

Do COVID babies “talk” less?

Research findings and potential
implications

LENA[®]



Presenters:



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Please use the Q&A feature to ask any questions you have during the webinar!

LENA®

A national nonprofit on a mission to transform children's futures through early talk technology and data-driven programs.



LENA GROW™



Practice-based professional development for early childhood educators.

LENA START®



Parent-group classes to strengthen community.

LENA SP™



Detailed language environment data for research and clinical applications.

LENA HOME™



Early-language focus for any home-visiting program.

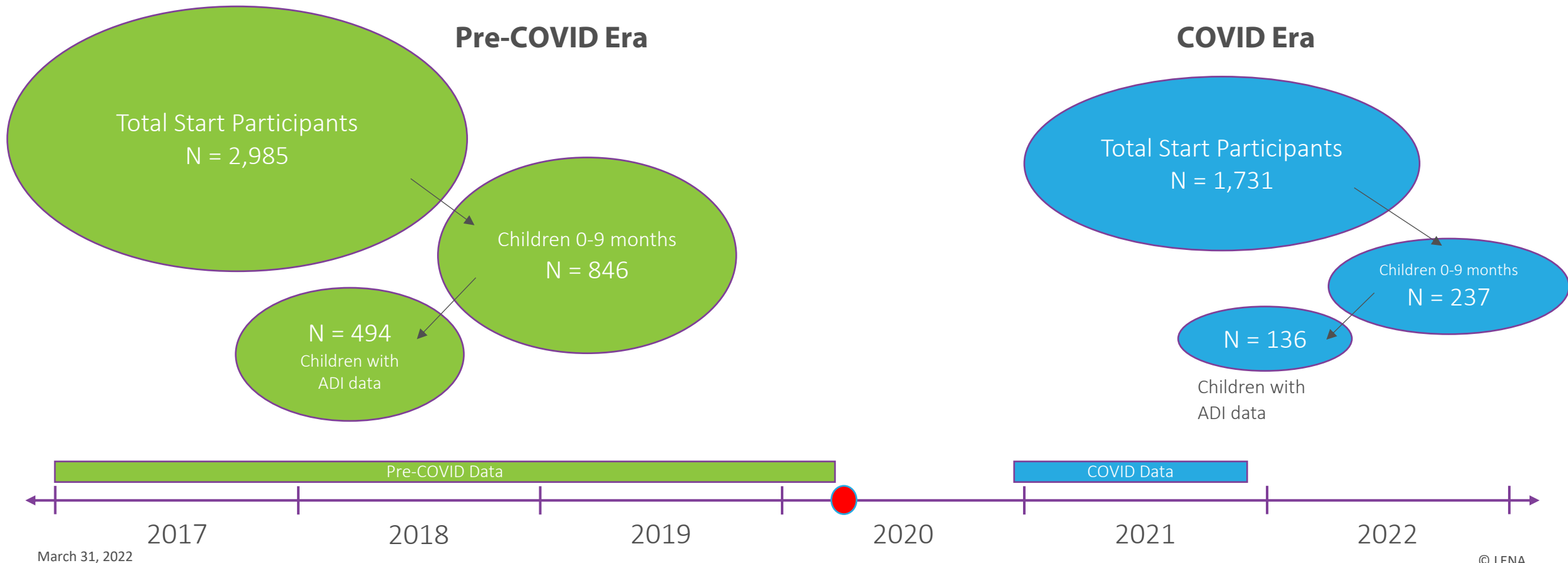
What is LENA measuring?

- Detail in “The Design and Purpose of the LENA System”
 - www.lena.org/technology
- Algorithm automatically parses daylong recording into "speaker"
- Key child and Adult are identified, but *what* is said is not
 - Audio data deleted after processing
- **Adult Word Count:** Estimated number of adult words spoken near the child
 - Words are not identified; estimates are based on acoustic variables like vowel/consonant distributions and adult segment duration
- **Child Vocalizations:**
 - Child sounds (words or babbles) separated by 300 ms of silence or other sound
 - Not including cries or digestive/respiratory sounds – burps and breaths are filtered

Conversational Turns

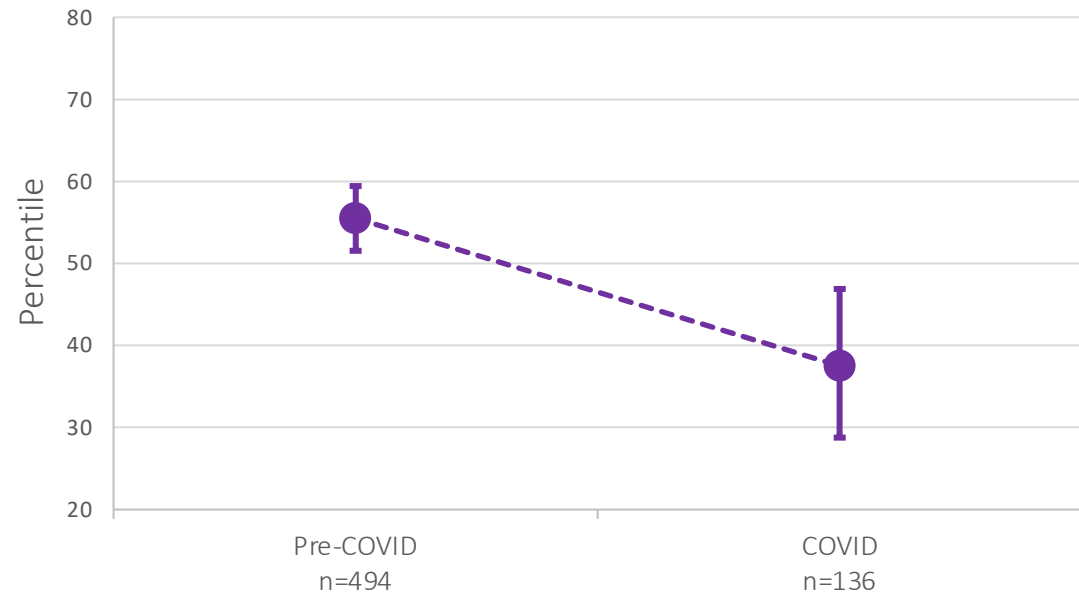
- **Conversational turns:**
 - Alternations between key child and adult – one initiation and one response
 - Key Child → Adult = 1 turn
 - Key Child → Adult → Key child = 1 turn
 - Key Child → Adult → Key Child → Adult = 2 turns
- **Conversational Turns correlated with standard language measures, predictive of longitudinal outcomes**
 - Gilkerson et al., 2017, *American Journal of Speech Language Pathology*
 - Gilkerson et al., 2018, *Pediatrics*
- **Conversational Turns correlated with brain structure and function**
 - Romeo et al., 2018, *Psychological Science*; Romeo et al., 2018 *Journal of Neuroscience*; Romeo et al., 2021, *Developmental Cognitive Neuroscience*.

