Language Growth Over Time in Young Children with Bilateral and Unilateral Hearing Differences

EHDI Conference

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Acknowledgement

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Disclaimers

The data presented here are provisional and have not been published

The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC).

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Today's Topics

- Summarize sample characteristics
- Present spoken/signed language outcome data over time
  - Children with bilateral hearing differences
    - Deaf/hard of hearing only (D/HH)
    - D/HH + disabilities that impact language (D/HH+)
  - Children with unilateral hearing differences
- Identify characteristics associated with better language outcomes

Participants

- Data were collected as part of ODDACE
  - Outcomes and Developmental Data Assistance Center for EHDI Programs
  - CDC-supported project examining language outcomes across multiple sites
  - 17 participating programs (15 programs across 13 states represented in this analysis)

States Represented by Participating ODDACE Programs

- Arizona
- Colorado
- Florida
- Idaho
- Illinois
- Indiana
- Maine
- Massachusetts
- North Dakota
- South Dakota
- Texas
- Vermont
- Wyoming

Participant Criteria

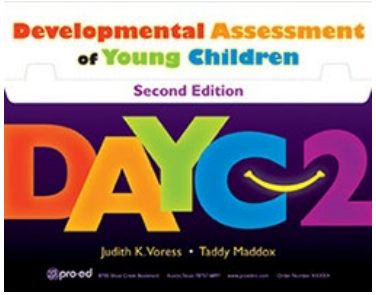
- Bilateral (BHD) or unilateral (UHD) hearing difference
  - (all levels -- mild to profound)
- Onset at birth
- Chronological age: 8 to 36 months

Study Description

- Longitudinal study
- Assessed on 2 to 5 occasions
- Assessments completed by the family and their early interventionist
- Assessments sent to ODDACE for scoring and database entry

Assessments

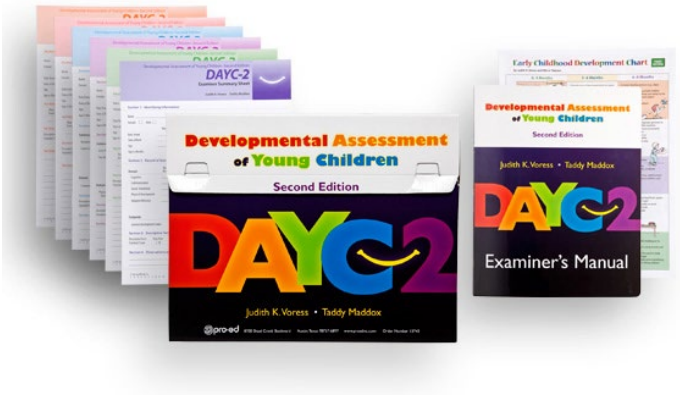
- Developmental Assessment of Young Children (DAYC-2)



- MacArthur-Bates Communicative Development Inventories

MacArthur CDI

Developmental Assessment of Young Children (DAYC-2)



DAYC-2: Description

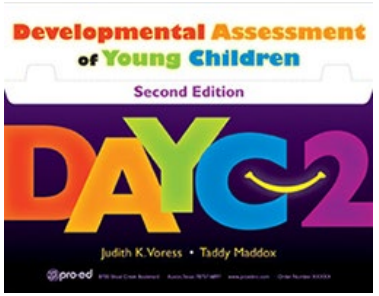
- 5-domain assessment
- Today's focus: Communication domain
  - General measure of communication
  - Receptive and Expressive Language subtests
- Skills can be demonstrated in spoken or sign language

DAYC-2: Sample Items

- Expressive Language
  - Names eight or more pictures of familiar objects
  - Uses sentences of three or more words
- Receptive Language
  - Responds to “where” questions
  - Carries out two-step unrelated commands

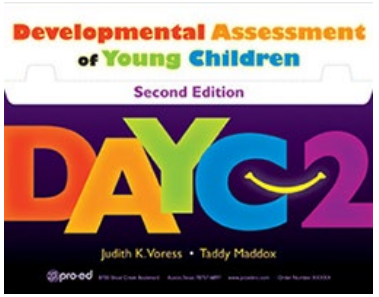
DAYC-2: Number of Participants

- Number of children
  - BHD with no additional disabilities = 387
  - BHD with additional disabilities = 94
  - UHD with no additional disabilities = 205



DAYC-2: Number of Assessments

- Number of assessments
  - BHD with no additional disabilities = 1070
  - BHD with additional disabilities = 249
  - UHD with no additional disabilities = 586



DAYC-2 Analysis: Participant Characteristics

- Chronological age
  - Range = 8 to 36 months
  - Mean = 21.8 months
- Boys = 54.5%; Girls = 45.5%

DAYC-2 Analysis: Participant Characteristics

Ethnicity	% of children
Non-Hispanic	59%
Hispanic	41%

DAYC-2 Analysis: Participant Characteristics

Race	% of children
White	85.6%
Black/African American	4.4%
Asian	2.2%
Native American/Alaska Native	1.3%
Native Hawaiian or other Pacific Islander	0.3%
Two or more races	6.2%

