



New Discoveries and Ongoing Research
at the LENA Research Foundation

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Presentation Outline

- Recently reported research
- New LENA online parent intervention website
- First LRF experimental study

Discoveries in Autism

Work presented at IMFAR 2012 by
Dongxin Xu, PhD

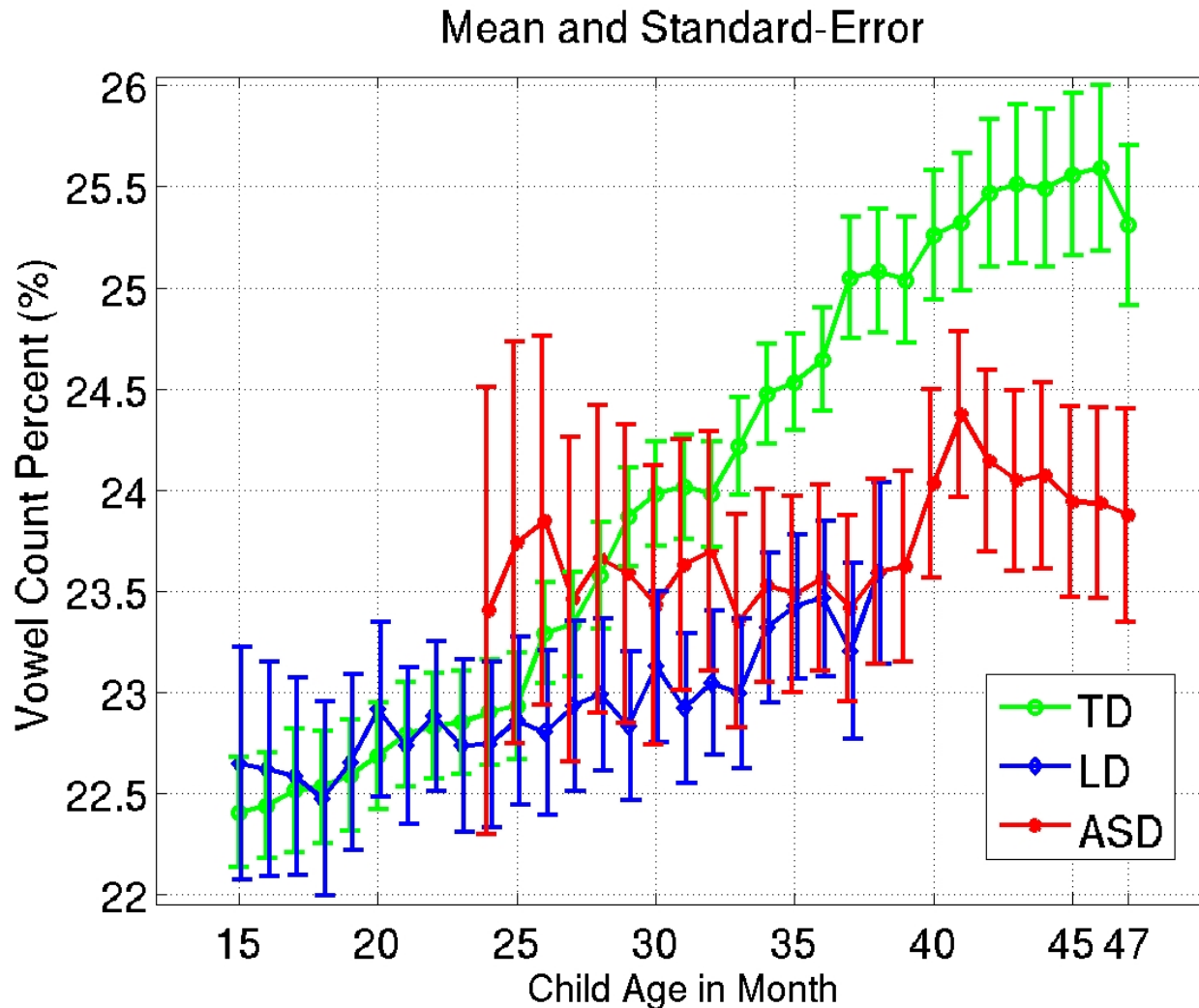
Data Set of the Study

Child Groups	Number of Children (N)	Number of Recordings	Child Segments (number in million)	Phoneme-like Units (number in million)
Typical Development (TD)	106	802	2.15 M	8.42 M
Language Delay but not ASD (LD)	49	333	0.75 M	2.65 M
Autism (ASD)	71	225	0.53 M	1.82 M
Total	226	1363	3.43 M	12.89 M

In the following slides of results of findings

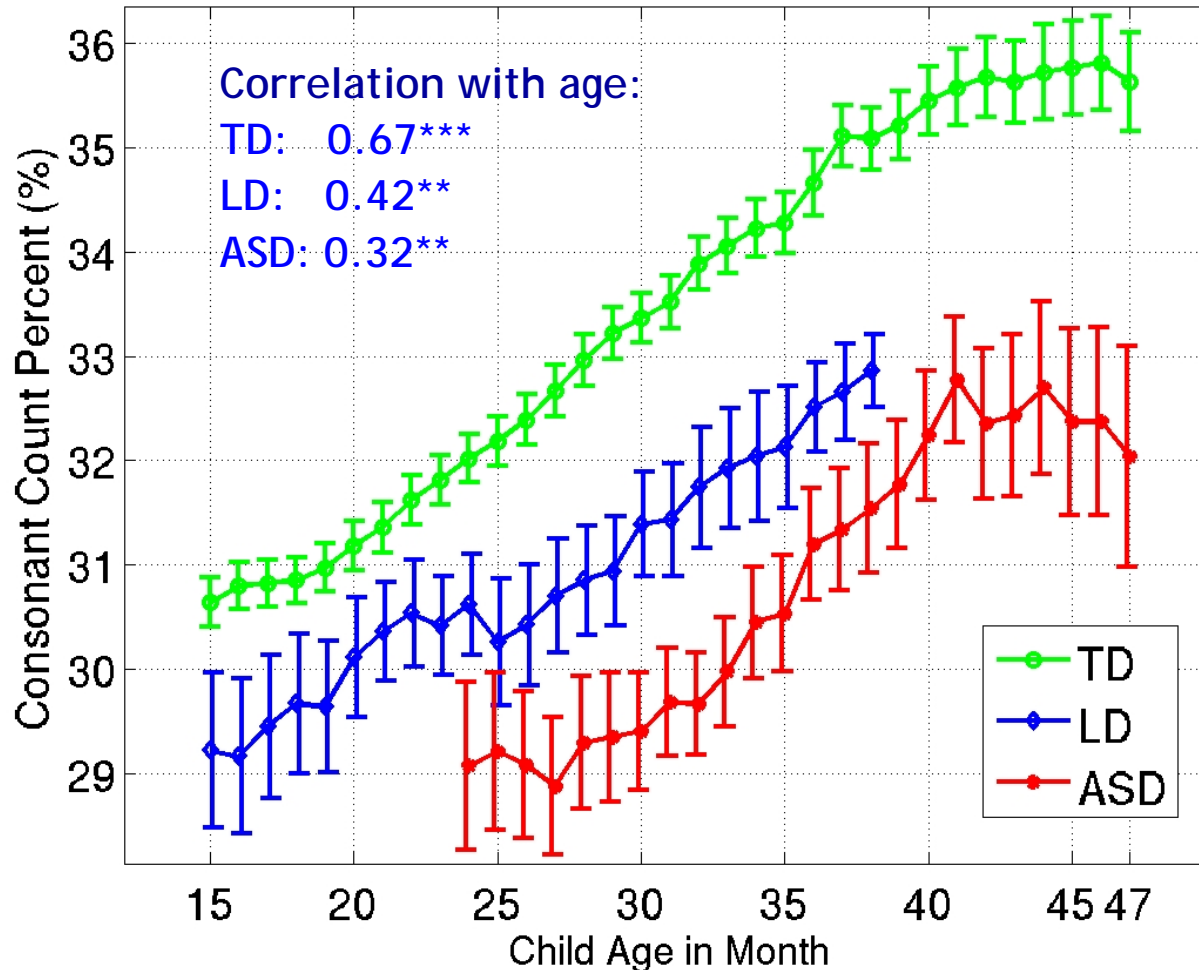
- **Green:** Typical Development (TD)
- **Blue:** Language Delay not Related to Autism (LD)
- **Red:** Autism (ASD)

Frequency of Vowel-like Sound



Frequency of Consonant-like Sound

Mean and Standard-Error



t-test

(Welch 2-sample 2-side)

TD versus ASD:
 $t(90) = 7.95^{***}$

TD versus LD:
 $t(68) = 5.52^{***}$

LD versus ASD:
 $t(118) = 2.62^{**}$

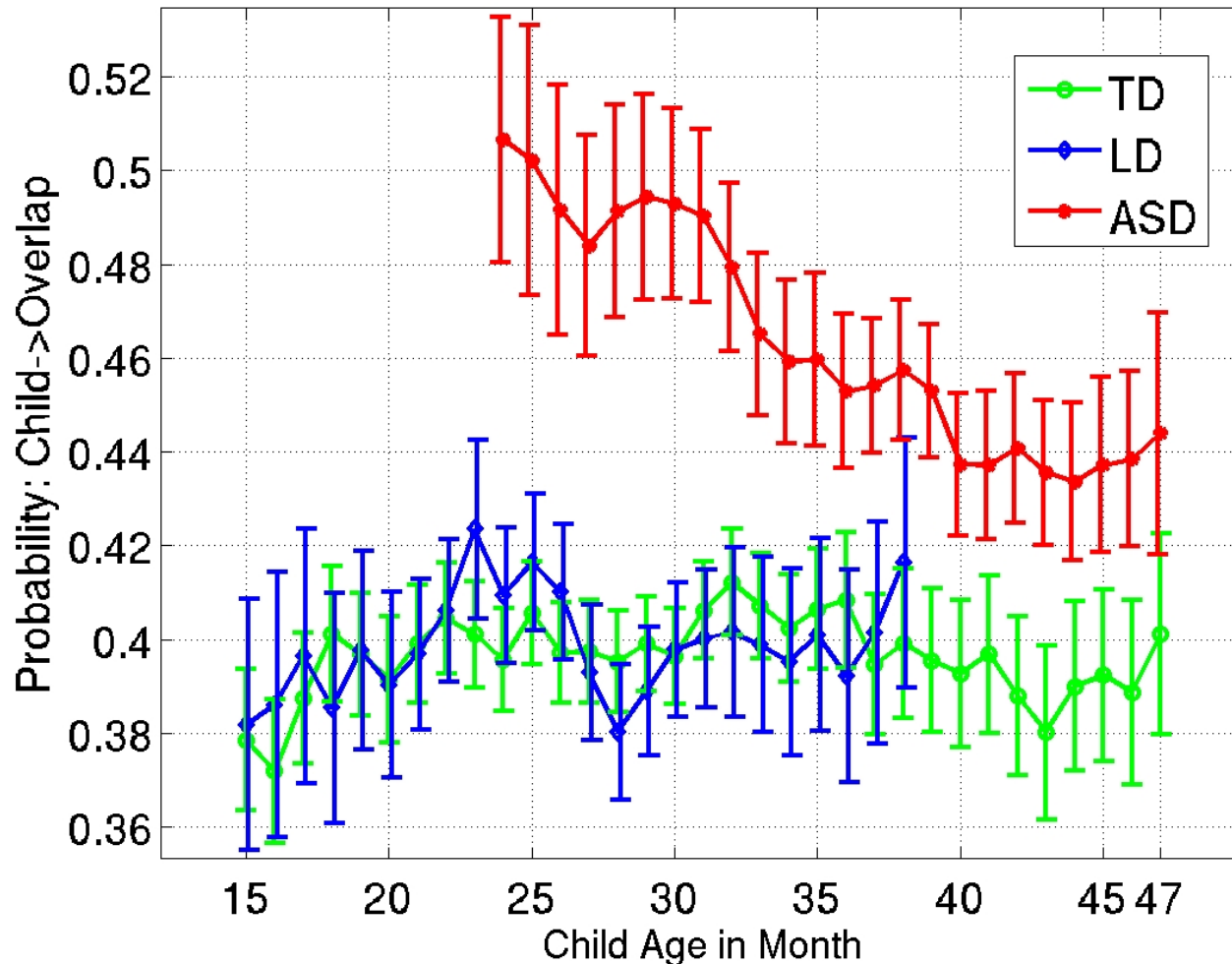
* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Probability of Sound Collision