- COVID Era children
 - Mothers who began gestating during or after the start of the pandemic → born after December 15, 2020
 - Aged 0 - 9 months during the baseline recording
- Pre-COVID Era children
 - Born and recorded before the pandemic; 0 - 9 months



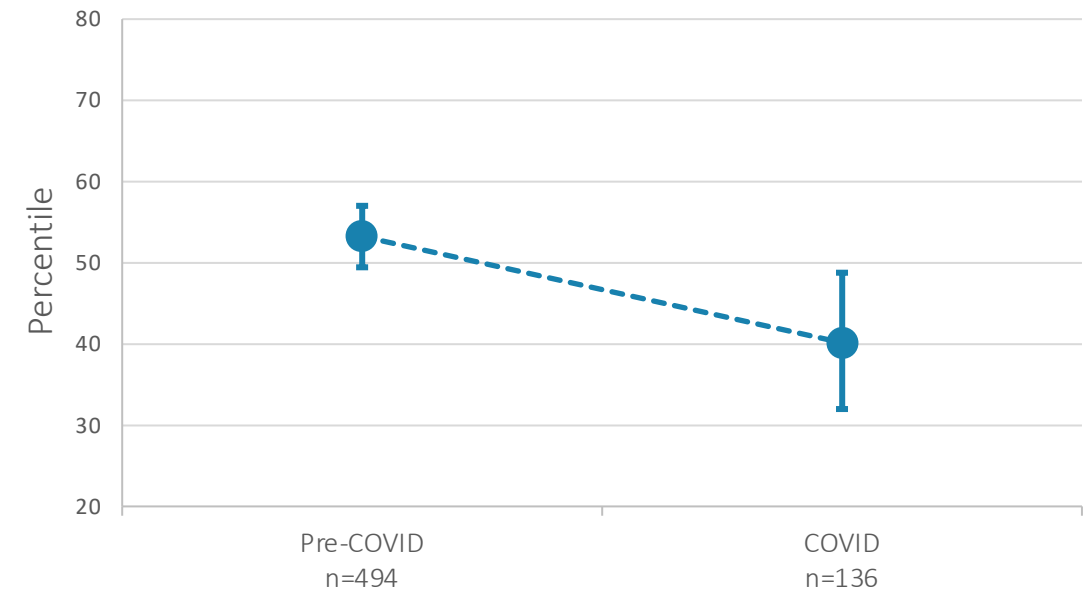
Child Vocs and Conversational Turns

Baseline **Child Vocalization** Percentiles for
Pre-COVID and COVID Samples