DAYC-2 Analysis: Participant Characteristics

Age at…	Mean (months)	Range (months)
Identification	3.3	< 1 to 26
Amplification	6.6	1 to 30
Intervention	6.9	< 1 to 30

*76% of children were identified by 3 months of age

*64% of children were in intervention by 6 months of age

*58% of children met EHDI 3 and 6

DAYC-2 Analysis (Bilateral): Participant Characteristics

Use of Hearing Technology (hours per day)	% of children
Doesn't have/Has but doesn't use	12%
1 to 3 hours	15%
4 to 5 hours	11%
6+ hours	63%

DAYC-2 Analysis (Unilateral): Participant Characteristics

Use of Hearing Technology (hours per day)	% of children
Doesn't have/Has but doesn't use	23%
1 to 3 hours	20%
4 to 5 hours	19%
6+ hours	39%

DAYC-2 Analysis (Bilateral): Participant Characteristics

Communication mode used with child by family	% of primary caregivers
Primarily spoken language	80%
Spoken only	35%
Very occasional sign used	45%
Spoken + sign language	20%
Sign only	1%

DAYC-2 Analysis (Unilateral): Participant Characteristics

Communication mode used with child by family	% of primary caregivers
Primarily spoken language	96%
Spoken only	59%
Very occasional sign used	37%
Spoken + sign language	4%
Sign only	0%

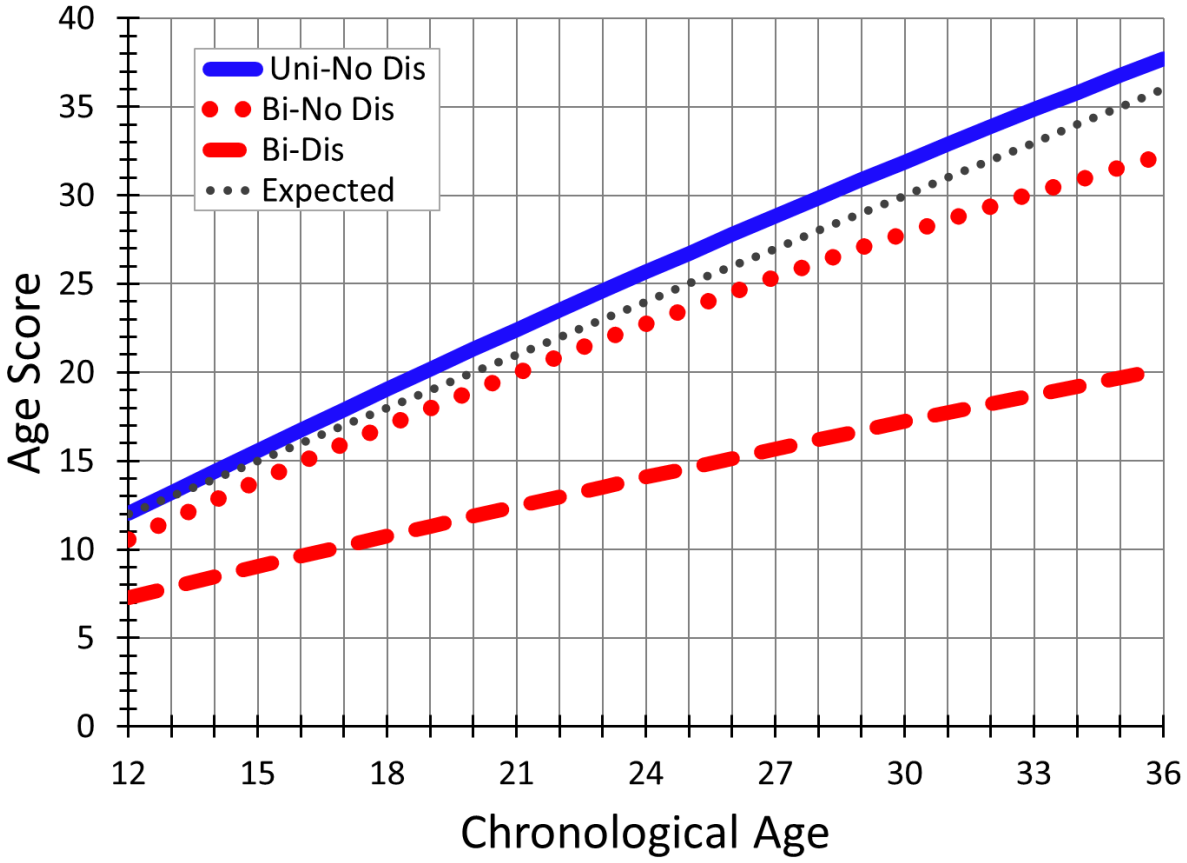
Statistical Analyses

- Hierarchical Linear Analysis (HLM) used to examine:
  - Growth over time
  - Differences between groups
  - Factors related to higher language scores and/or more accelerated growth