Mean and Standard-Error



t-test

(Welch 2-sample 2-side)

ASD versus TD:

$t(132) = 3.66^{***}$

ASD versus LD:

$t(111) = 2.94^{**}$

TD versus LD:

$t(90) = 0.13$

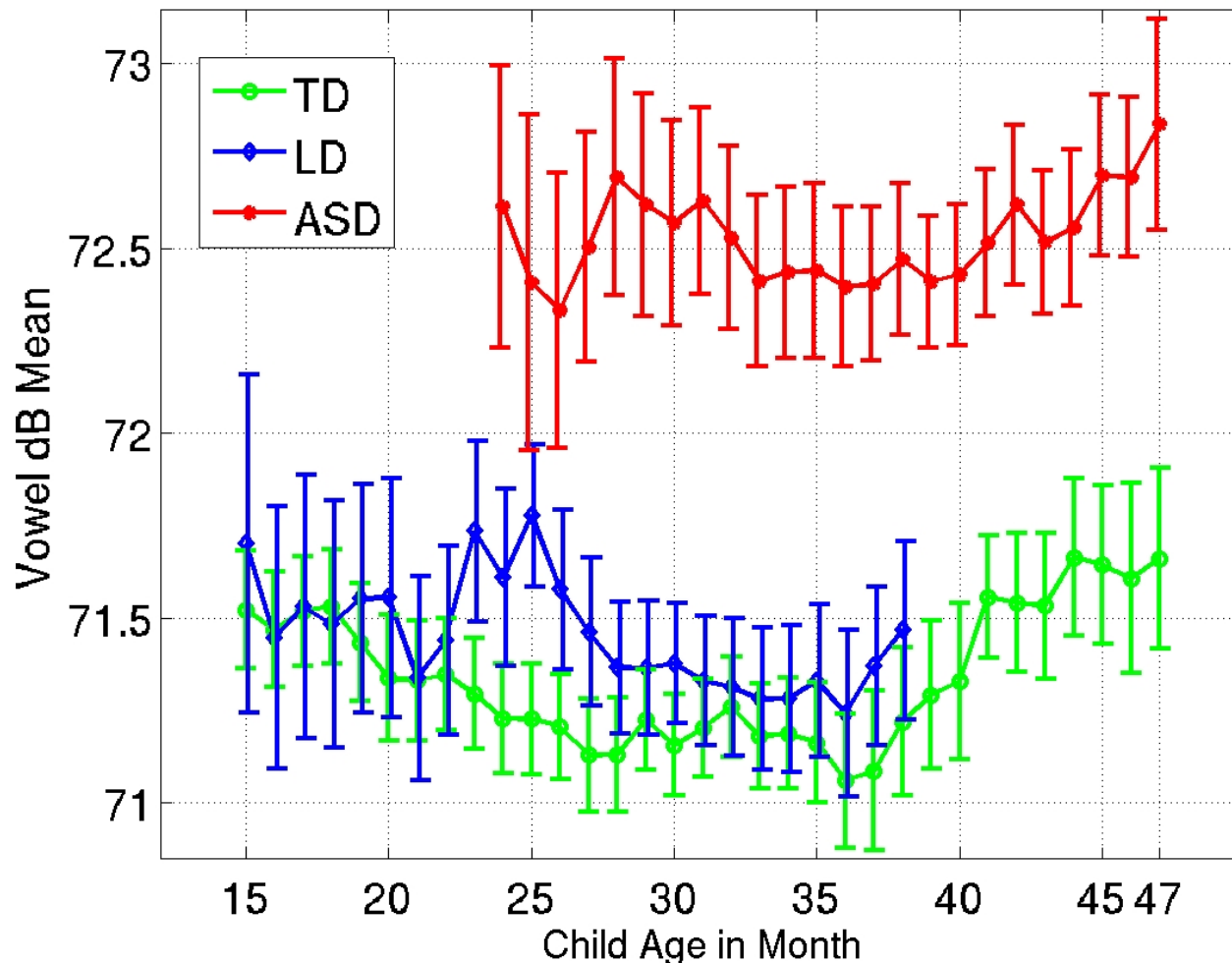
* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Child Vowel Volume (dB)

Mean and Standard-Error



t-test

(Welch 2-sample 2-side)

ASD versus TD:
 $t(125) = 5.84^{***}$

ASD versus LD:
 $t(117) = 4.78^{***}$

TD versus LD:
 $t(97) = 0.45$

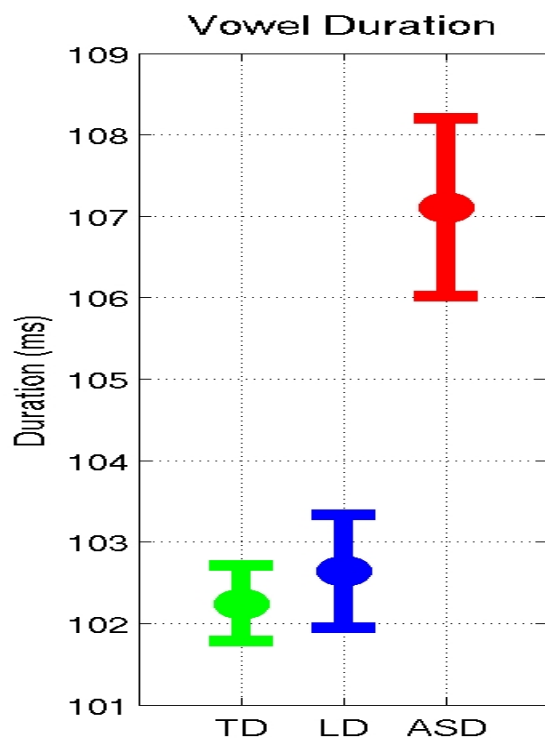
* $p < 0.05$

** $p < 0.01$

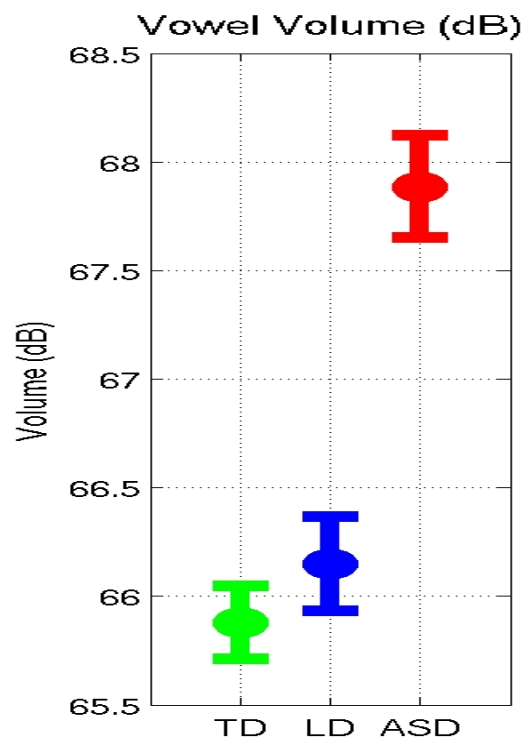
*** $p < 0.001$

Characteristics of Female Caregiver (Vowels inside “Child-directed” Voice)

