Effects of Early Hearing Detection and Intervention on Language Development in Children with Hearing Loss at 14 and 30 Months of Age

EHDI Annual Meeting
Denver, CO
March 2018

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Presentation Objectives

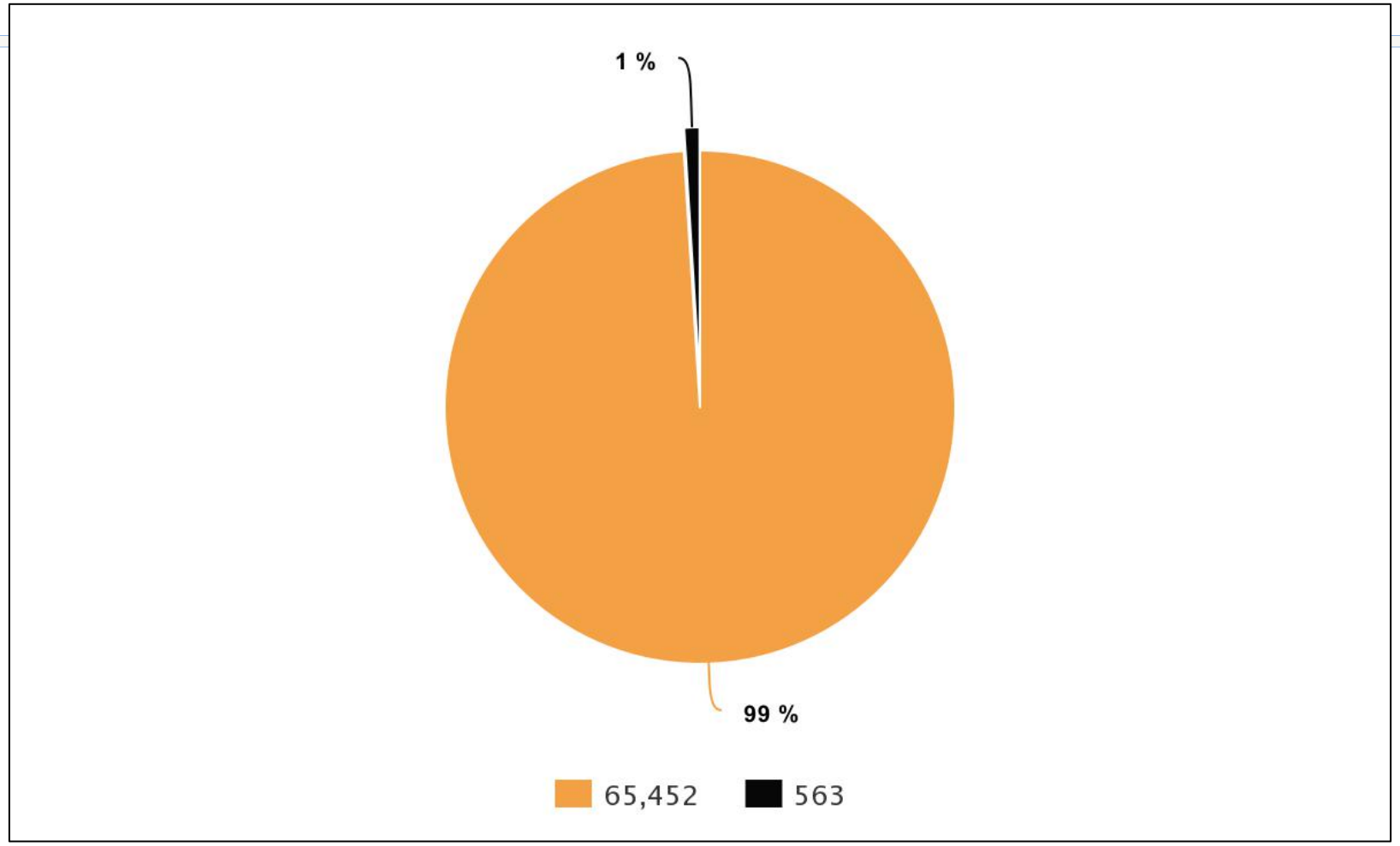
Attendees will be able to:

1) Identify the demographic variables of the study population
2) Describe the results of the research study
3) Discuss system and clinical implications of this research