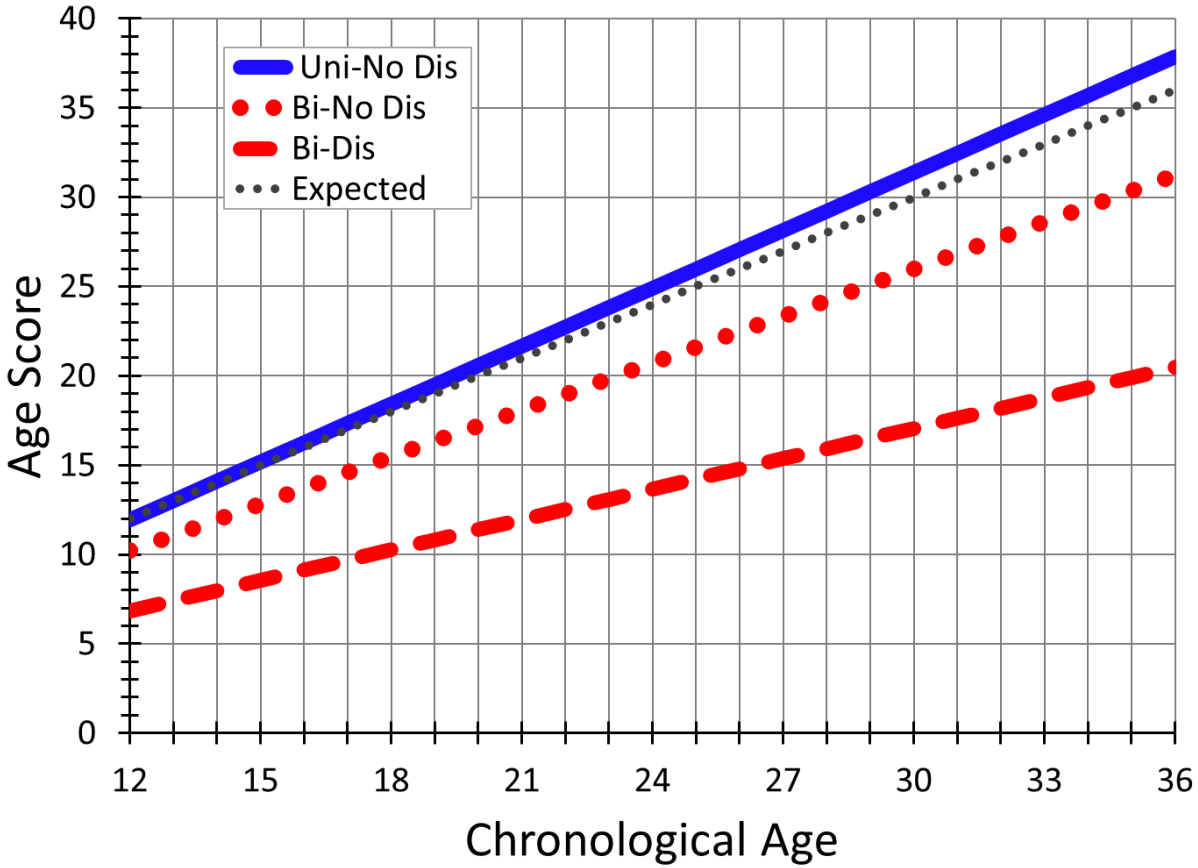
Statistical Analyses

- HLM growth curves generated controlling for:
  - Sex
  - Ethnicity
  - Race
  - Primary caregiver's level of education
  - Meeting EHDI 3 and 6 guidelines

DAYC-2: Expressive Language Age Scores



DAYC-2: Receptive Language Age Scores



MacArthur-Bates Communicative Development Inventories: Expressive Vocabulary

MacArthur-Bates Communicative Development Inventories

- Assesses diversity of expressive vocabulary
- Parent-report instrument
- Includes both spoken and signed expressive vocabulary

MacArthur-Bates CDI Analysis: Number of Participants

- Number of children
  - BHD with no additional disabilities = 348
  - BHD with additional disabilities = 67
  - UHD with no additional disabilities = 176