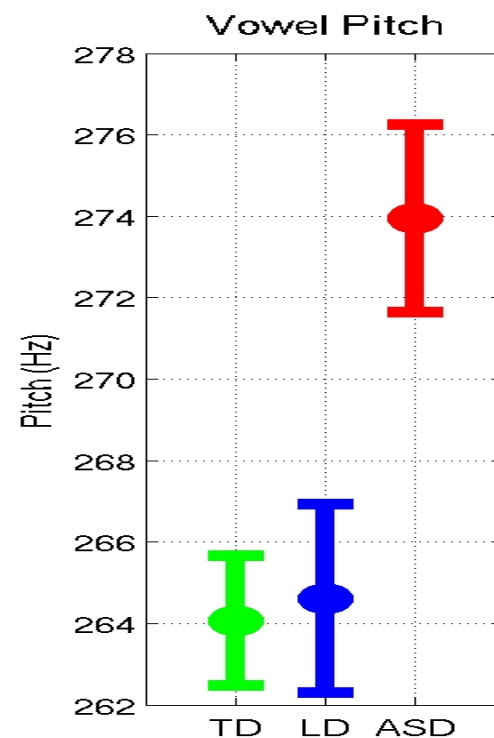
Mean, Standard Error and t-Statistics



ASD-vs-TD: 4.63***
ASD-vs-LD: 3.58***
TD-vs-LD: 0.91



ASD-vs-TD: 8.58***
ASD-vs-LD: 6.09***
TD-vs-LD: 1.72



ASD-vs-TD: 3.37***
ASD-vs-LD: 2.25**
TD-vs-LD: 0.16

t-test: *p<0.05; **p<0.01; ***p<0.001

Previously
Studied

PNAS Article

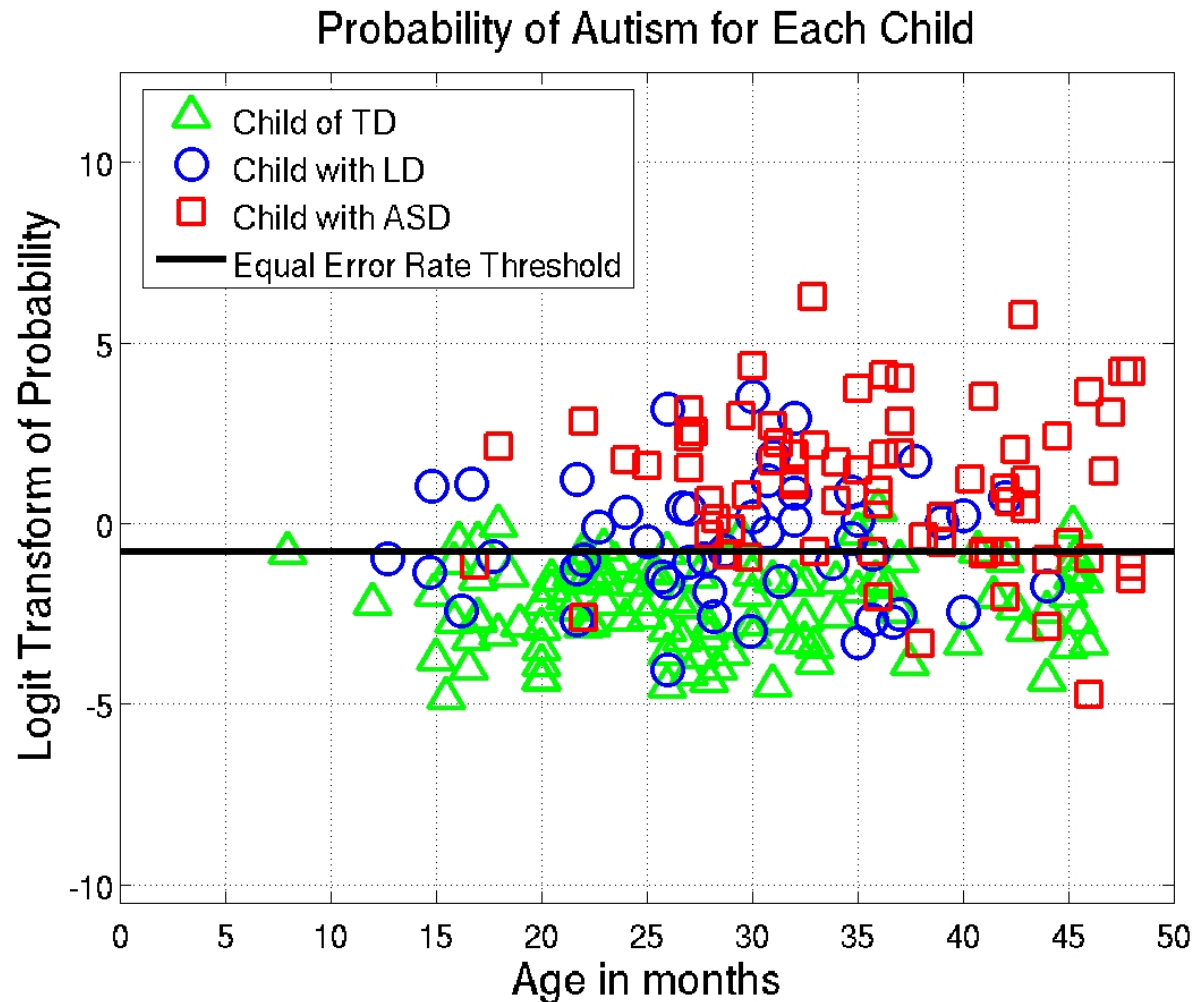
July 2010, 107(30)

12 features from
top-down approach

ASD vs TD + LD:

Equal Sensitivity
and Specificity:

79%



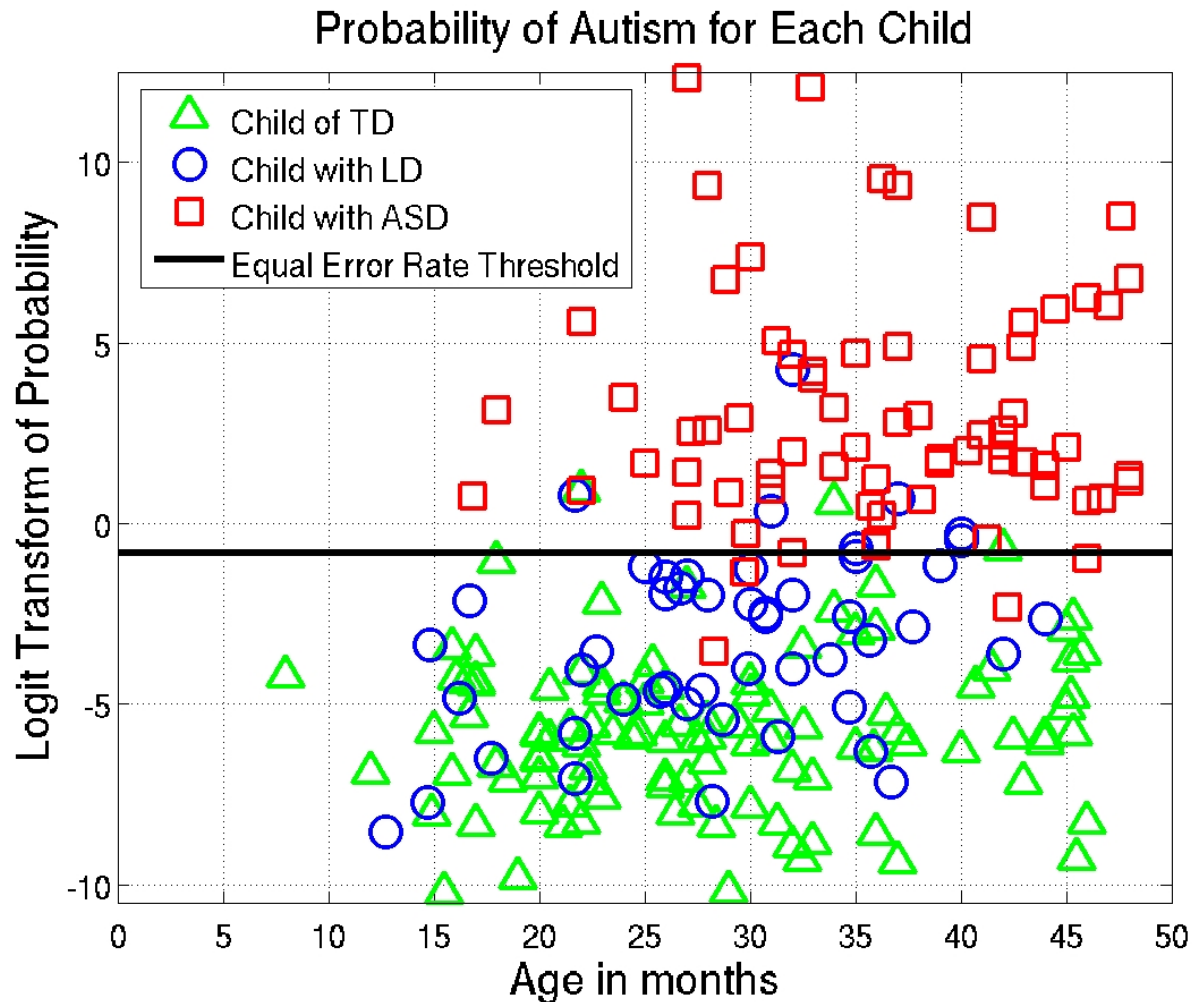
New Method:

features derived
from bottom-up
data-driven
approach

ASD vs TD + LD:

Equal Sensitivity
and Specificity:

94%



- Third-Party Data:

SCMC (TD), Thanks to Drs. Yiwen Zhang &
Fan Jiang of SCMC

UNC (ASD), Thanks to Dr. Brian Boyd of UNC

VU (ASD), Thanks to Dr. Paul Yoder of VU

- Train a model with LENA-Data:

LENA.TD, 802 recordings, 106 children

LENA.LD, 333 recordings, 49 children

LENA.ASD, 228 recordings, 71 children

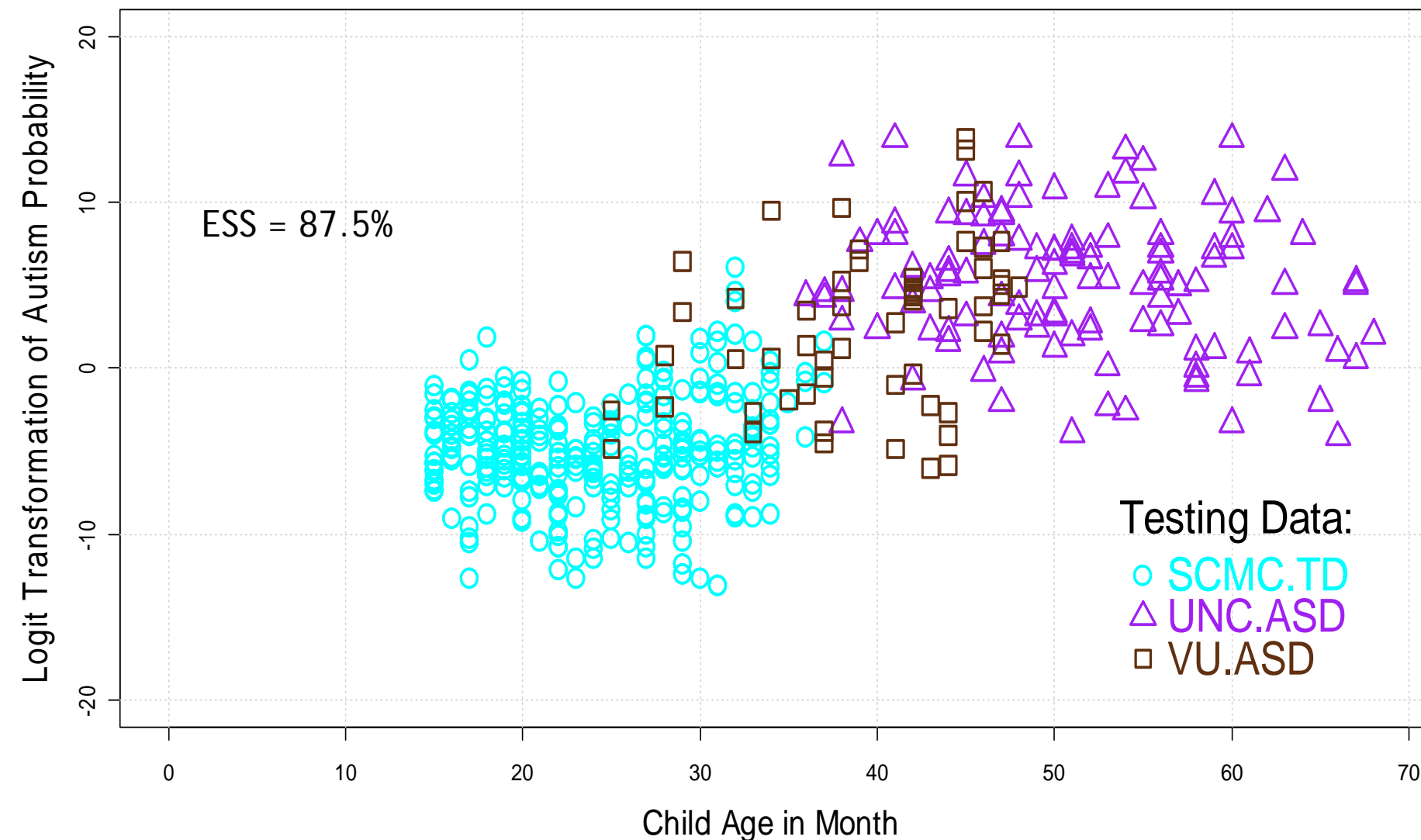
- Test the trained model with the third-party data:

SCMC.TD, 432 recordings, 22 children

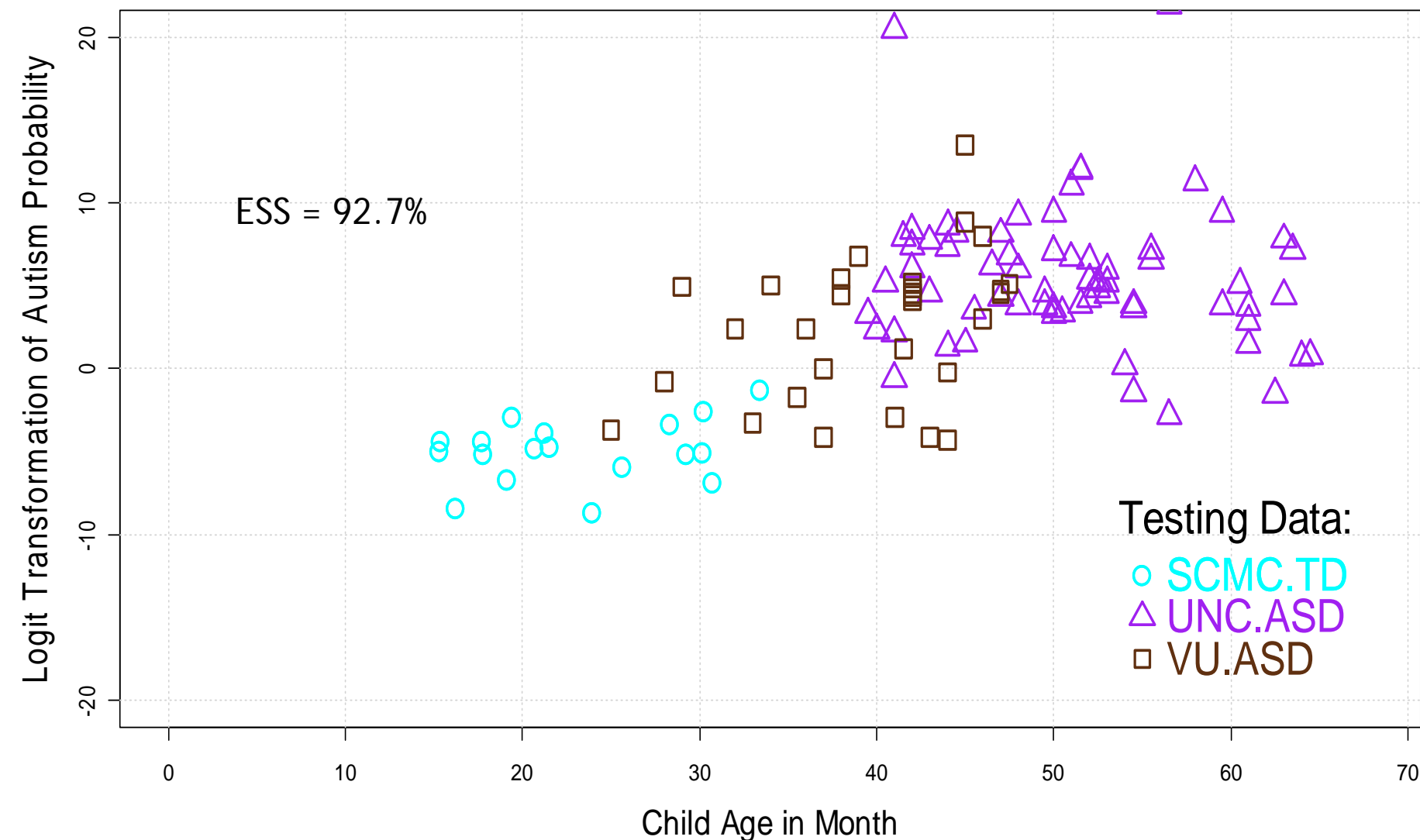
UNC.ASD, 125 recordings, 67 children

VU.ASD, 59 recordings, 31 children

Autism Probability of SCMC, UNC & VU Recordings Using a Model Trained on LENA Data



Autism Probability of SCMC, UNC & VU Children Using a Model Trained on LENA Data



Preschool Environments

Work presented at IMFAR 2012 by
Jill Gilkerson, PhD

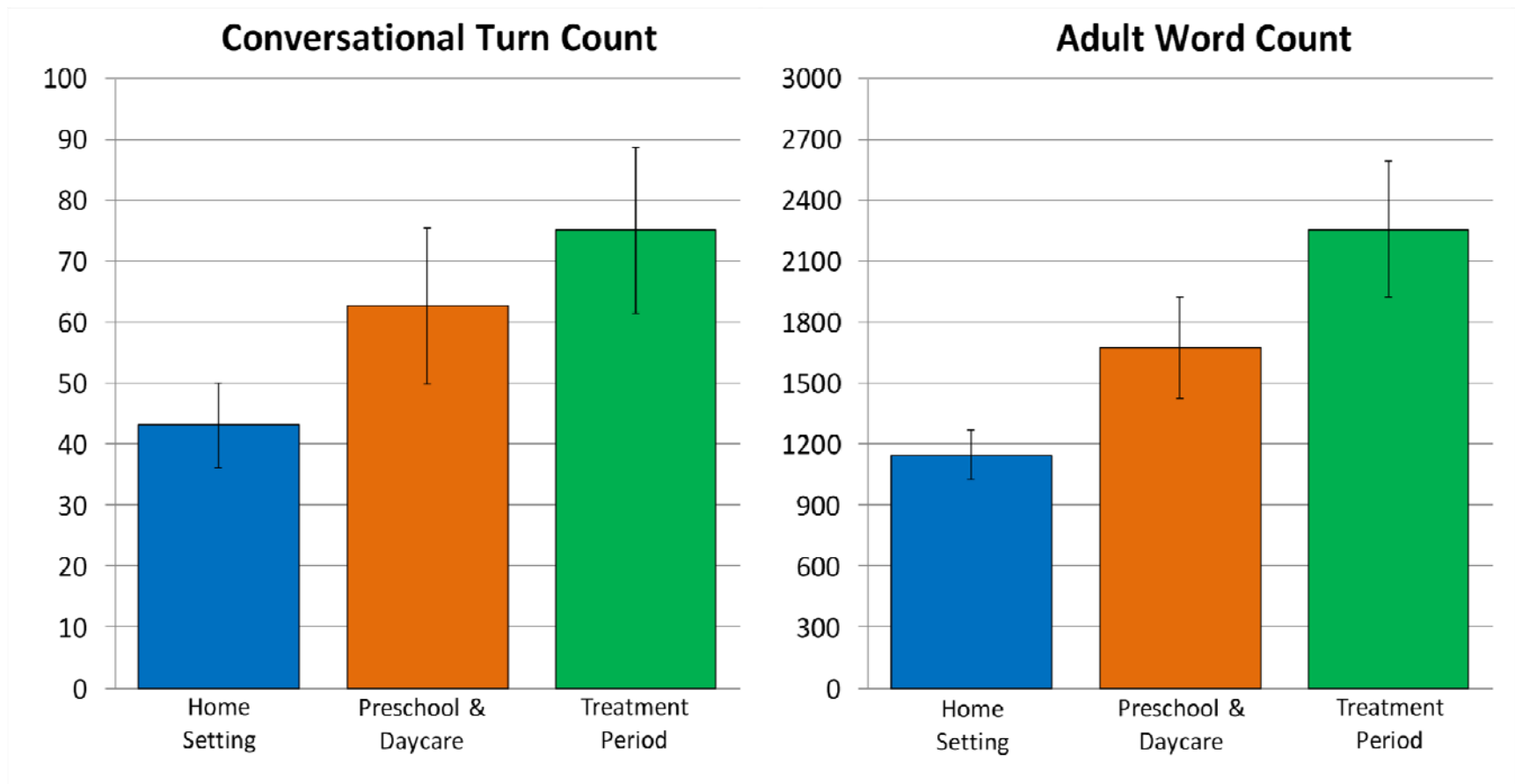
Overview

- Purpose: examine environments of ASD and TD children in the home setting, during preschool and therapy times.
- Participants: 74 children with ASD between 24-48 months of age and 44 age-matched TD peers.
- Procedure: Participants recorded continuously throughout the day, and parents completed session diaries indicating specific times children attended therapy or preschool.

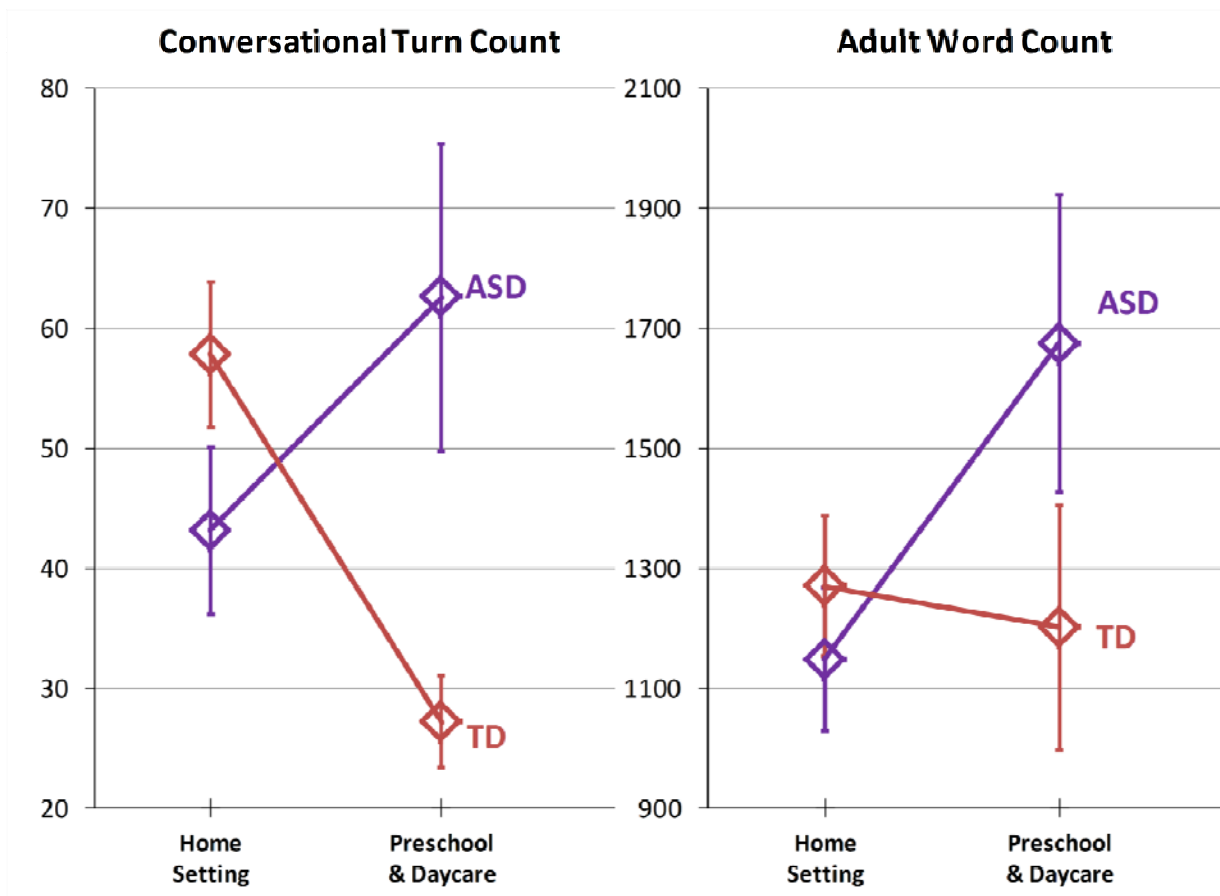
Sample Demographics

	ASD	TD
N	74	44
Age Mean (SD)	37 (7)	39 (6)
Range	24-48	26-48
% Female	18	64
Total Recording Hours (sessions)	3943 (326)	3139 (439)
Home Hours (sessions)	2366 (217)	2829 (310)
Preschool/Daycare Hours (sessions)	170 (19)	647 (129)
Therapy Hours (sessions)	285 (90)	

Children with ASD Experience Different Language Environments in Different Settings



Language Environments in Preschool and Home Settings for ASD and TD Children



Conclusions

- LENA is an effectively way monitor language environments provided by parents, preschool teachers and therapists.
- In the future, automated analysis could be used to set standards for language enrichment and engagement in both TD and ASD preschools.
- Preschool teachers could be trained using automated analysis and objective feedback.
- The language environment of preschool programs could be monitored at intervals and improved over time.

