength



Finestack et al. Am J
Speech Lang Path (2012)

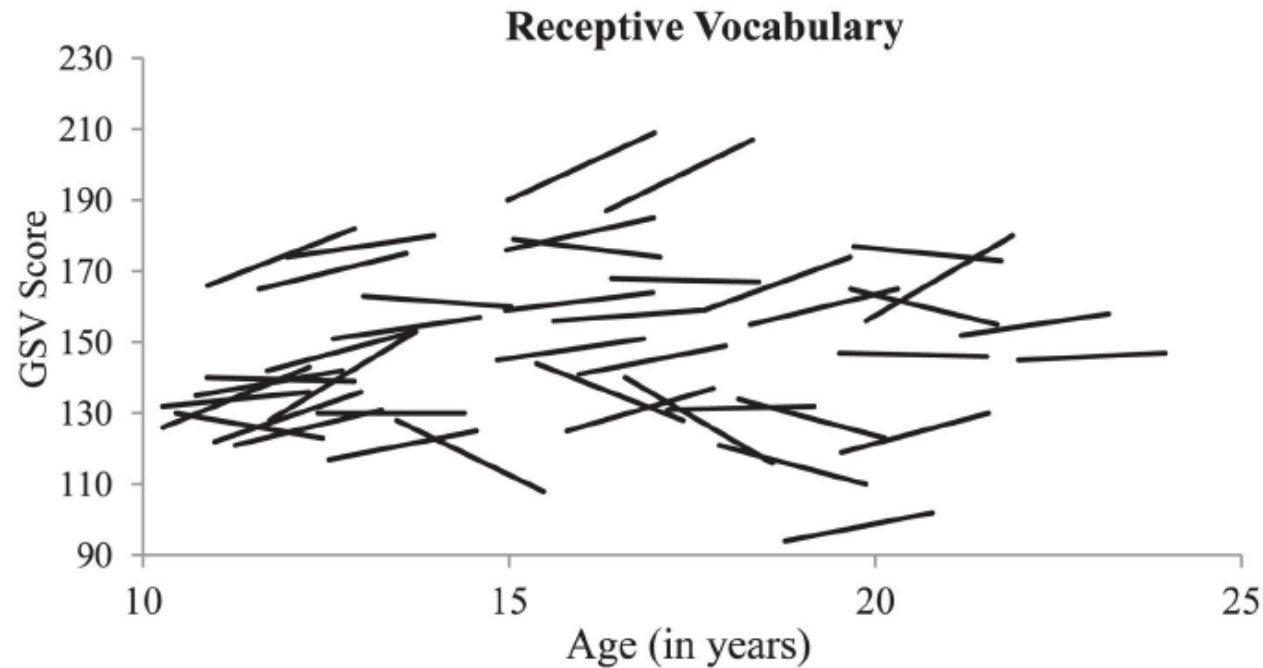
Language Growth and Decline in Adulthood

Figure 5. Individual growth trajectories (linear fits) for syntactic production (MLU-S of spontaneous utterances in 12-min narratives).



Chapman et al. 2002 J Speech
Hear Lang Res

Language Growth and Decline in Adulthood



Conners et al. 2018 Am J Intellect
Dev Disabil

Figure 1.

Change over two years in receptive vocabulary scores. Individual Time 1 vs Time 2 scores plotted by participant's age. Groupwise, receptive vocabulary scores improved significantly over the two years. Age did not correlate with change scores. GSV = Growth Scale Value.