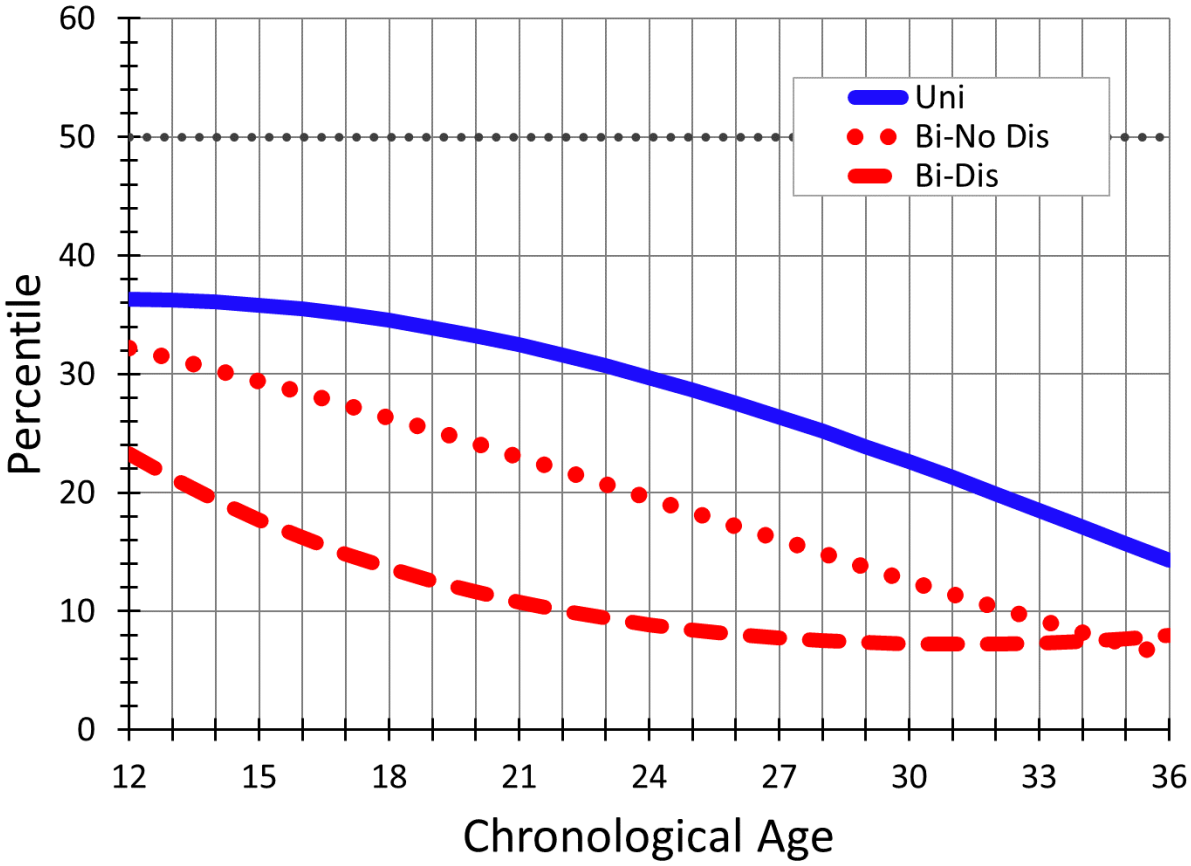
MacArthur-Bates CDI Analysis: Number of Assessments

- Number of assessments
  - BHD with no additional disabilities = 953
  - BHD with additional disabilities = 180
  - UHD with no additional disabilities = 502

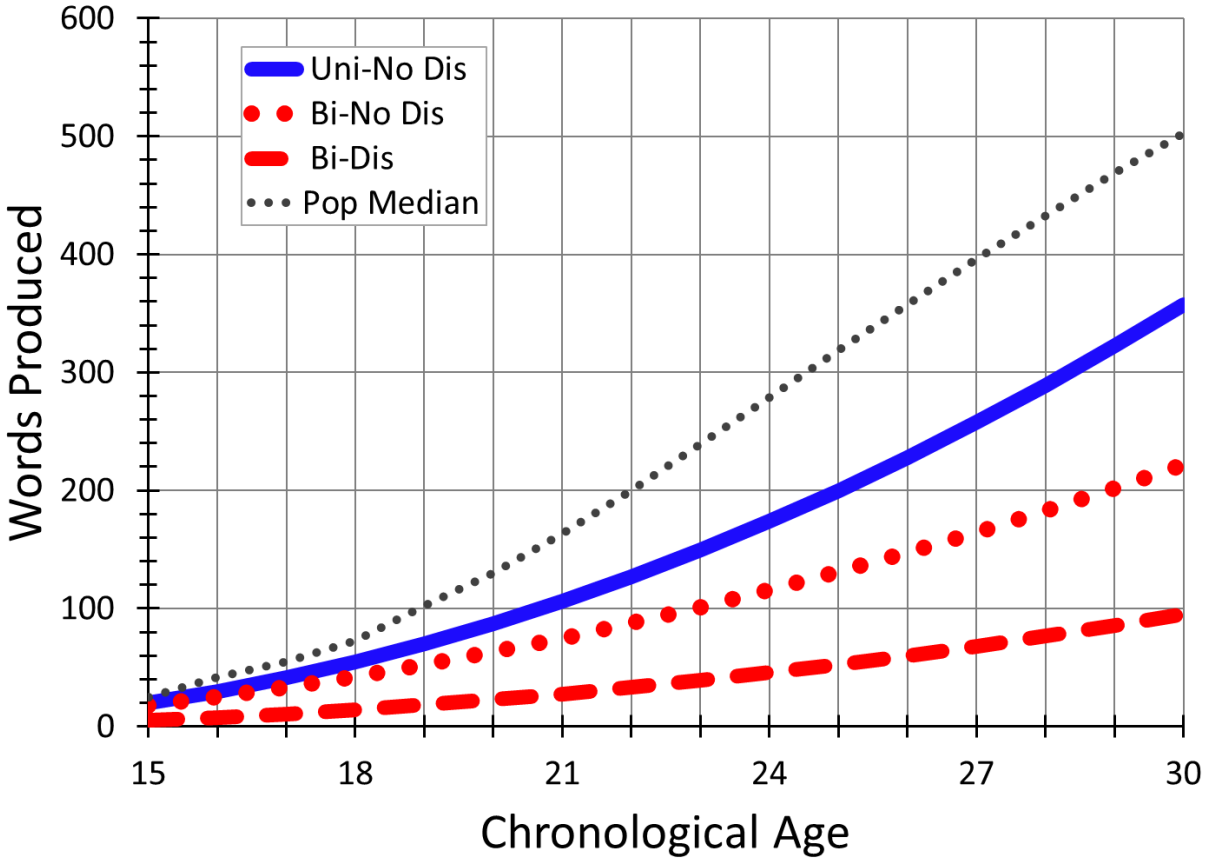
MacArthur-Bates CDI Analysis: Participants and Analyses