A New Look at Response Time

Work presented at ISIS 2012 by
Jill Gilkerson, PhD

Overview

Purpose: To evaluate the relationship between caregiver response time and child language skills.

Participants: 229 typically developing children 2 - 35 months of age from LENA normative corpus.

Procedures:

- Participants completed one daylong recording per month (no feedback provided) for 6-38.
- Certified SLPs administered the PLS-4 and REEL-3 to assess language skills at 4-6 month intervals. Analysis includes composite average total language scores.

N	289
Age range in mo.	2-35
Mean age (SD)	20.5 (9.1)
% Female	49.8
Recording sessions	2,007
Recording hours	24,084
Mean PLS-4/REEL-3 SS (SD)	102 (13)
PLS-4/REEL-3 SS range	60-139

Caregiver Responsiveness in Higher- and Lower-Language Ability Groups

Ability Group	N	Mean Ability Standard Score	Mean % Response
SS > 105	145	115	20%
SS < 95	51	87	16%

$t(194)=3.75, p<.001$

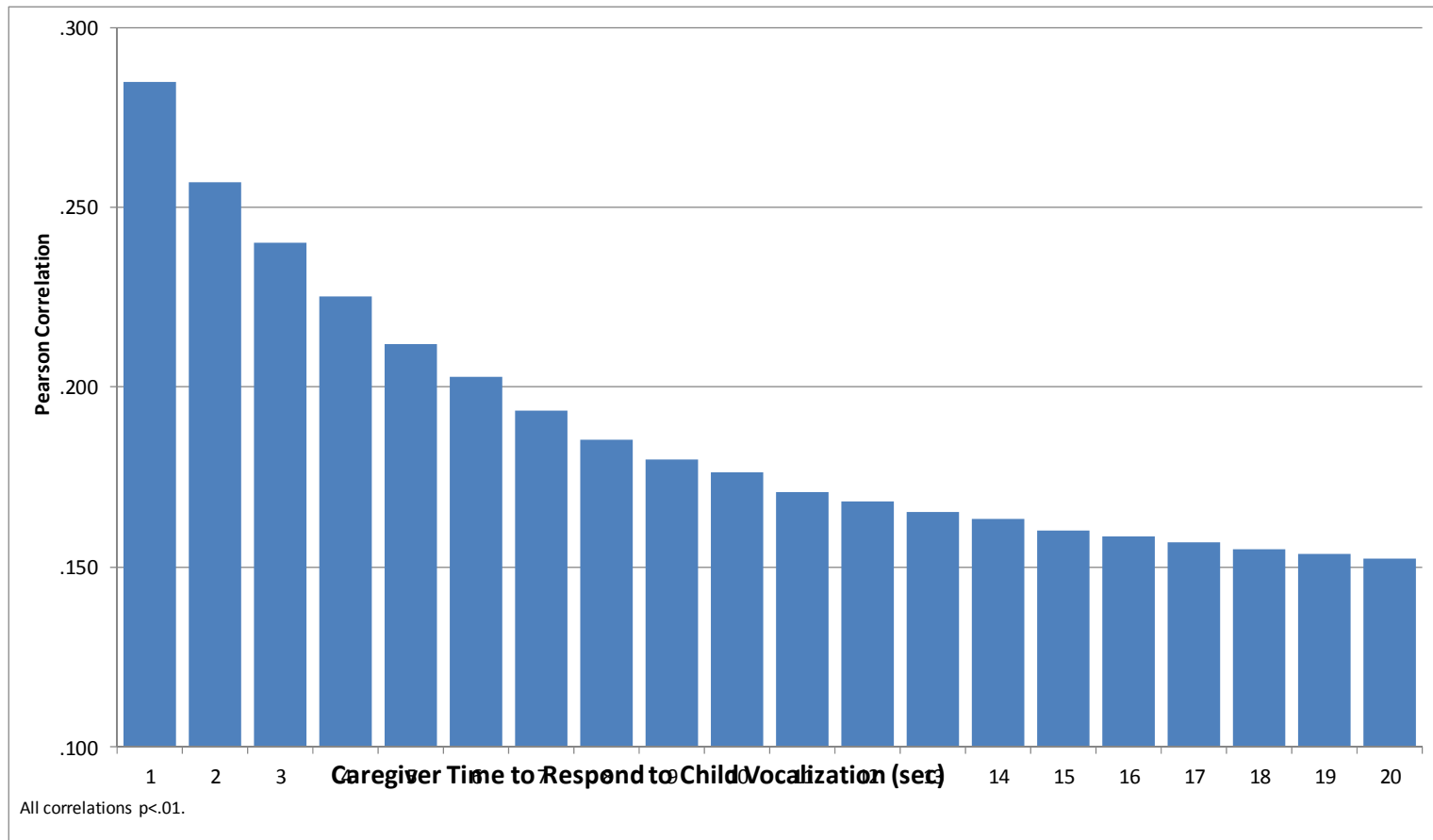
Caregiver Responsiveness in Higher- and Lower-Language Ability Groups

Table 1. Age and Ability Group Comparisons

Age Group	N	Pearson Correlation	Ability Group	N	Mean Ability Standard Score	Mean % Response
All Ages	289	.21**	SS > 105	145	115	20%
<12M	101	.25*	SS < 95	51	87	16%
12M-23M	154	.28**	$t(194)=3.75, p<.001$			
24M-35M	167	.20*				

* $p<.05$; ** $p<.01$

Caregiver Response Time to Child Vocal Output Predicts Child Language Ability



Conclusions

- There is a relationship between caregiver response time and child language ability.
- Immediacy of response to a child's initiation may be relevant to communicative development.
- LENA technology can provide this type of feedback to caregivers and parents.

New Online Parent Intervention

- 12-week web-based parent intervention
- Experimental study investigating:
 - change in parent behavior
 - acceleration in child language development

Parent Resources Website

- Talking Tips
- Book Lists
- Videos
- Webinars
- Parent Forums
- Live Chat

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Welcome to the LENA Smarter Happier Baby™ site.
Please enter your username and password below to continue.

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Password

☐ Remember Me

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Book Reading

Talking Tips

Videos

Webinars

Forums

Live Chat & FAQs

Welcome to the LENA Smarter Happier Baby™ Program

We are so excited that you've joined our select group of parents committed to advancing their child's language development. Our goal is for you to see your child grow far beyond your expectations!

The Smarter Happier Baby Program uses advanced technological breakthroughs and over 30 years of child language research. The program is going to be easy and fun. The results you'll see will be phenomenal!

Be sure to use the resources at the top of the site - they're designed to help you get the most out of the program. If you've [installed the LENA software](#), it's time to get started! Your schedule is below.

Your Schedule: Week

1

2

3

4

5

6

7

8

9

10

11

12

Schedule Overview

Join Monday All-Day Chat!

Live Chat is open all day on Monday, 10 AM – 4 PM MDT. Join us to [...]

Final Coaching Session

Get in touch via email to set up a coaching session at any time. If you [...]

Webinar 4: Sing and Play Throughout Your Day!

Our last webinar, Sing and Play Throughout Your Day! is ready to view. Visit the Webinars [...]

Special Announcement: LENA Stories Contest!

Cute, silly, surprising, enlightening – this is your chance to share your LENA memorable moment with [...]

Home

Additional Resources

Log Out

Smarter Happier Baby - Mozilla Firefox

FileEditViewHistoryBookmarksToolsHelp

Smarter Happier Baby

smarterhappierbaby.org/groupa/talking-tip-videos/

Google

SMARTER | HAPPIER
BABY™ PROGRAM

B

Book Reading

T

Talking Tips

V

Videos

W

Webinars

F


Forums

?


Live Chat & FAQs

Talking Tip Videos


Speaking 17,000 words per day to your child is easier than you think. Click on any Talking Tips Video below to learn how easy it is to increase your Adult Word Counts, boost your Conversational Turns and create an everlasting bond between you and your child.