Language Growth and Decline in Adulthood

Conners et al. 2018 Am J Intellect Dev
Disabil

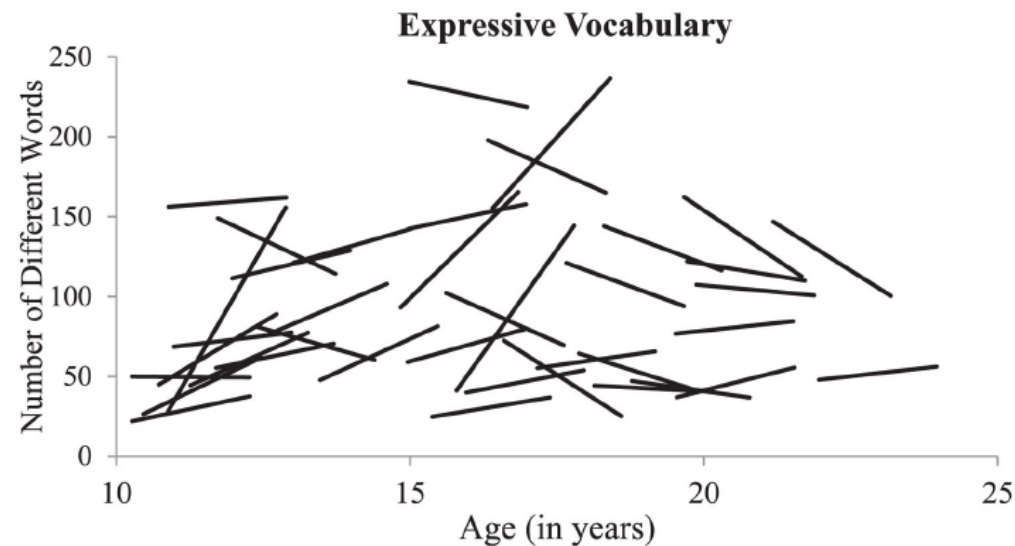


Figure 2. Change over two years in expressive vocabulary scores. Individual Time 1 vs Time 2 scores plotted by participant's age. Age correlated negatively with change. Also, when the sample was split at the midpoint of the age range, younger participants' scores increased from Time 1 to Time 2 whereas older participants' scores did not change.

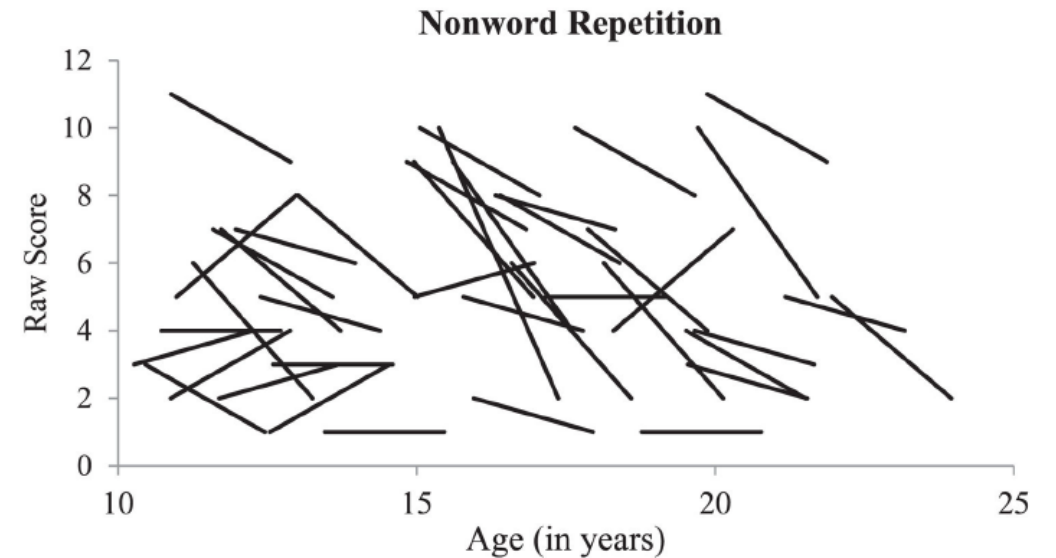


Figure 4. Change over two years in nonword repetition scores. Individual Time 1 vs Time 2 scores plotted by participant's age. Groupwise, nonword repetition scores declined significantly. Age did not correlate with change scores.

Telehealth-delivered Parent-implemented Language Intervention (only fragile X syndrome so far)



McDuffie et al. 2016. Am J Speech Lang Path
Oakes et al. 2015. Dev Neurorehab
McDuffie et al. 2016. Am J Int Dev Disab
McDuffie et al. 2018. Dev Neurorehab

Rationale for PII

- The ways in which caregivers interact with, and talk to, children shapes language development (e.g., Brady et al. 2014 JSLHR, Warren et al. 2010 AJIDD)

Teach parents how to optimize their interactions and language input

PILI Delivery

- Deliver intervention to parent in the “home” through video teleconferencing and other digital technologies



Advantages of Distance-delivered PII

- Low burden on family
- Supports generalization
- Accessible to the majority of families
- Enables high dose and duration of treatment
- Cost-effective
- Creates parent-professional alliance

Intervention Structure

- Parent education through didactics
- Real-time coaching
- Homework with feedback