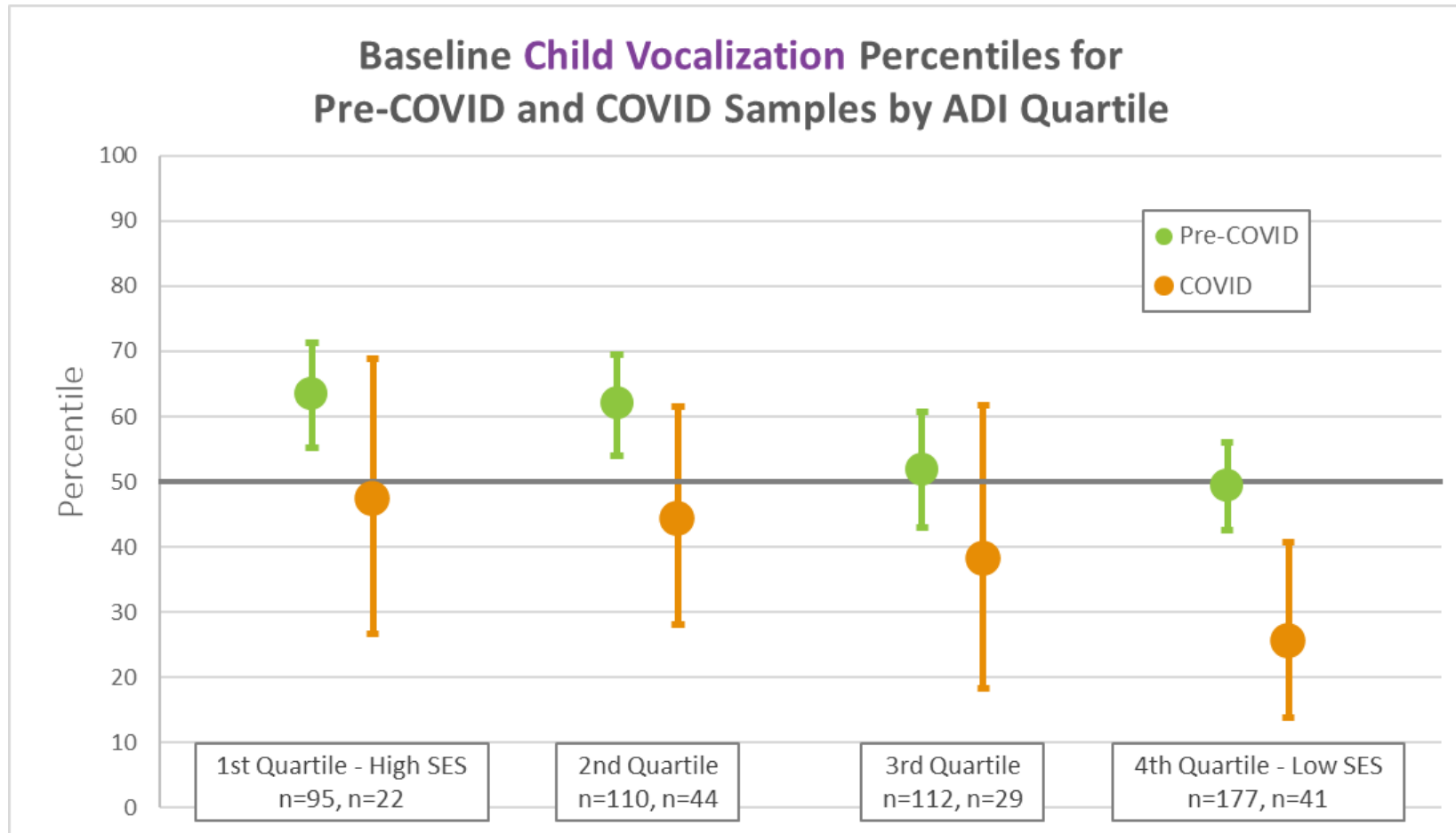
$t(628) = 3.03, p = 0.003$

Baseline **Conversational Turns** Percentiles for
Pre-COVID and COVID Samples



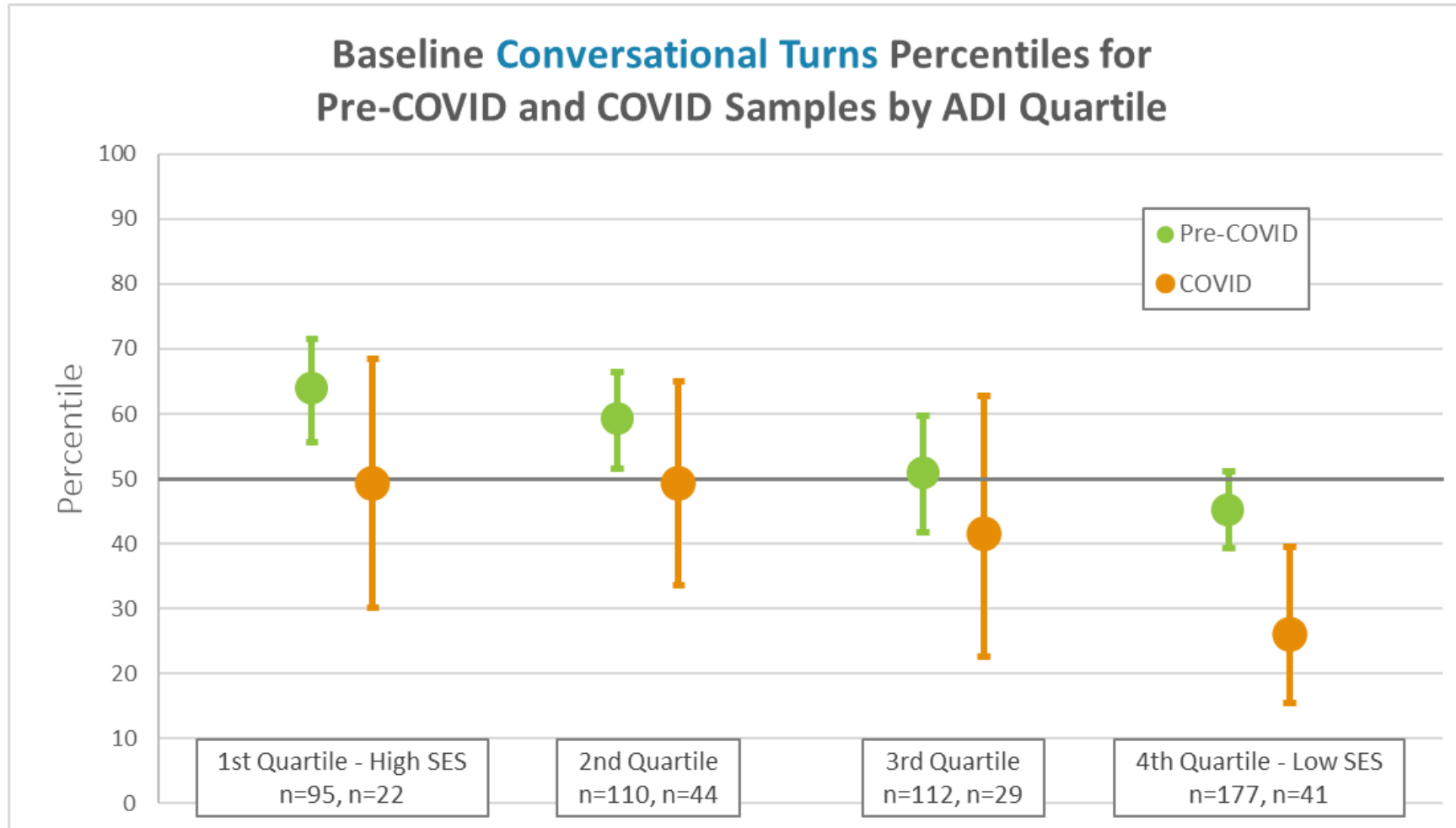
$t(628) = 3.94, p < 0.001$

4 SES subgroups – Child Vocalizations



$t(216) = 3.13, p = 0.002$

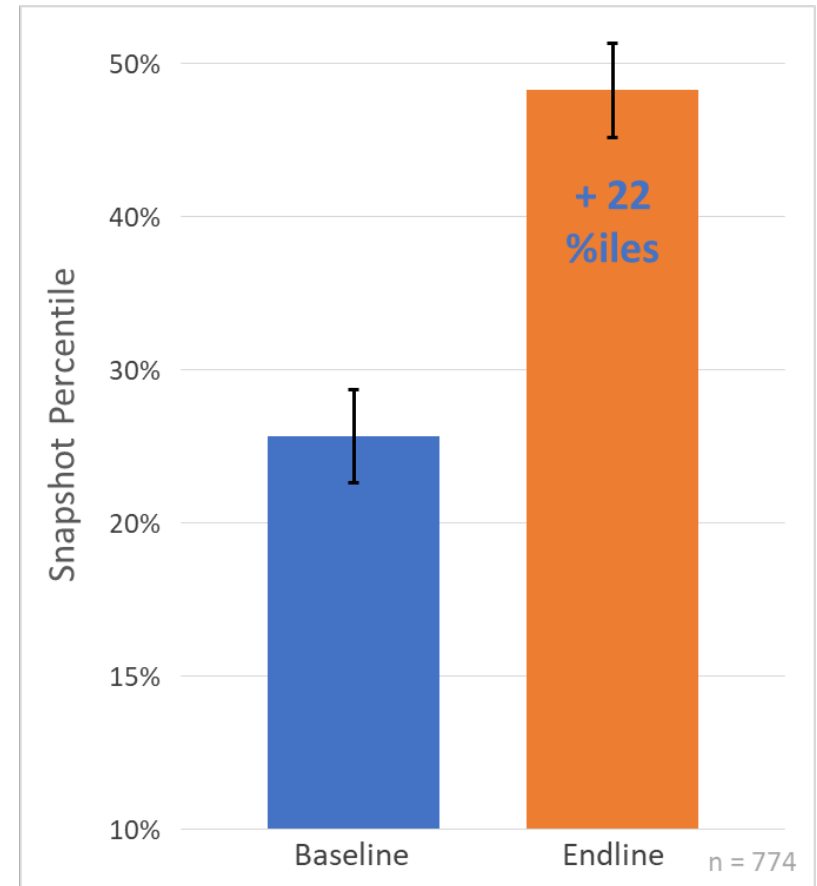
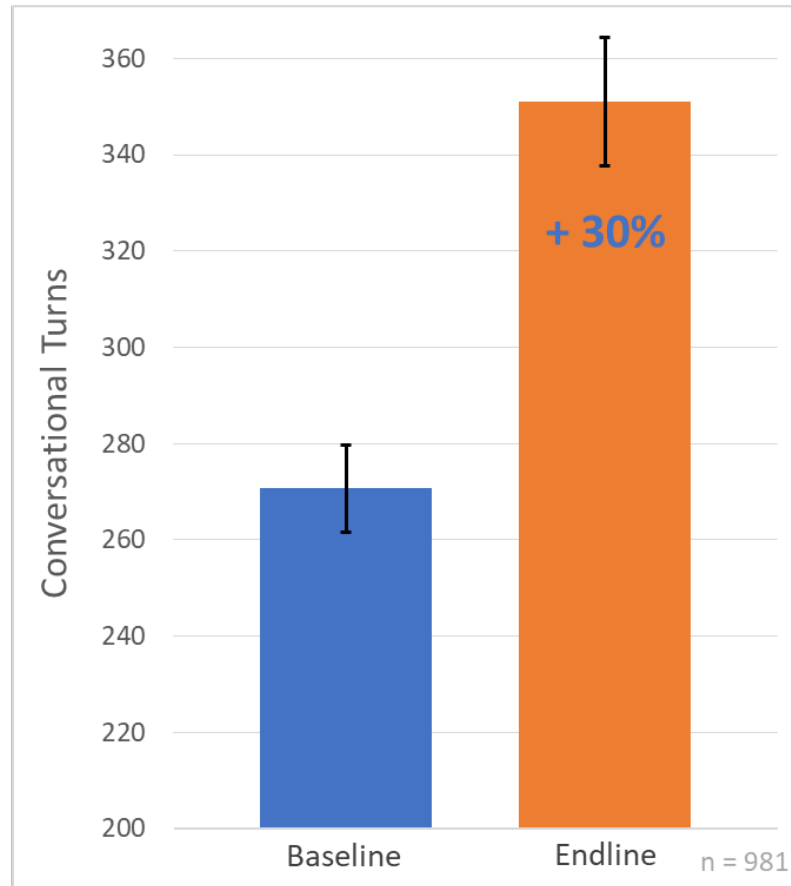
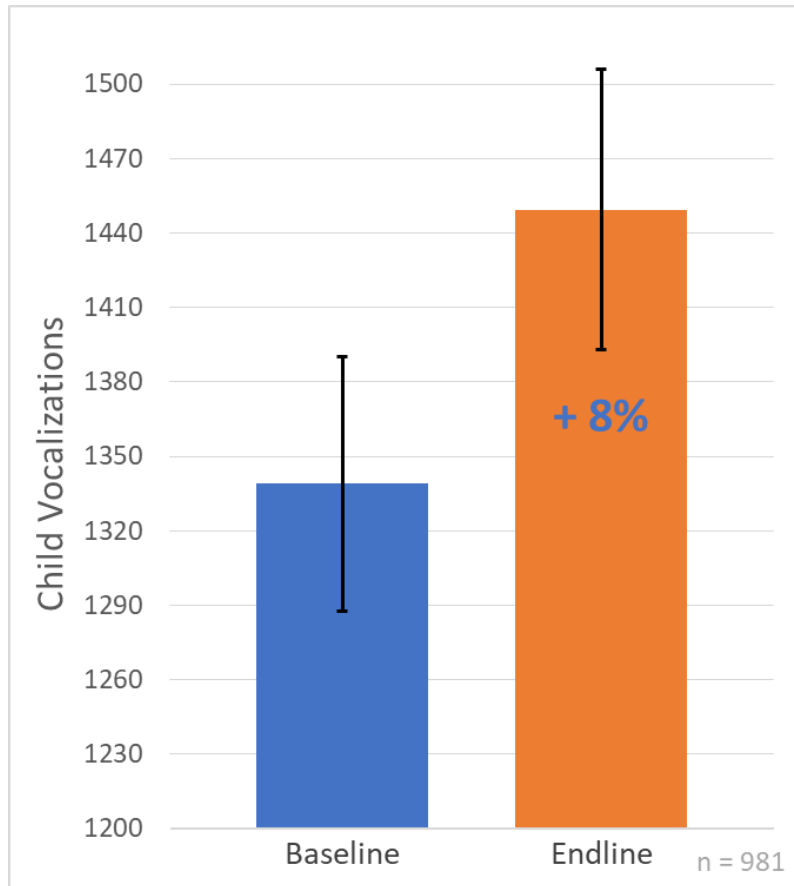
4 SES subgroups – Conversational Turns