Introduction by Todd Risley




Wardrobe Change




Broadway, Here I Come




Gab It Up at the Grocery Store




Laugh and Talk While Doing Laundry



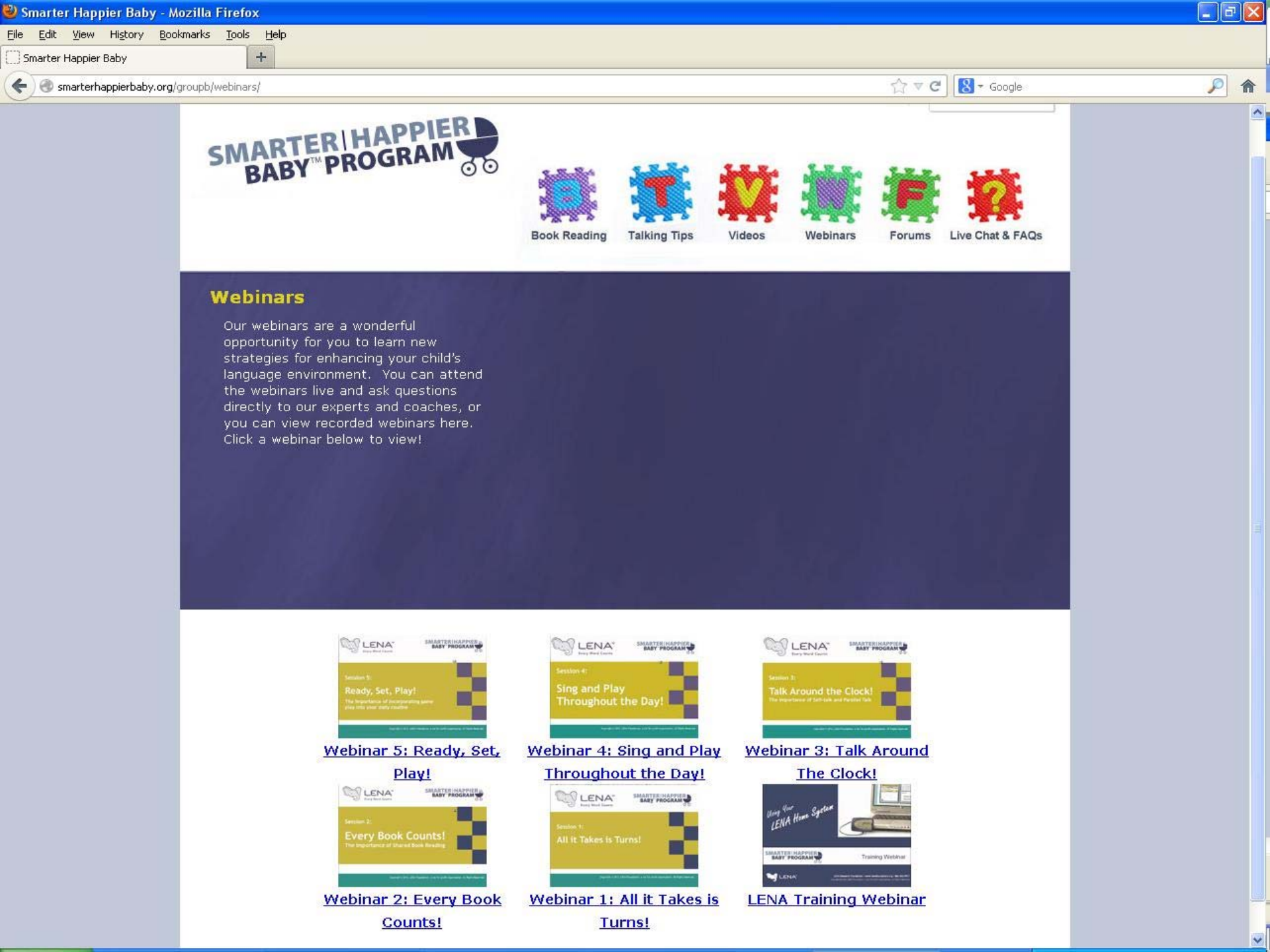
Slicing and Dicing Doesn't Have to Be a Solo Effort



The Great Outdoors



Read All About It



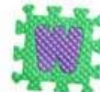
Book Reading



Talking Tips



Videos



Webinars



Forums



Live Chat & FAQs

Webinars

Our webinars are a wonderful opportunity for you to learn new strategies for enhancing your child's language environment. You can attend the webinars live and ask questions directly to our experts and coaches, or you can view recorded webinars here. Click a webinar below to view!



[Webinar 5: Ready, Set, Play!](#)



[Webinar 2: Every Book Counts!](#)



[Webinar 4: Sing and Play Throughout the Day!](#)



[Webinar 1: All it Takes is Turns!](#)



[Webinar 3: Talk Around The Clock!](#)



[LENA Training Webinar](#)





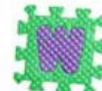
Book Reading



Talking Tips



Videos



Webinars



Forums



Live Chat & FAQs

Live Chat
with a LENA Coach

Send an Email
to a LENA Coach

Browse Frequently
Asked Questions



LIVE CHAT
AVAILABLE

Connect >

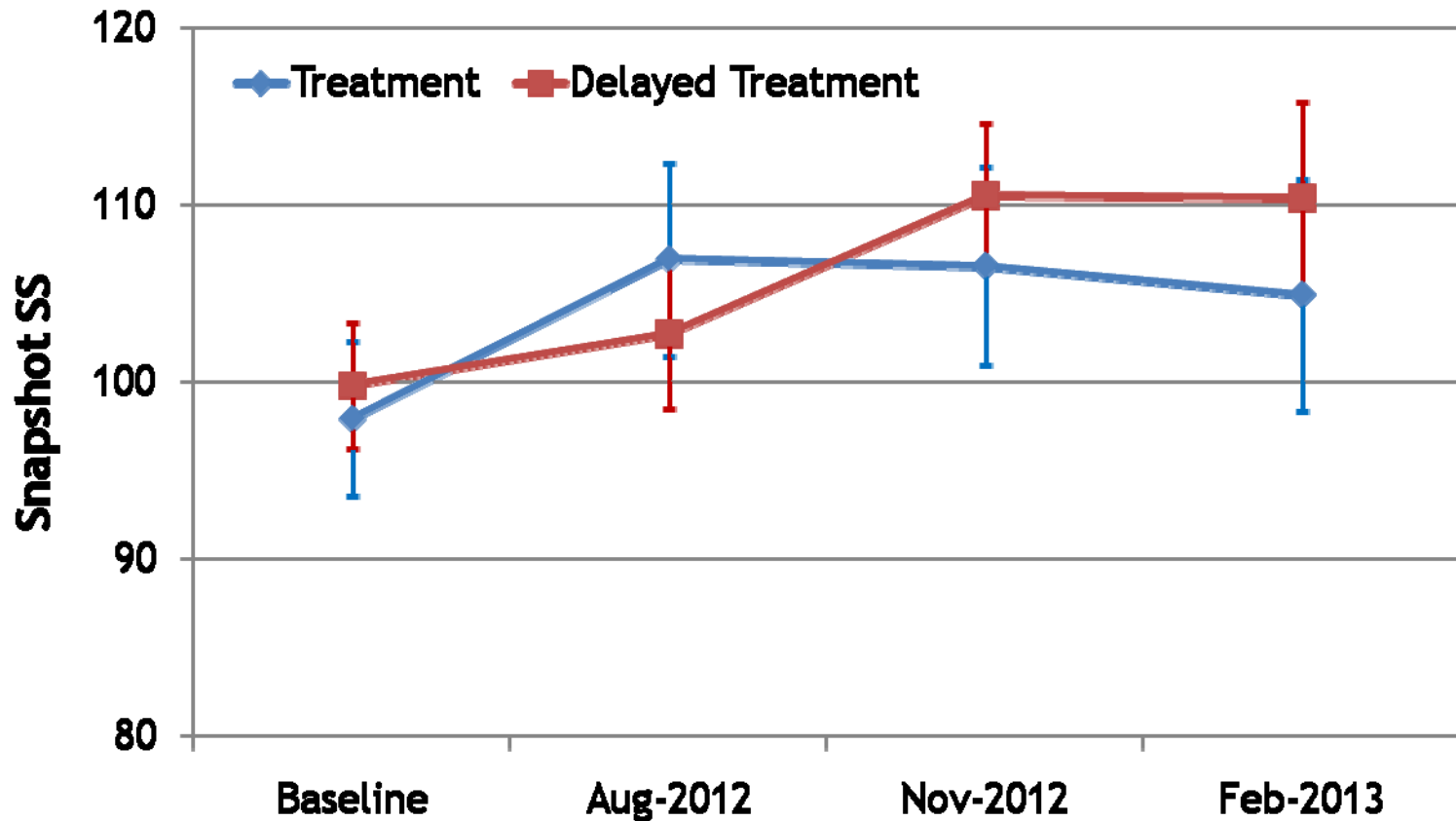
12-Week Online Intervention

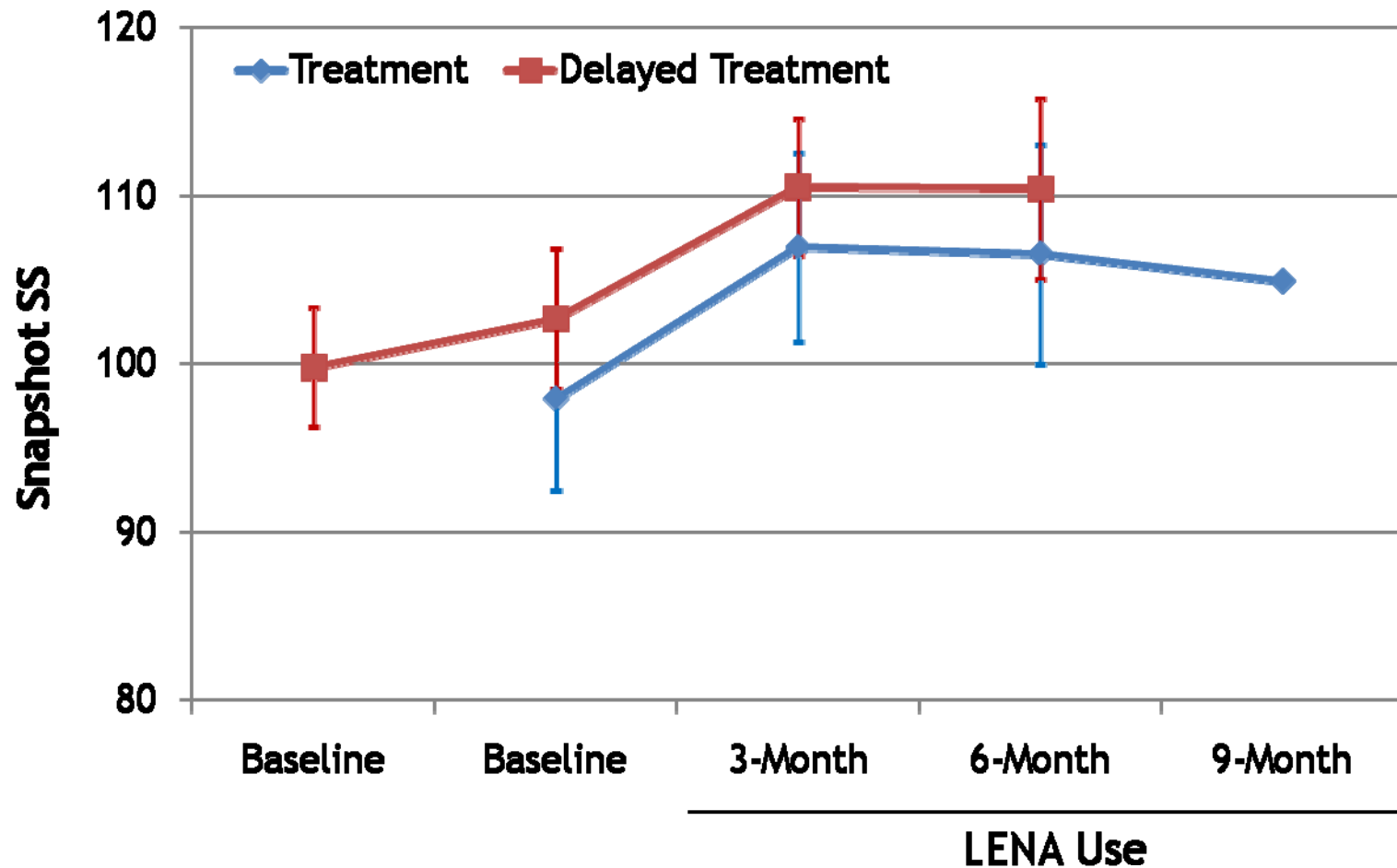
- **First Week**
 - Parent receives LENA Home and website login
 - Parent installs LENA
 - Parent records, processes data, views reports
 - Parent accesses internet to pass ITS file
 - Phone meeting with LENA coach to set goals
- **Week 2-12**
 - Parent makes best effort to improve language environment
 - Parent views Talking Tips Videos and Shared Reading Tips
 - Parent participates in Forum and Chat
 - Parent attends live Webinars once every other week
 - Parent completes Snapshot in LENA software once per month