- With a few exceptions, participants in the MacArthur analyses were a subset of those in the DAYC-2 analyses
- Participant characteristics were very similar to those presented previously
- Statistical analyses were the same as described for the DAYC-2

MacArthur-Bates CDI: Expressive Vocabulary Percentiles



MacArthur-Bates CDI: Total Words Spoken and/or Signed



Differences Between DAYC-2 and MacArthur-Bates CDI

What might explain differences in the scores on the DAYC-2 versus the MacArthur-Bates CDI?

Differences Between DAYC-2 and MacArthur-Bates CDI

- DAYC-2: Uses a basal/ceiling approach
- MacArthur: Respond to all items
- Assessments that use a basal/ceiling
  - Points given for all items below the basal
  - Child may have gaps (have not yet acquired some earlier developing skills)
  - So, they may get credit for items they can't actually do

Differences Between DAYC-2 and MacArthur-Bates CDI

- DAYC-2: Includes general communication questions and level of linguistic complexity of response is often not specified
    - e.g.: “Tells you what he/she is doing”
        - “eat” vs. “I’m eating a turkey sandwich”
        - Both get 1 point
- MacArthur: Very specific - must say or sign specific words to get a point

Differences Between DAYC-2 and MacArthur-Bates CDI

- DAYC: Points given for pre-verbal items (which typically are not delayed in children who are D/HH)
  - Shakes head “no”
  - Points at things
- MacArthur: Points are only given for verbal (spoken or signed) skills

Predictors of Better Language Outcomes

What factors were related to higher language scores and/or faster growth in scores over time?

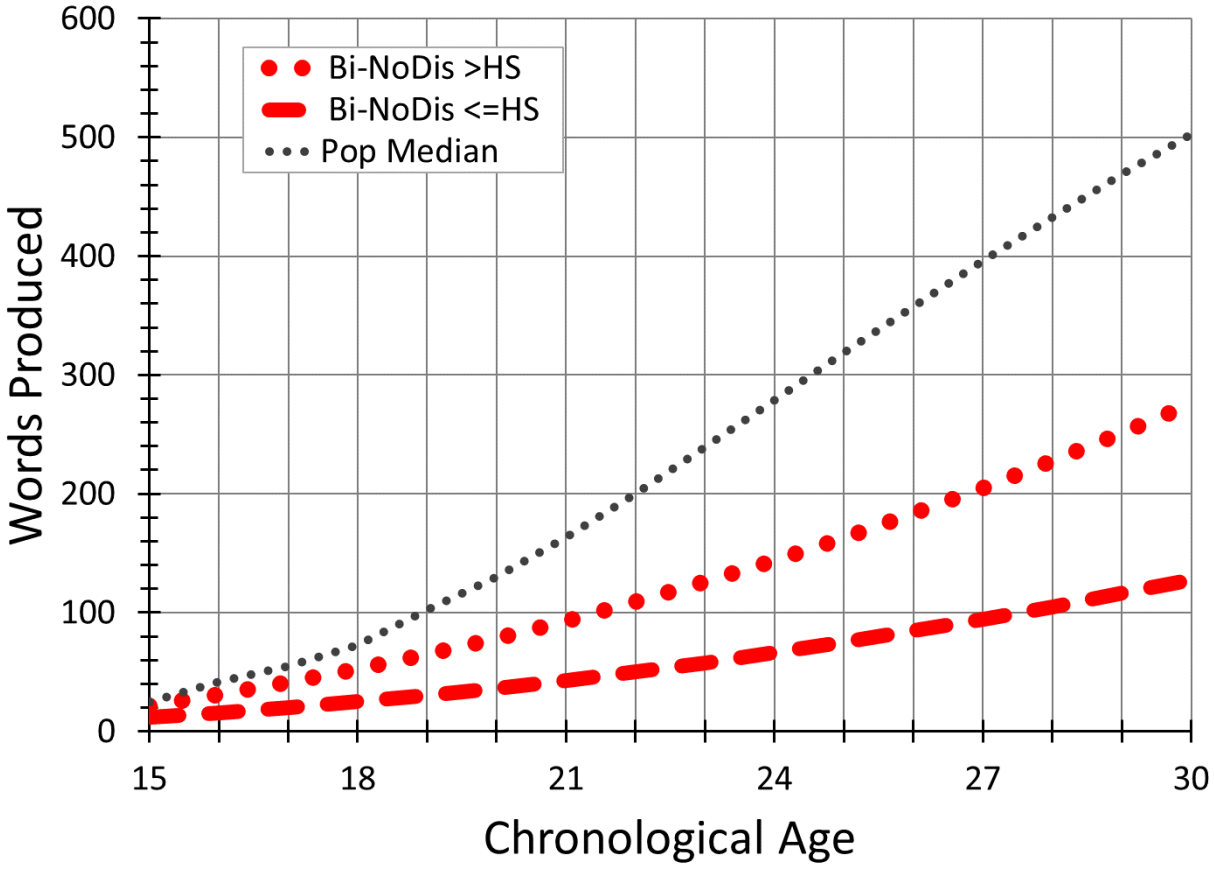
DAYC-2 and MacArthur-Bates CDI: Predictors of Higher Scores