$t(216) = 2.89, p = 0.004$

Increases in talk through LENA Start

LENA Start Covid-era results – lower talk participants



The COVID-19 Pandemic & Early Child Cognitive Development.

Sean Deoni, PhD

Advanced Baby Imaging Lab, INSPIRE Center, Rhode Island Hospital;
Departments of Radiology and Pediatrics, Warren Alpert Medical School at
Brown University



Advanced Baby Imaging Lab



RESONANCE: A Study of Child Development

Neuroimaging

Behaviour & Cognition

Language Environment



LENA[®]
Building brains through early talk



RESONANCE: A Study of Child Development

Since 2010: ~1700 Families; ~6500 longitudinal Datasets; Growing @ ~6/day



BAMBAM

Neurotypical
Development

Birth - 12 years

n=723



PEBBLES

Late & Moderate
Preterm

Birth - 12 years

n=287



MINNIE

Maternal Health &
Nutrition

22w - 6 years

n=489



SIMBA

Growth Restriction
Small for Gestation

22w - 6 years

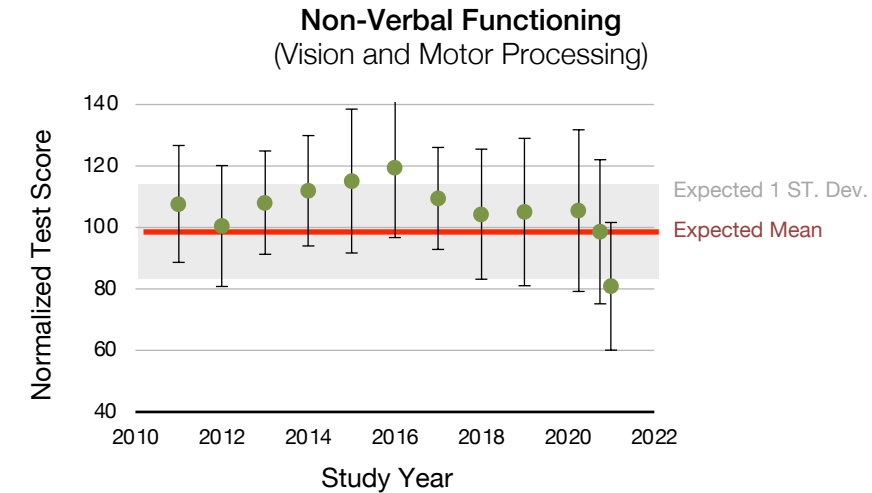
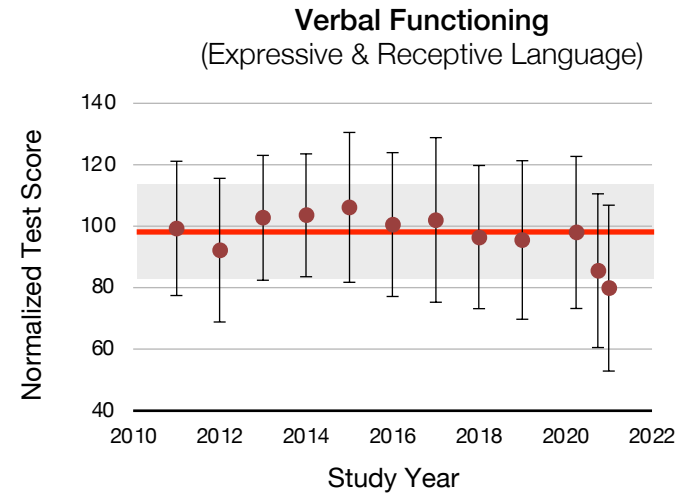
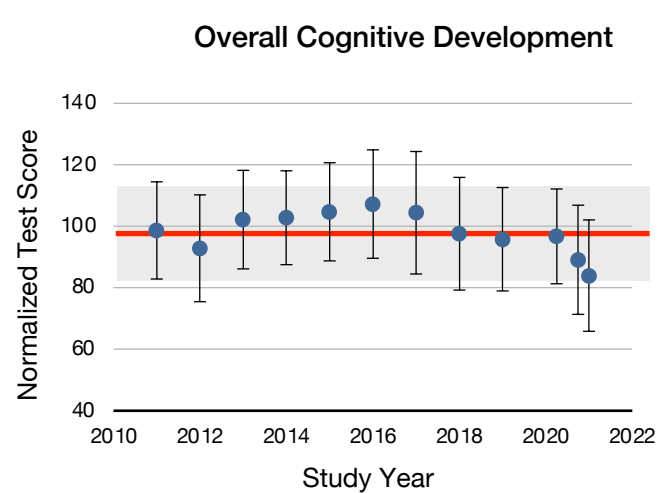
n=133





Yearly Trends in Cognitive Development

- Mean composite scores from a standard assessment tool (Mullen Scales of Early Learning) calculated per year.
- 783 children (401 female), 3-months to 3-years of age, 1348 total measures.