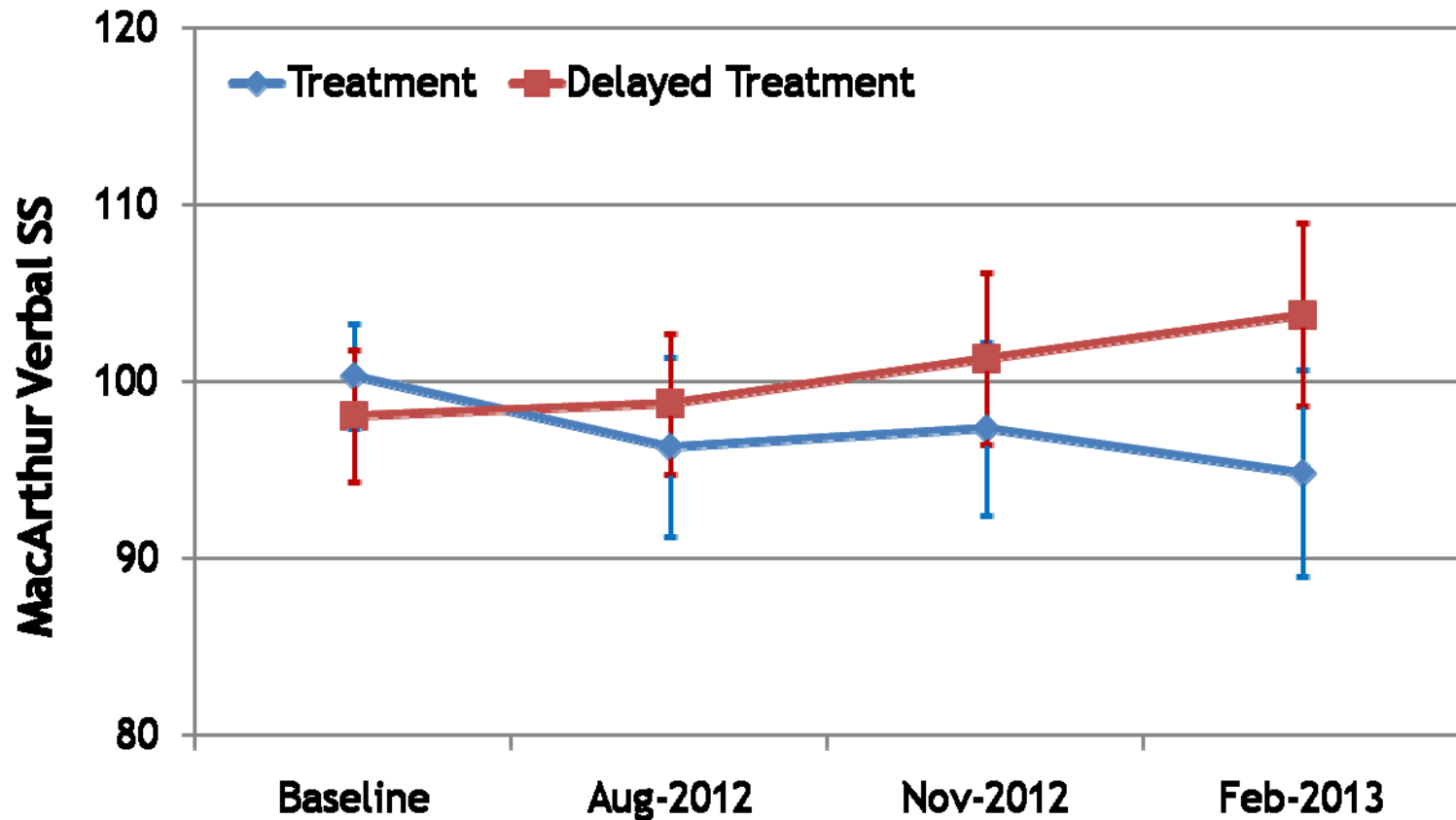
First LRF Experimental Study

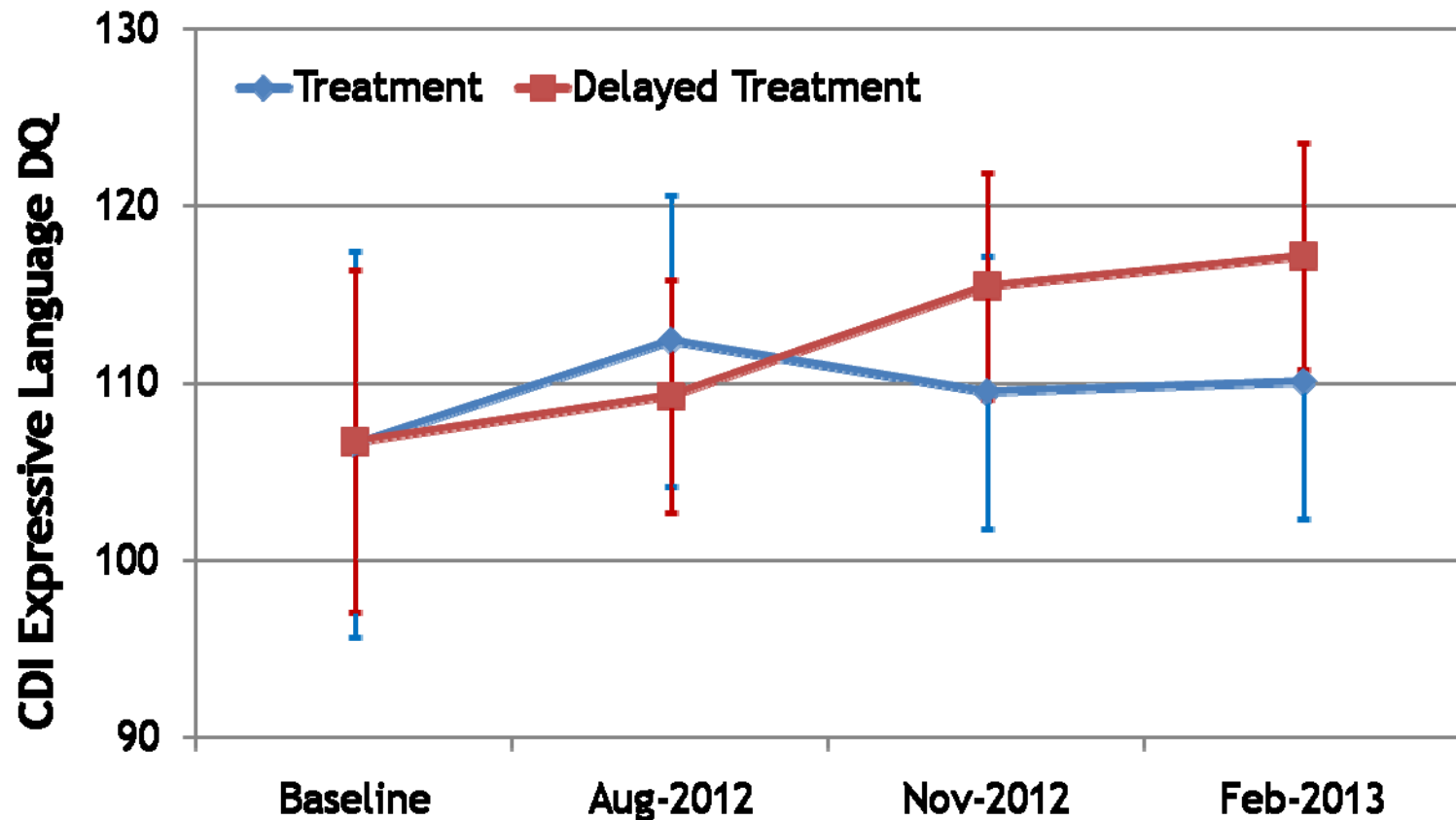
- N = 60 “completers” (began with 80 participants)
- 6 - 18 months of age at first recording
- Random assignment to Treatment and Control groups
 - Treatment: Begin using LENA Home immediately, SHBO website
 - Control: Record with LENA but no feedback
(Control became “delayed treatment” after 3 months)
- Assessments: Snapshot, MacArthur and CDI
 - At baseline, post treatment, 3 and 6 month follow up
- Treatment Phase Recordings
 - Month 1-2: Once per week
 - Month 3-6: Every other week
 - Months 7-12: Once per month

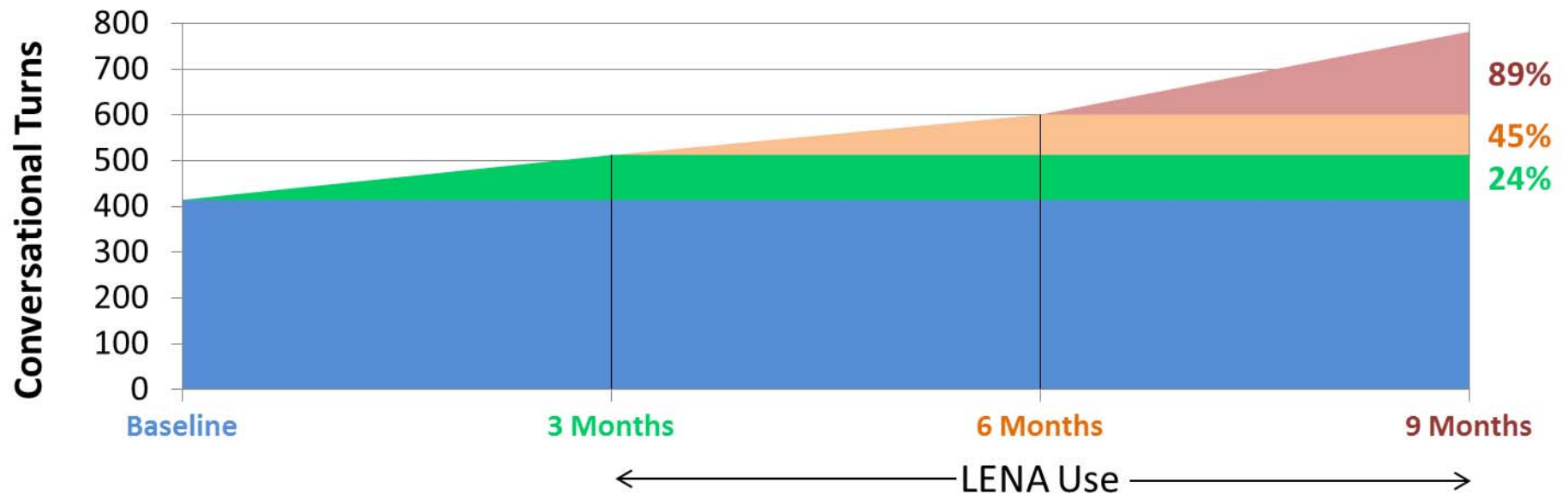
Month	Date	Treatment Recordings	Control Recordings	Assessments
1	June, 2012	4	1	Snapshot, CDI, MacArthur
2	July, 2012	4	1	
3	August, 2012	2	1	Snapshot, CDI, MacArthur
4	Sept, 2012	2	4	
5	Oct, 2012	2	4	
6	Nov, 2012	2	2	Snapshot, CDI, MacArthur
7	Dec, 2012	1	2	
8	Jan, 2013	1	2	
9	Feb, 2013	1	2	Snapshot, CDI, MacArthur
10	March, 2013	1	1	
11	April, 2013	1	1	
12	May, 2013	1	1	Snapshot, CDI, MacArthur