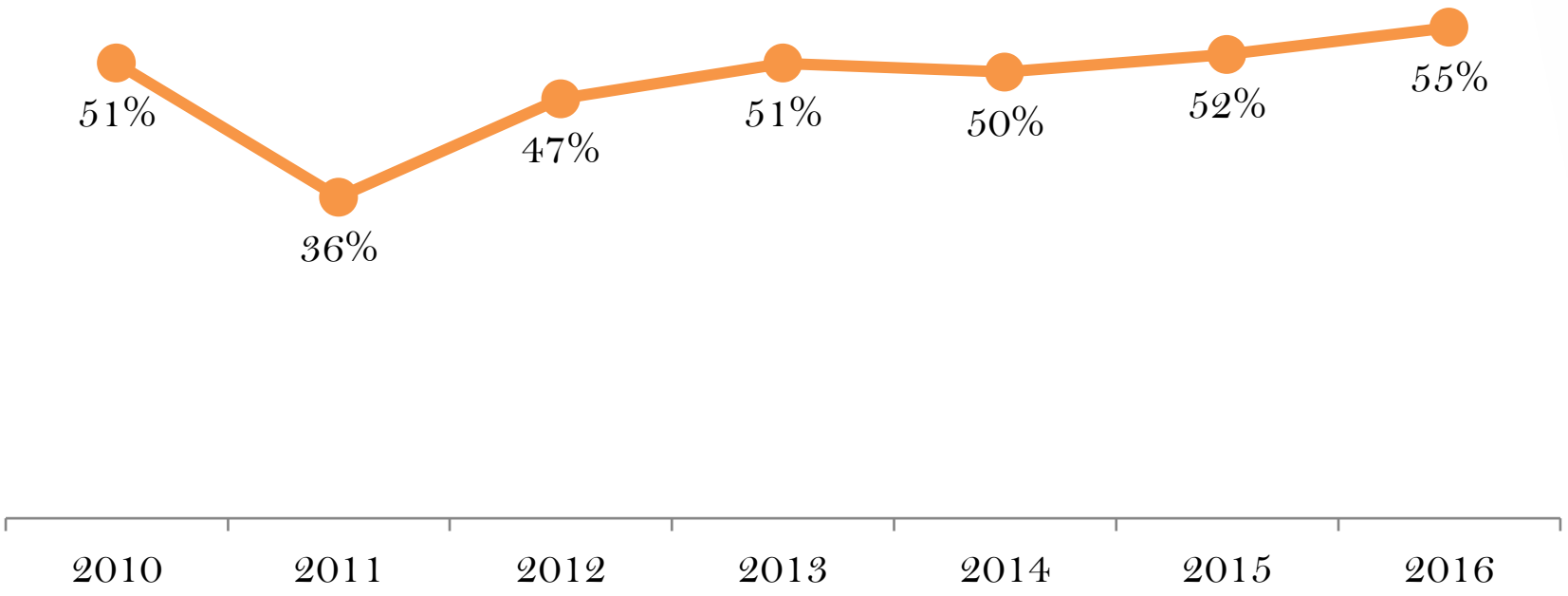
What's the Plan?

- What is Happening in WI?
- Background, History, & Collaboration
- AEIOu Research Study
- Clinical and Programmatic Implications in WI (and beyond)