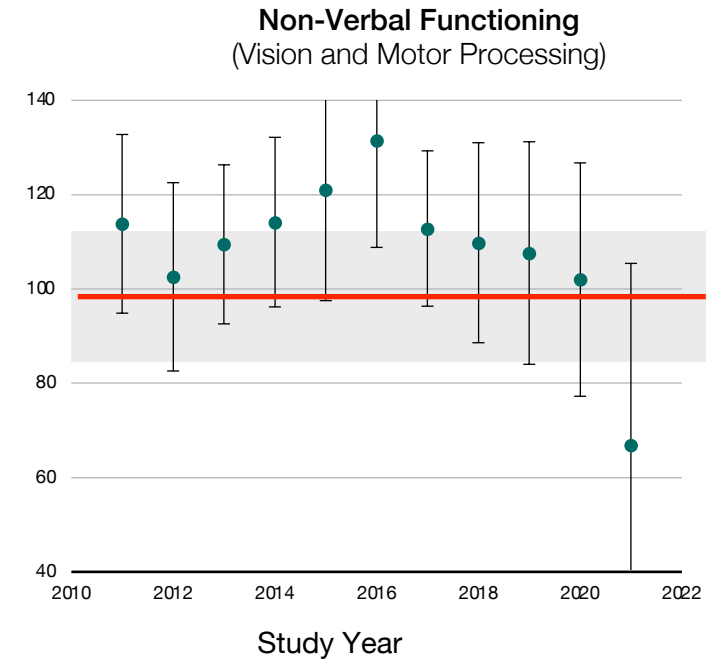
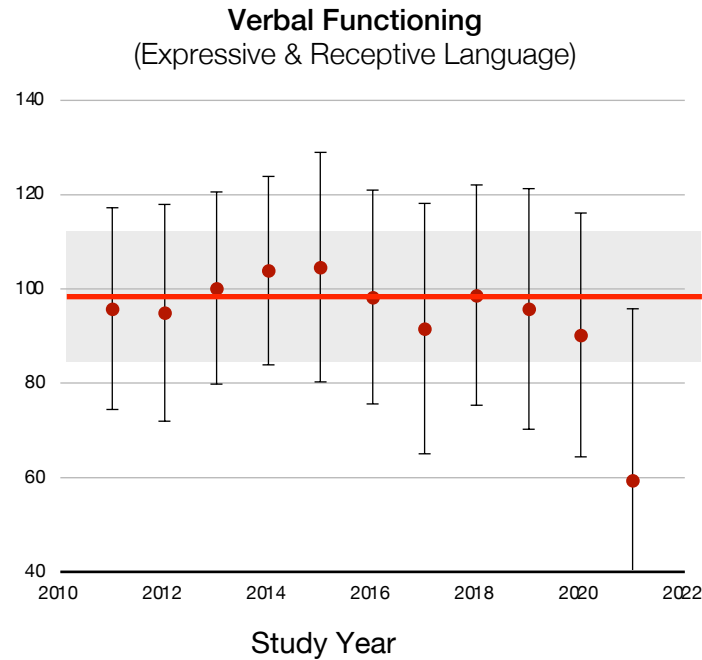
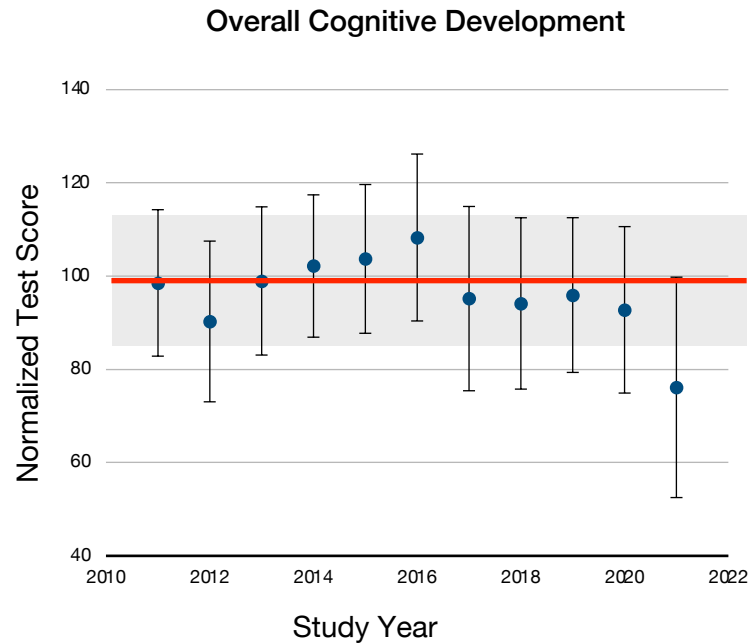


*2021 measures are significantly lower ($p < 0.001$) than any other year in the past decade.
An average decrease of **24.6** points across the composite values.



Disproportionate Impact on Infants

- Focusing only on infants, 0-1.4yrs, born prior to Jan 2019 or after July 2020.
- 137 infants born during pandemic; 558 before pandemic

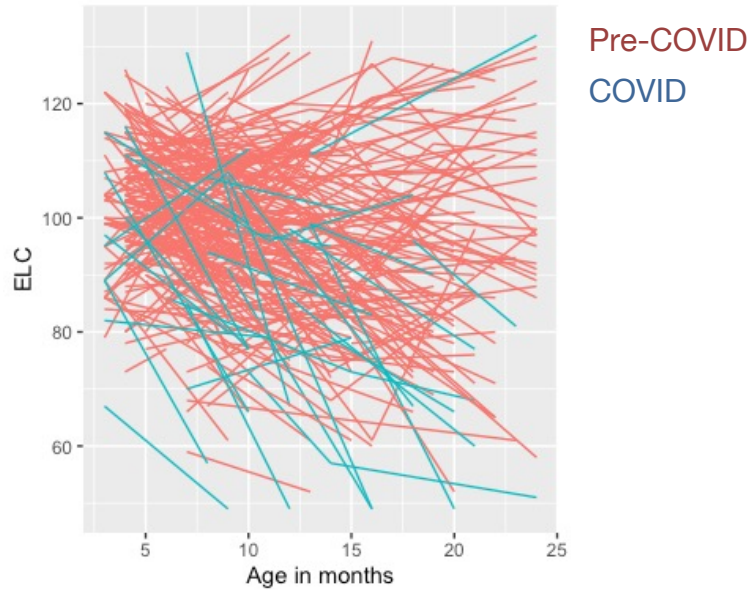


*2021 measures are significantly lower ($p < 0.001$) than any other year in the past decade.
An average decrease of **33** points across the composite values.

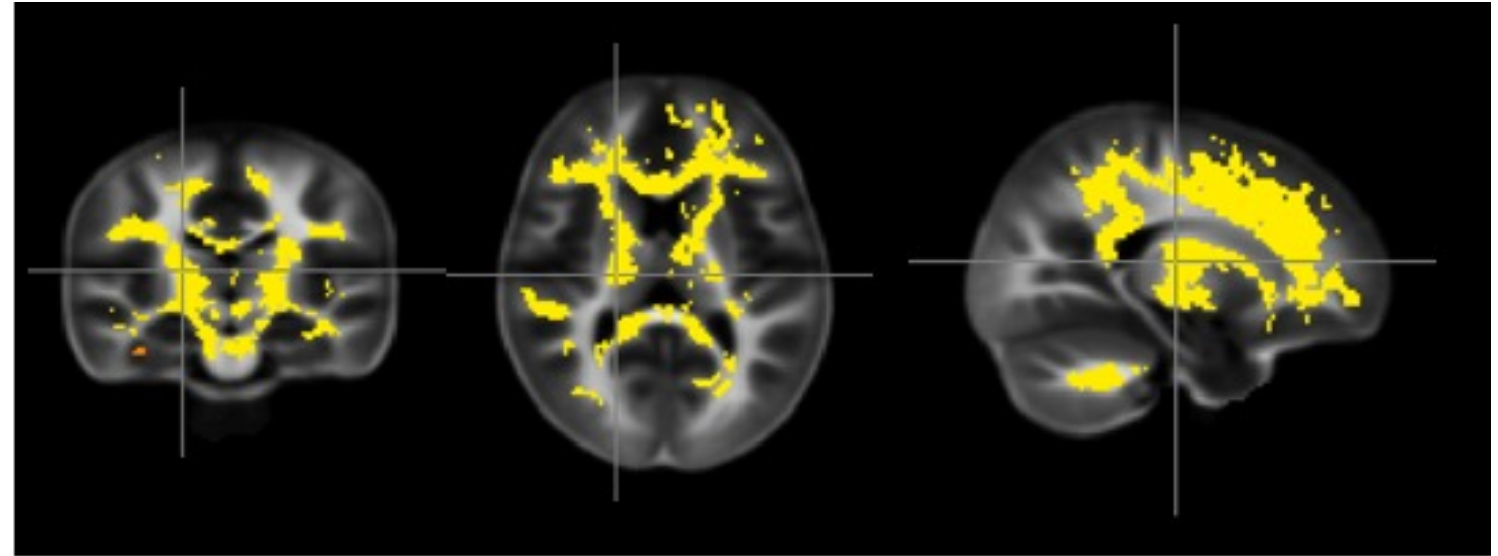


Long Term Outcomes?