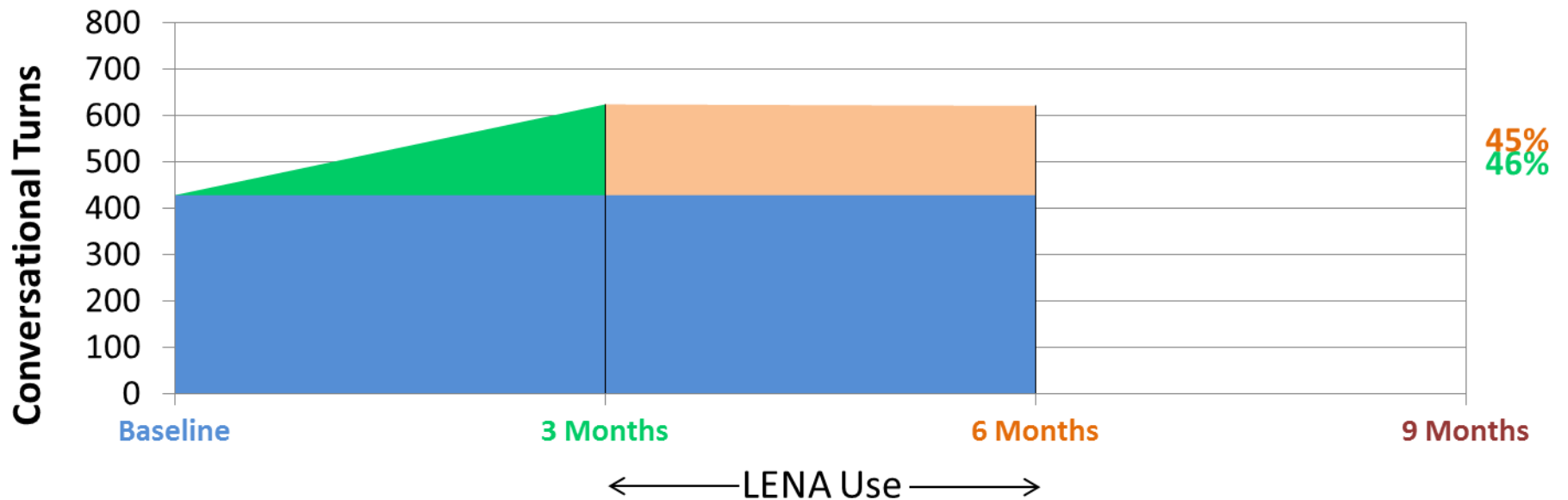
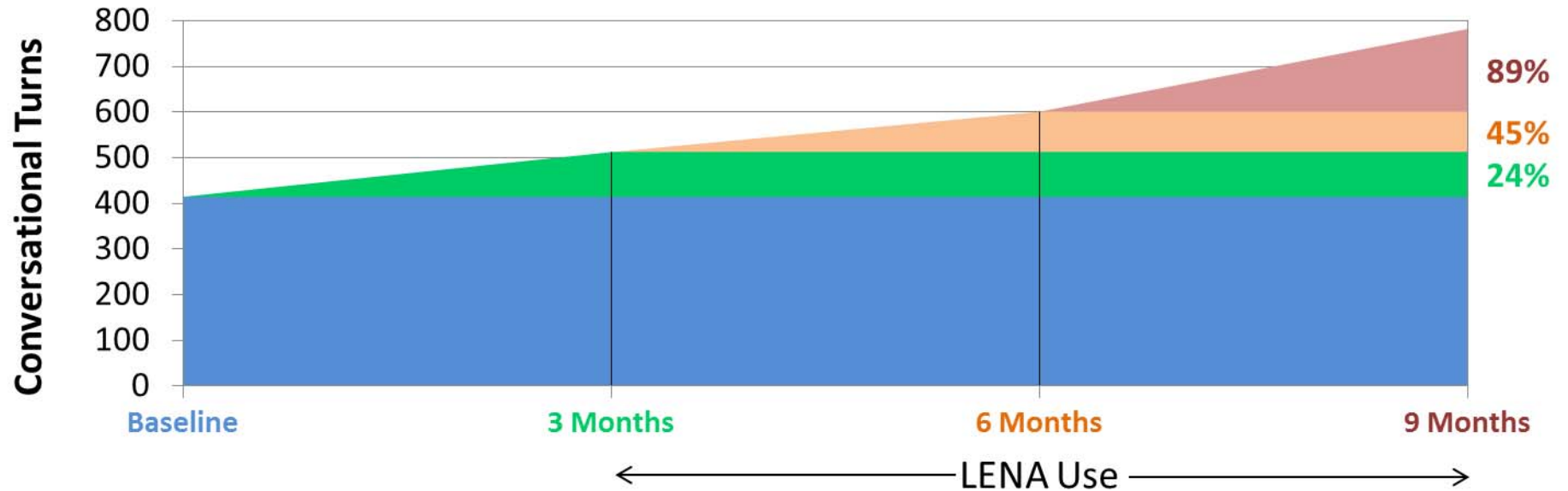




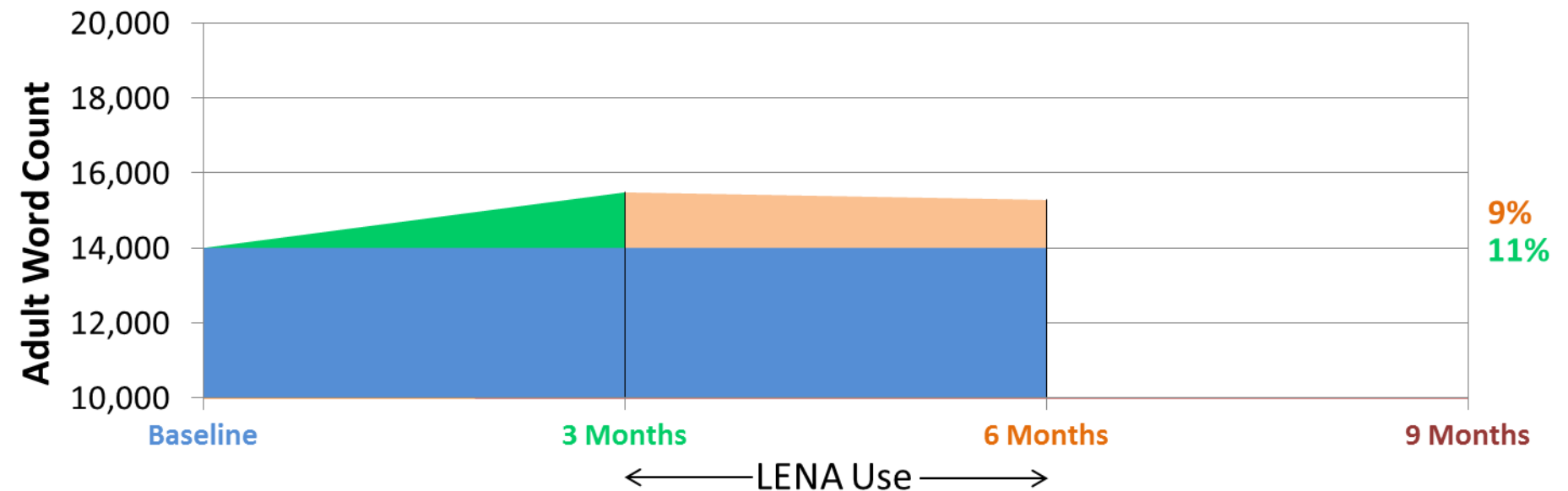
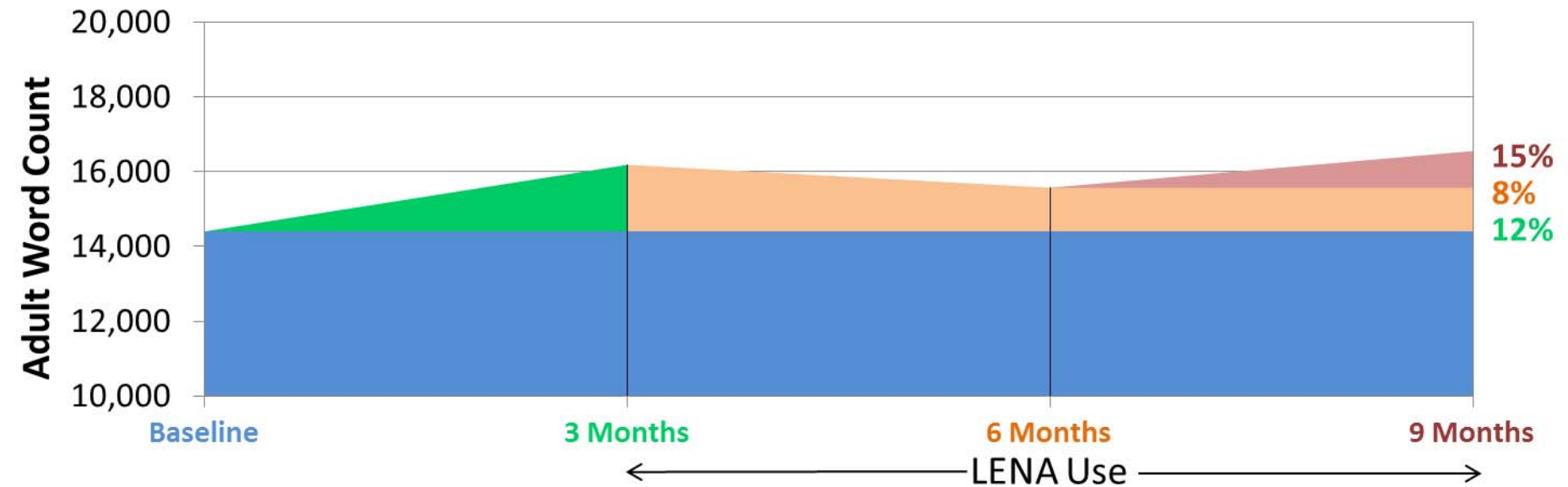




Maintaining Positive Behavioral Change



Maintaining Positive Behavioral Change



Conclusions

- Preliminary data suggest that parent-child interaction increases significantly with LENA use.
- There is indication on some measures that child language skills are accelerated for children whose parents use LENA
- Both of these changes are holding over time

Thank You Team!

- Rebecca Mills, M.A. – Research Supervisor
- Kate Lincoln, M.A. – Research Coordinator
- Joanna Lester, B.A. – Research Assistant

Q&A

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