- Higher DAYC-2 and MacArthur scores ($p < .01$) were associated with:
  - Female sex
  - Non-Hispanic ethnicity
  - White race
  - Primary caregivers with a degree beyond HS
  - Meeting EHDI 3 and 6 guidelines
  - Mild to moderate hearing levels

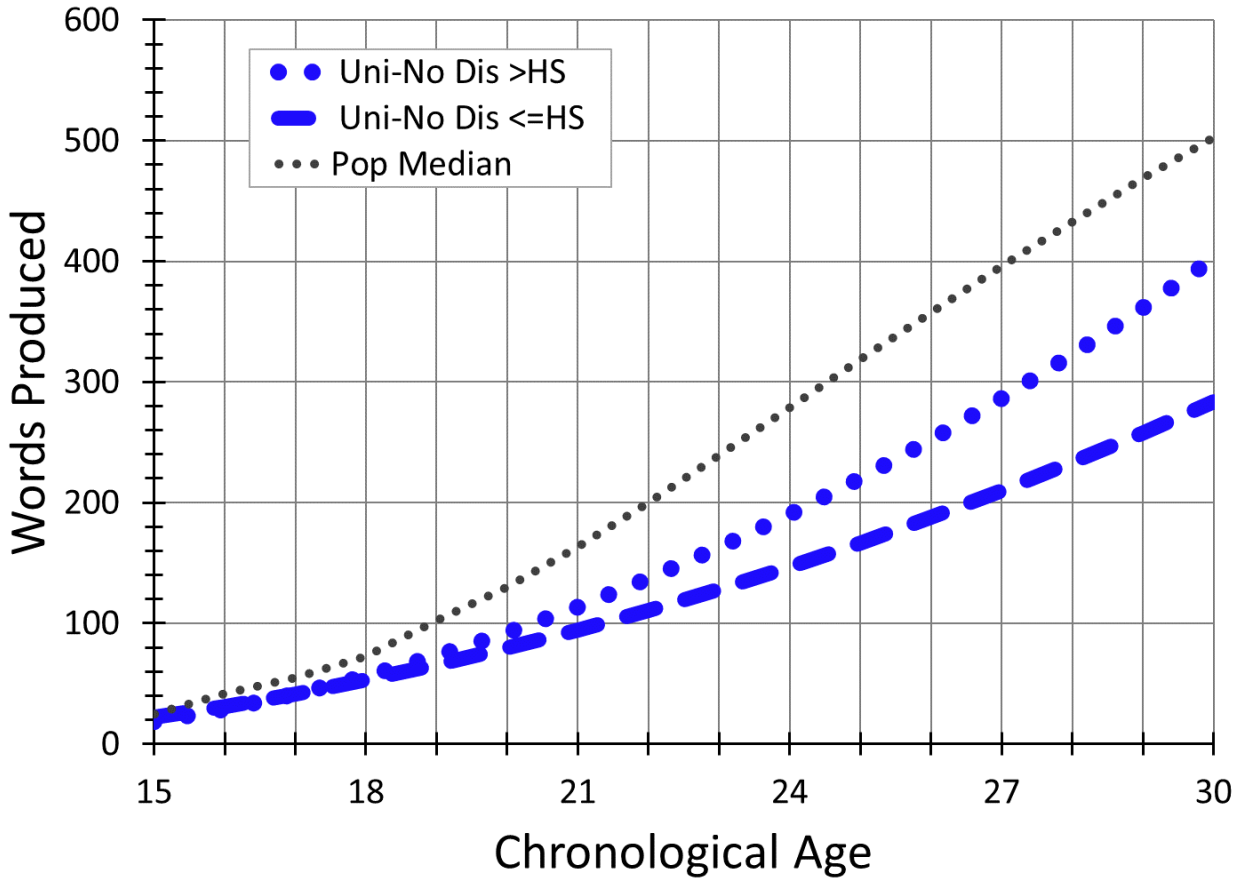
Predictors of Accelerated Growth Over Time ($p < .05$)