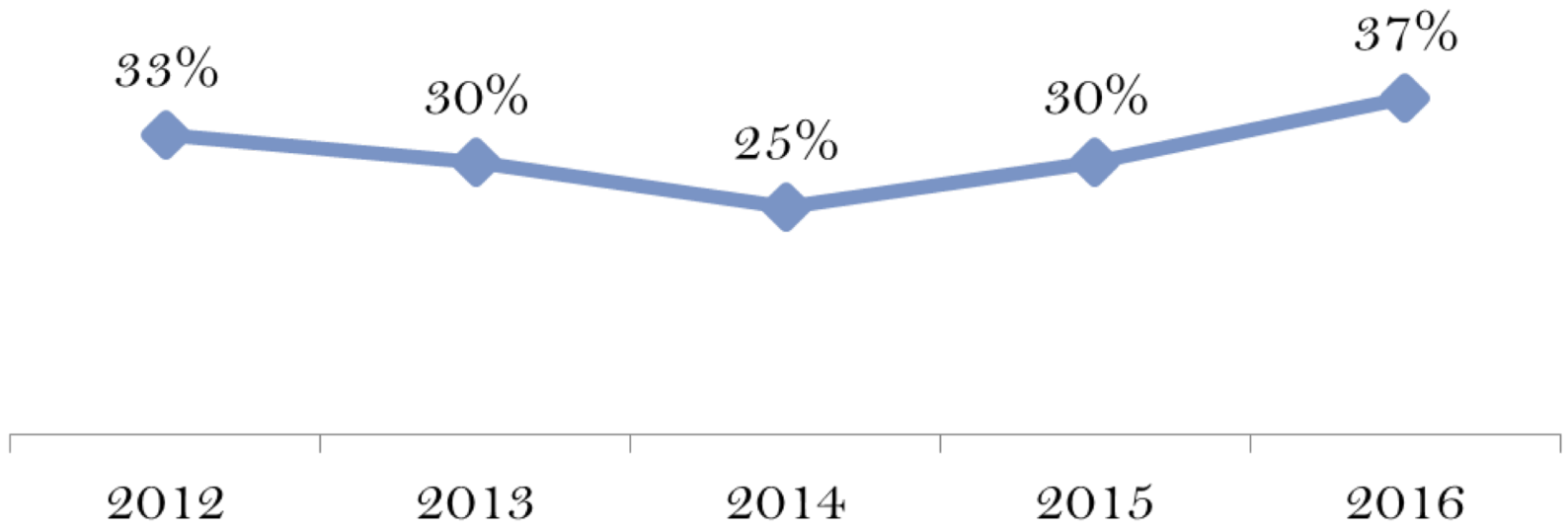
99% of babies screened by 1 month



55% of babies diagnosed by 3 months



37% of babies enrolled in EI by 6 months



WE-TRAC
(Wisconsin EHDI Tracking Referral and Coordination System)

- Web based system
- Provides a mechanism for the tracking and reporting of individual, hospital, and statewide aggregate newborn hearing screening data
- Allows electronic referrals to appropriate audiological and early intervention organizations
- Acts as a safety net assuring timely and appropriate coordination of care throughout the EHDI continuum

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What have we learned from others?

- NECAP study – children identified with hearing loss before 3 months AND receiving intervention by 6 months of age had higher verbal quotient (MacArthur-Bates CDI), *Yoshinaga et al, Pediatrics 140(2), 2017*
- Even children identified early with hearing loss continue to demonstrate language underperfomance (as measured by comparing receptive language score from PLS-5 with non-verbal IQ) *Meinzen-Derr et al, JDBP, 2017*
- These were cross-sectional studies – longitudinal studies may also clarify outcomes for language development

Key Partners

- Wisconsin Sound Beginnings (WSB), Wisconsin's Early Hearing Detection and Intervention (EHDI) program.
- WSB is administered collaboratively with Maternal Child Health Bureau and CDC funding through contracts between Wisconsin Department of Health Services and:
  - University of Wisconsin-Madison Waisman Center University Center for Excellence in Developmental Disabilities (UCEDD)
  - Local health departments in Wisconsin
- University of Colorado, Boulder, National Early Childhood Assessment Project (NECAP)

Assessment of Early Intervention Outcomes (AEIOu) Study in Wisconsin

- Partnership between WSB, Waisman Center UCEDD and University of Colorado, Boulder, National Early Childhood Assessment Project (NECAP) starting in 2009
- Children identified with a diagnosed hearing loss in Wisconsin through the EHDI program were contacted at 13-14 months of age and offered opportunity to enroll in the AEIOu study, IRB approved at UW-Madison
- AEIOu protocol included parent-completed assessments at ~14 mos and ~30 mos
- Data included in NECAP protocol sent to Colorado for scoring
- Additional instruments used in WI to measure social-emotional development

EHDI Outcomes Study

Building on the existing AEIOu study - funding for enhanced recruitment, support for early intervention and data analyses was obtained from DRDC 2016-2019, awarded to Waisman Center UCEDD.

Disclosure:

The study results presented here were supported by the Disability Research and Dissemination Center (DRDC) through its Cooperative Agreement Number 5U01DD001007 from the Centers for Disease Control and Prevention (CDC). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the DRDC or the CDC.

EHDI Outcomes Study

Research Questions:

1) What is the impact of receiving early intervention services on developmental outcomes of children with hearing loss as measured in the AEIOu study at two points in time?

2) Are there differences in developmental outcomes for children identified with hearing loss before 3 months and/or enrolled in EI before 6 months of age?

What's the Plan?

- ✔ What is happening in WI?
- ✔ Background, History, & Collaboration
  - AEIOu Research Study
  - Clinical and programmatic implications in WI (and beyond)

Eligibility Criteria

- Unilateral or bilateral hearing loss
- Permanent and conductive or sensorineural hearing loss
- Any degree of hearing loss
- Hearing loss only or with additional disabilities
- English, Spanish or American Sign Language
- Enrolled in Part C Early Intervention (Birth to 3 Program)