Early longitudinal trends are worrisome.



....and so are neuroimaging results.

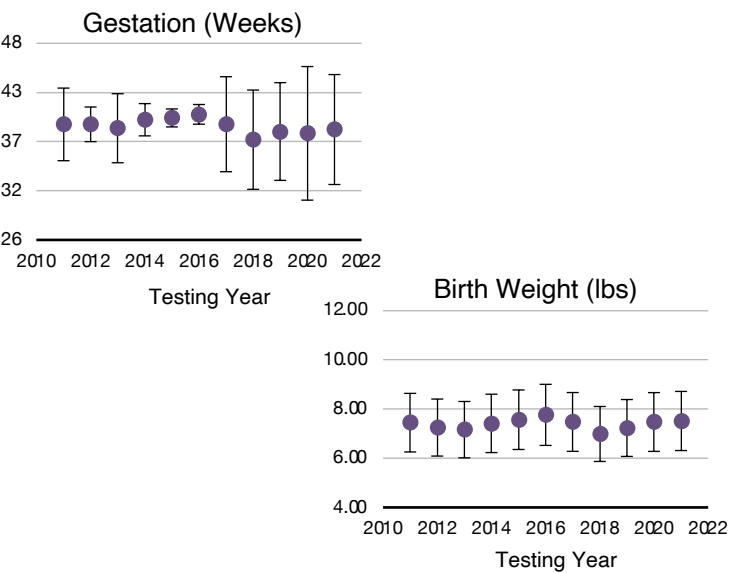


Significantly delayed rate of white matter development in infants born during the pandemic ($p < 0.05$ FDR)

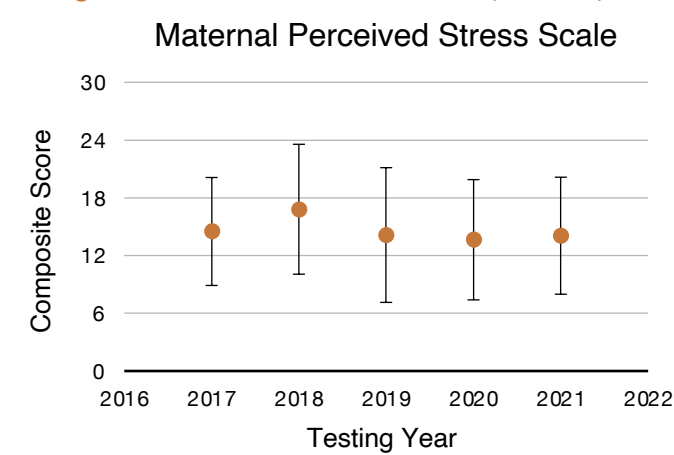


Potential Explanatory Factors

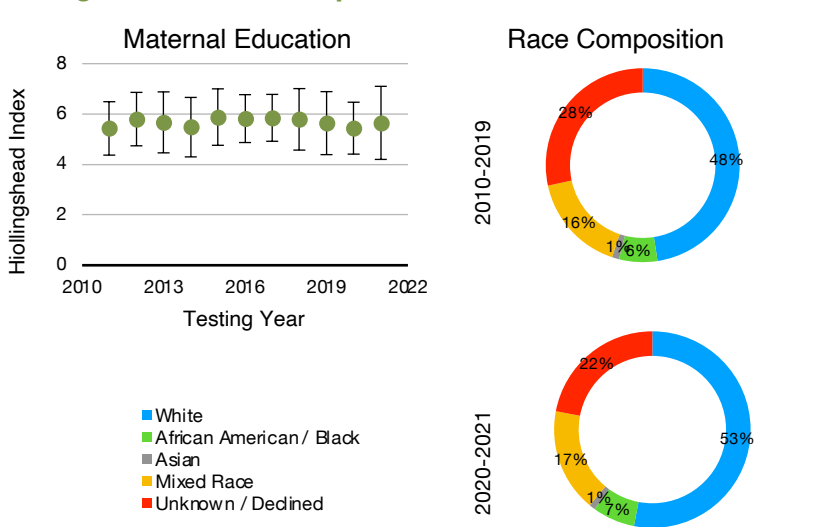
Differences in Birth Outcomes & Neonatal Health



Changes in Maternal Mental Health, Stress, & Anxiety



Changes or Bias in Sample Socioeconomic Characteristics



Reduced Caregiver-Child Interaction



Change in Testing Environment - PPE on Staff and Children



Reduced Maternal, Infant, & Child Sleep & Physical Health



Putting it Together

$$Cog = \beta + age + SES + Gestation + BirthWeight + BiologicalSex + Pandemic + Pandemic \times SES + Pandemic \times BiologicalSex$$

Overall Cognitive Development

	All Children 0-3yrs		Infants Born Before & During	
Term	Estimate	pValue	Estimate	pValue
Intercept	7.3425	0.5404	-1.668205	0.907809
Child Age	0.0047	0.0011	-0.009452	0.100363
SES	2.5534	<0.001	0.990045	0.066967
Gestation	1.6706	<0.001	2.286943	<0.001
Birth Weight	1.6085	0.0035	1.233054	0.054573
Male	-3.6299	0.0013	-1.719909	0.176304
Pandemic	-31.7072	<0.001	-49.882144	<0.001
SES x Pandemic	4.0896	0.0033	7.239489	<0.001
Male x Pandemic	-5.2100	0.1184	-3.132217	0.504954

Verbal Functioning
(Expressive & Receptive Language)

	All Children 0-3yrs		Infants Born Before & During	
Term	Estimate	pValue	Estimate	pValue
Intercept	4.5812	0.7901	-23.804131	0.356684
Child Age	0.0059	0.0024	-0.047249	<0.001
SES	4.0385	<0.001	0.639073	0.503533
Gestation	1.4403	0.0050	3.023880	<0.001
Birth Weight	2.0723	0.0086	1.491077	0.188468
Male	-4.9862	0.0025	-0.352928	0.875775
Pandemic	-37.3486	0.0017	-76.614237	<0.001
SES x Pandemic	3.7750	0.0657	10.739714	0.003465
Male x Pandemic	-4.7268	0.3387	-0.876683	0.915634

Non-Verbal Functioning
(Vision and Motor Processing)

	All Children 0-3yrs		Infants Born Before & During	
Term	Estimate	pValue	Estimate	pValue
Intercept	9.0809	0.5581	-44.258268	0.074154
Child Age	-0.0085	<0.001	-0.001571	0.859054
SES	4.4253	<0.001	2.950514	0.001422
Gestation	1.7647	<0.001	3.447173	<0.001
Birth Weight	1.5669	0.0274	1.193121	0.268472
Male	-4.1207	0.0057	-2.640348	0.221525
Pandemic	-27.0720	0.0093	-82.326814	<0.001
SES x Pandemic	2.8363	0.1163	12.323787	<0.001
Male x Pandemic	-5.4600	0.2074	-4.956133	0.503528

Aspects related to the COVID-19 pandemic have by far the greatest impact on infant & toddler neurodevelopment;
Overall, impacts appear to be amplified in children from lower SES households.