- DAYC-2 Expressive, Receptive, and MacArthur:
  - Primary caregivers with a degree beyond HS
- DAYC-2 Receptive and MacArthur Exp. Vocab.:
  - Female sex
  - Non-Hispanic ethnicity
  - White race
  - Primary caregivers with a degree beyond HS

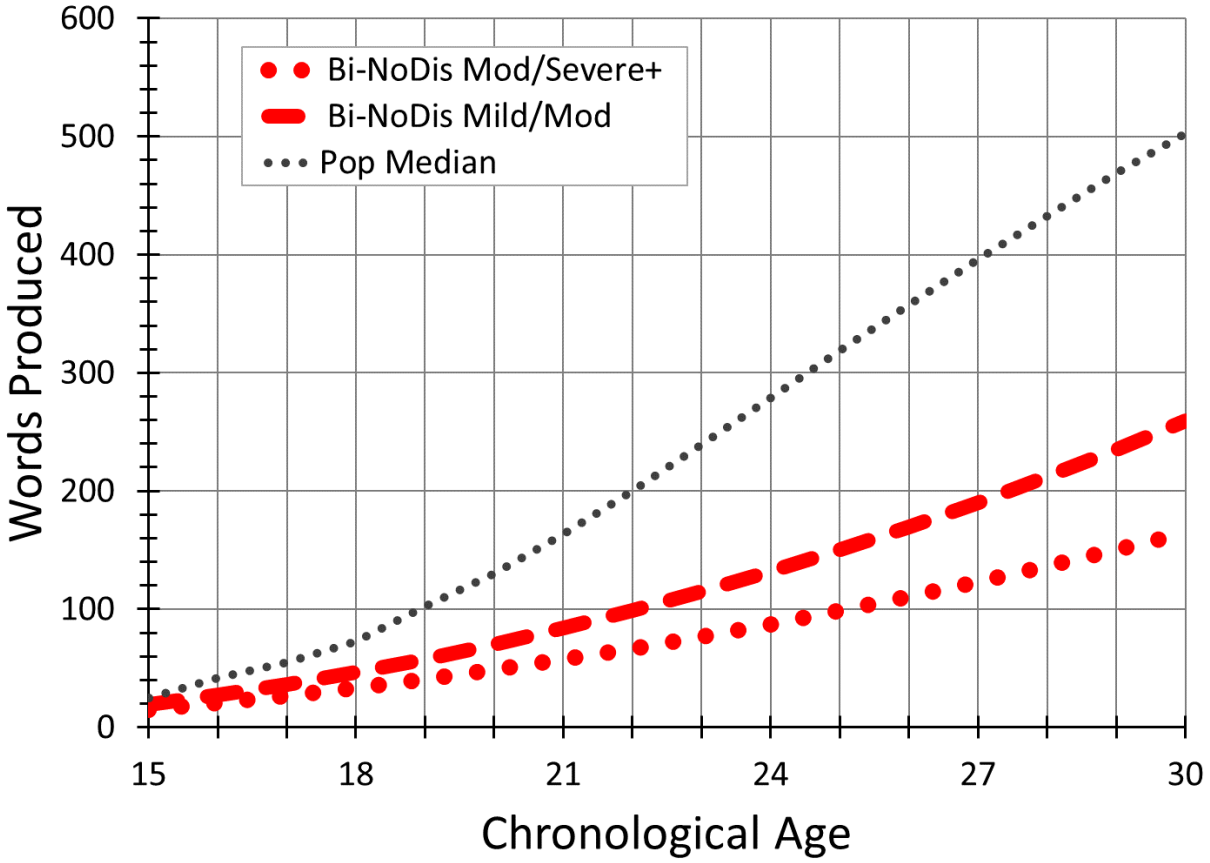
MacArthur-Bates CDI (BHD): Effect of Caregiver's Education