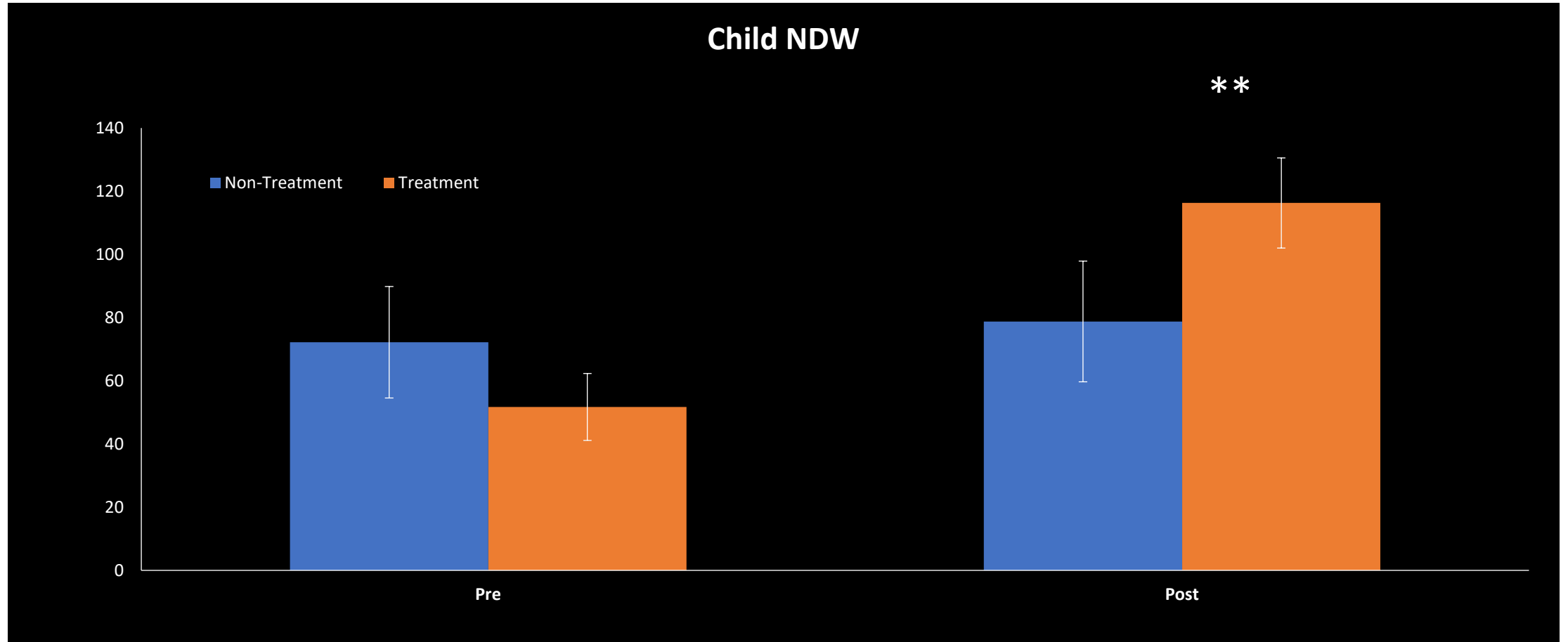
Strategies Taught

- **Use follow-in commenting**
 - Describe child focus of attention
- **Prompt communication indirectly**
 - Environmental arrangement, time delay, and choices
- **Respond contingently**
 - Interpret nonverbal communication, expand verbal communication

Child Communication Acts

MEANS ACROSS ALL DYADS FOR CHILD COMMUNICATION ACTS				
	Baseline		Intervention	
Child Communication Acts	Mean	Range	Mean	Range
Prompted	0.08	(0 – 4)	2.86	(0 – 12)
Spontaneous	2.51	(0 – 9)	4.24	(0 – 18)

Child Language



Future Directions for PILL

- Document its efficacy for families of individuals with Down syndrome
- Build in a focus on improving speech intelligibility
 - Broad Target Speech Recasts (BTSR, Yoder et al. 2016 J Speech Hear Lang Res)

A few Take Aways

- Language grow out of communication, including gestures and vocalizations. Supporting achievements in these prelinguistic foundations is important.
- Language is slow to develop, but some aspects of language pose greater challenges than others. Areas of strength too. Leverage strengths to address challenges.
- In their 20s, some individuals appear to lose (or stop using their language skills). Foreshadowing of Alzheimer's Disease? Mental health challenges? Transition out of school?
- Wide individual differences.
- Many other skills (e.g., memory, attention) affect communication and language.
- Lots of paths for intervention, including training parents to support communication, language, and speech.

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