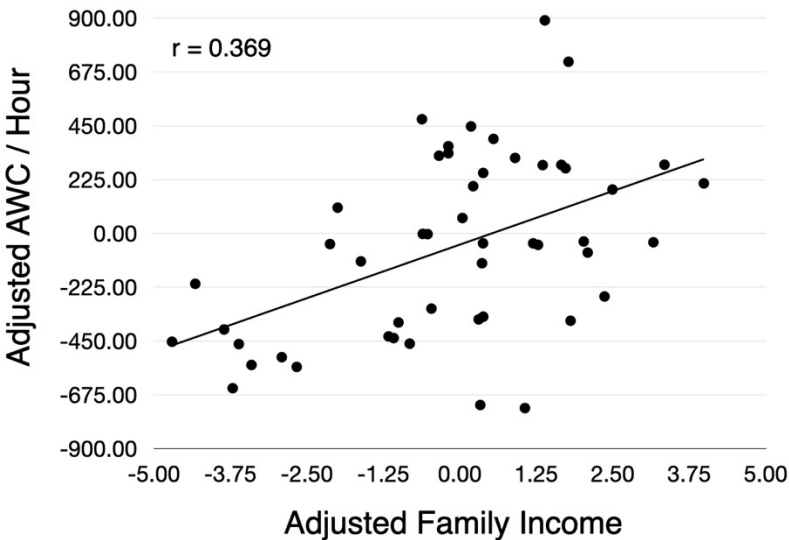


Parent-Child Interaction & Play

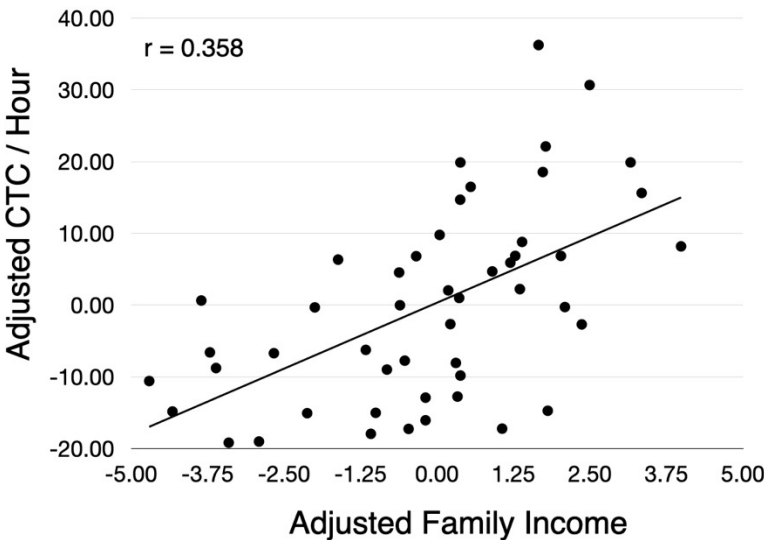


Language Environment & Early Brain Development

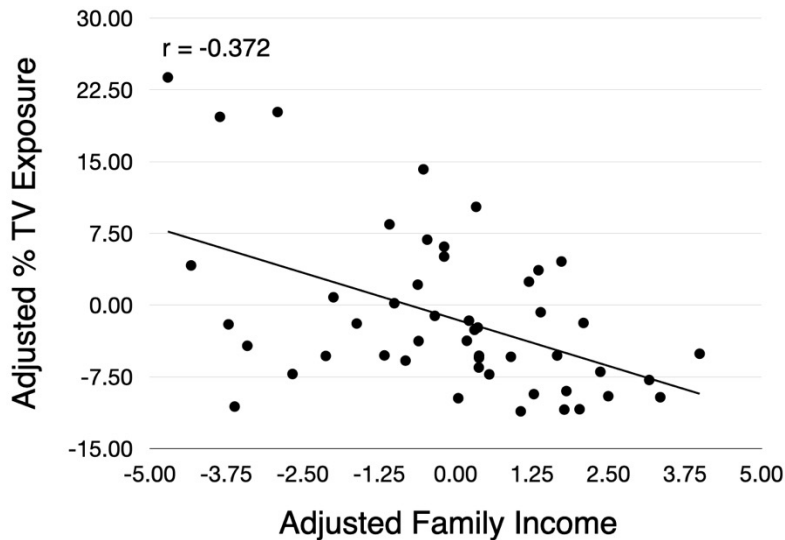
Adult Word Exposure



Conversational Turns / Interaction

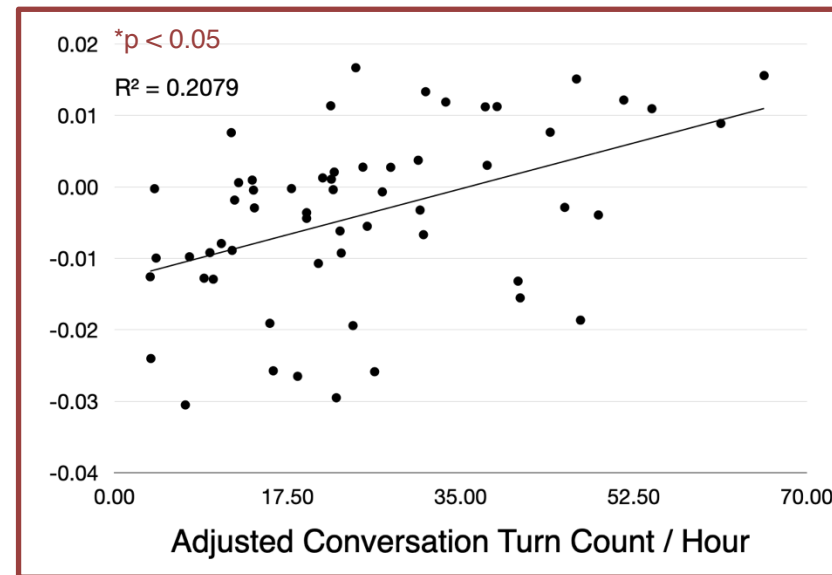
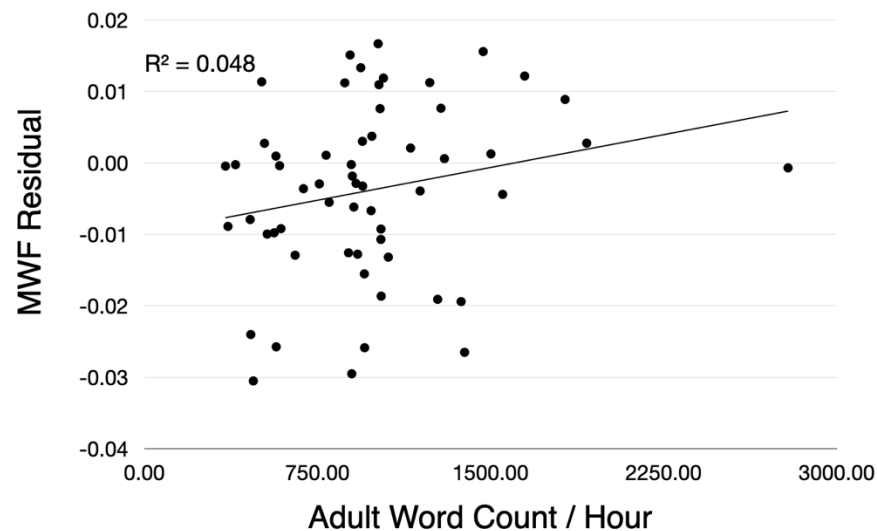
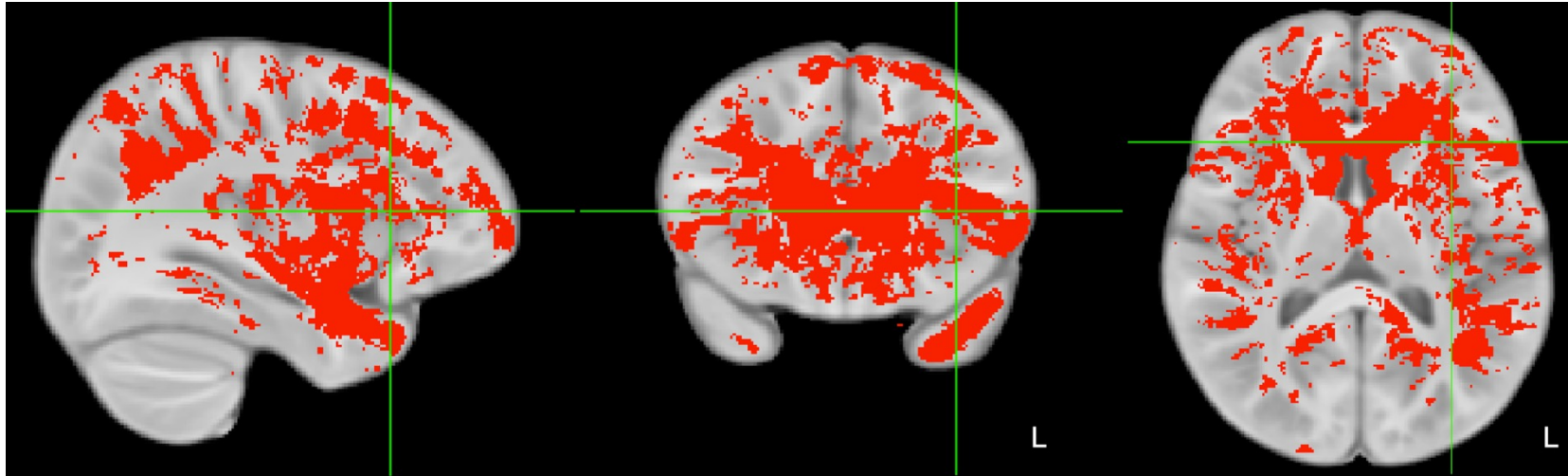