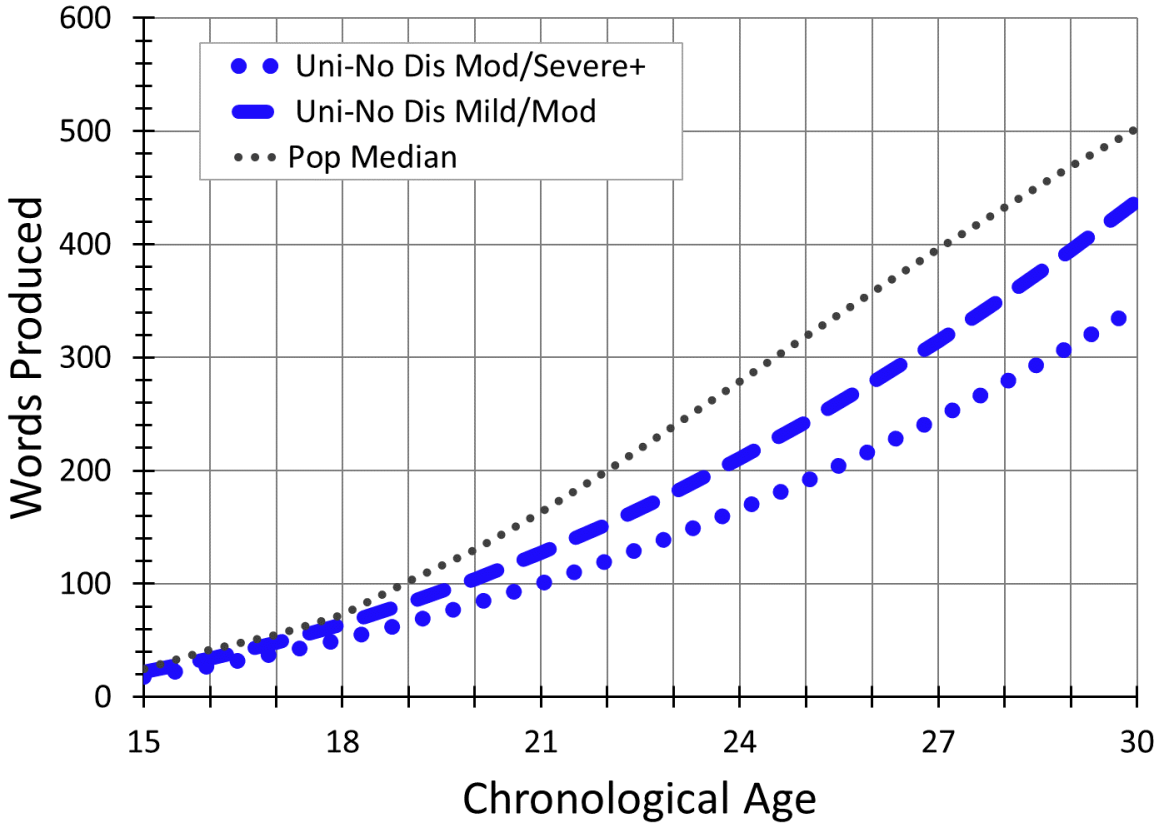
MacArthur-Bates CDI (UHD): Effect of Caregiver's Education



MacArthur-Bates CDI (BHD): Effect of Hearing Levels



MacArthur-Bates CDI (UHD): Effect of Hearing Levels



Conclusions: DAYC-2

- For children with BHD, as language demands increase over time, the gap between CA and Language Age widens

- At 33 months of age, for children with BHD and no additional disabilities, on average, the difference from age expectations is:
  - Expressive Language = 5 months delay
  - Receptive Language = 7 months delay

Conclusions: MacArthur-Bates CDI

- Beginning at 19 mos, hearing children produce 35 to 40 new words per month
- Beginning at 19 months, children who are deaf or hard of hearing average 14 to 17 new expressive words per month

Conclusions: Children with UHD

- Language scores on a general language test (the DAYC-2), on average, were at age expectations for children with UHD

- The MacArthur CDI was sensitive to gaps in vocabulary diversity in children with UHD
  - Mean percentiles declined with age averaging the 15th %ile by 36 months of age

Clinical Implications

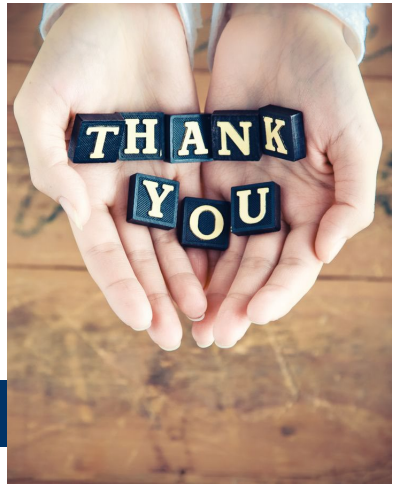
- To identify language gaps, specific language tests (e.g., the MacArthur CDI) should be used as opposed to general language measures
- Language tests that include pre-verbal communication skills may under-estimate language delays in children with no additional disabilities

Clinical Implications: Risk Factors

Factors placing children at higher risk for language delay:

- Sex (boys)
- Hispanic ethnicity
- Non-white race
- Lower levels of primary caregiver education
- Higher hearing levels
- Not meeting EHDI 3 and 6 guidelines

With Appreciation



- to the families who shared their children's information with ODDACE
- to the interventionists who took the time to complete and send in the assessments
- to the ODDACE Assessment Coordinators
- to the ODDACE Project Assistants