Media / TV Exposure



Language Environment & Early Brain Development

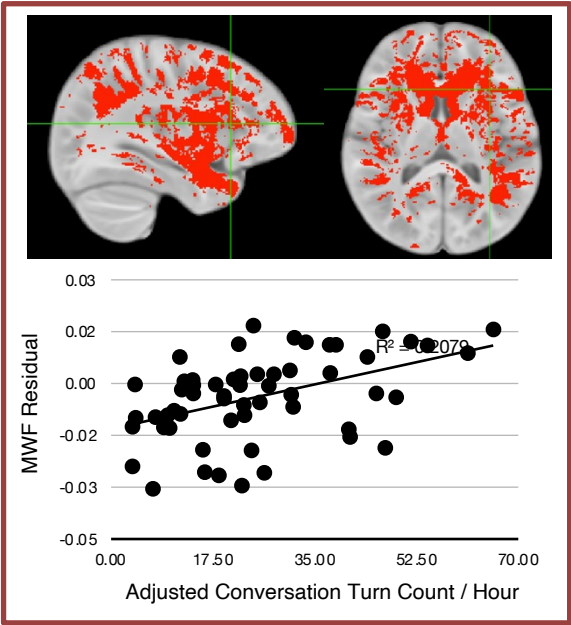
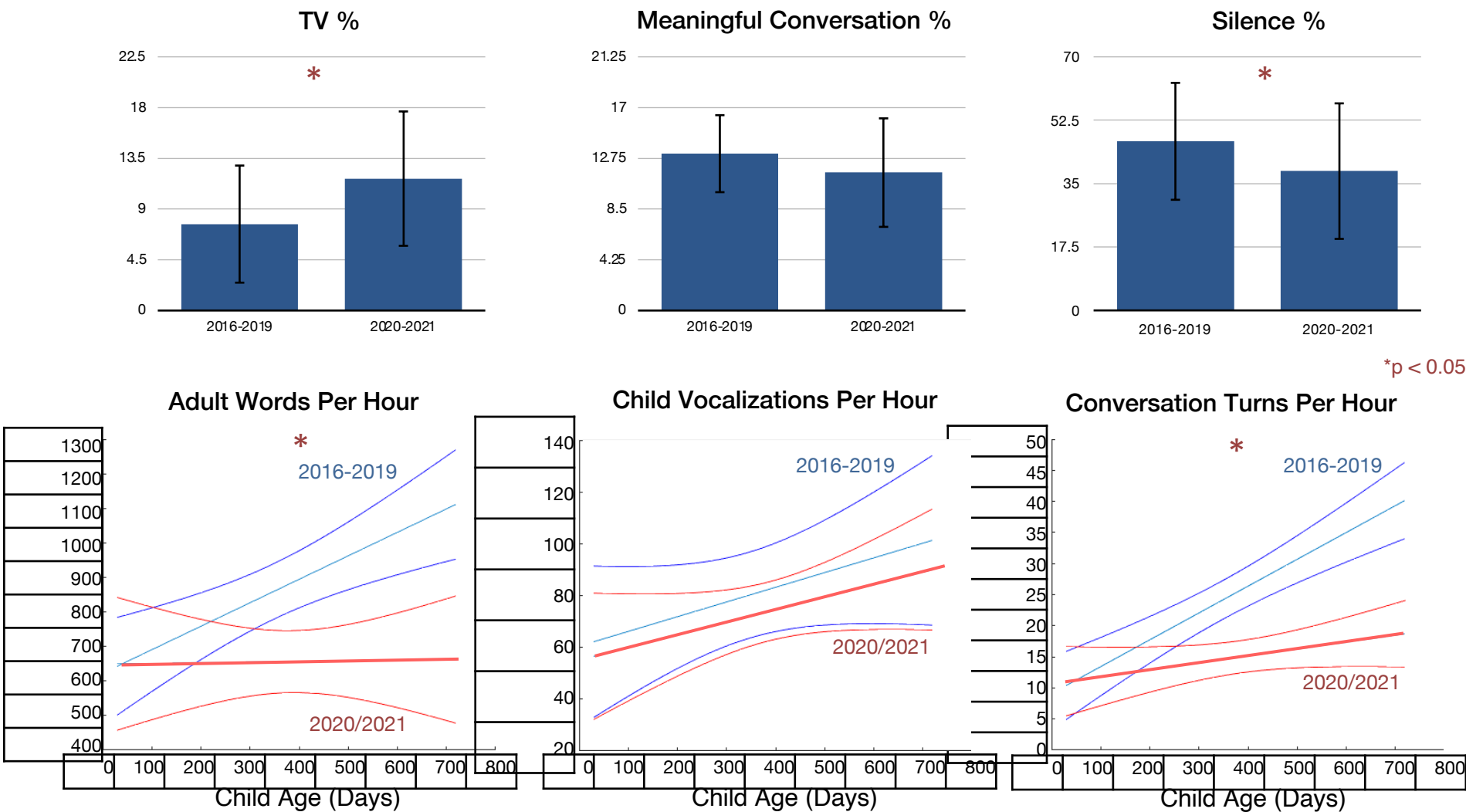
Significant associations only found between brain and conversational turns and not total word exposure.



Language Environment & Early Brain Development

Caregiver-Child Language Interaction

- 62 children 0-2yrs during pandemic; 162 children 0-2yrs from 2016-2019



Discussion: Potential Implications



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Pediatrics, Brown University



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Chief Research and
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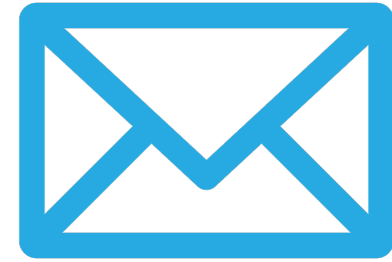
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