Study Population Demographics

	Phase 1 (n = 116)	Phase 2 (n = 62)
Chronological Age (range)	14.6 (9-18) months	31.9 (29-44) months
Female (%)	60 (52%)	34 (55%)
Maternal Education (range)	14.6 (8-19) years	15.1 (11-19) years
Laterality		
- Bilateral	89 (77%)	44 (71%)
- Unilateral	27 (23%)	18 (29%)
Degree of Hearing Loss (%)		
- Slight/Mild	16 (18%)	7 (16%)
- Moderate/Mod Severe	26 (29%)	19 (43%)
- Severe/Profound	18 (20%)	13 (30%)
- Unknown/Missing Data	29 (33%)	5 (11%)
Presence of Additional Disabilities (%)	28 (24%)	20 (32%)

Outcome Measures

- **MacArthur Bates Communication Development Inventory**
  - Parent report questionnaire
  - Measures receptive vocabulary, expressive vocabulary, use of gestures, and use of grammatical markers
  - vocabulary inventory for words understood, words signed, words spoken, and gestures used

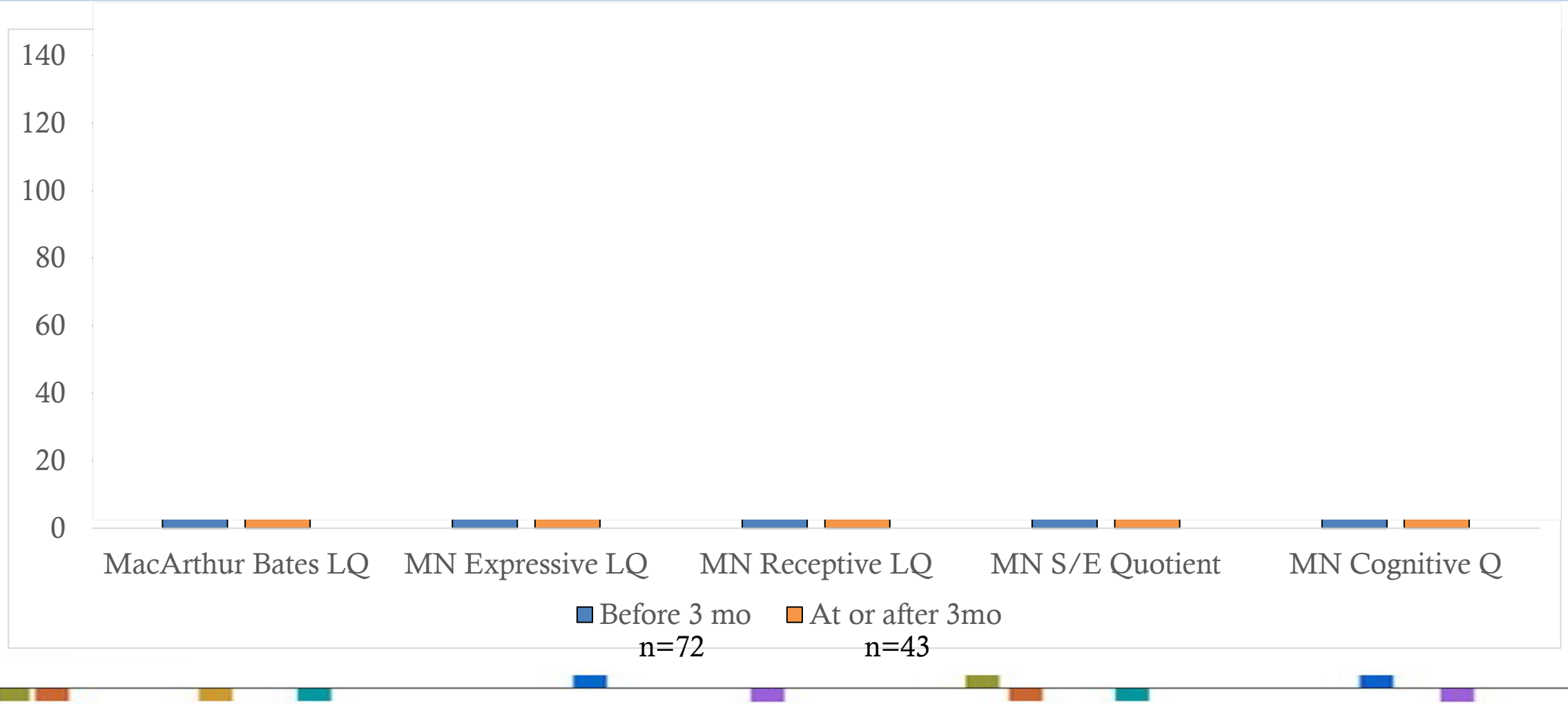
- **Minnesota Child Development Inventory**
  - Parent report questionnaire
  - Measures social development, self help skills, gross motor skills, fine motor skills, language (receptive and expressive), early literacy skills, and non-verbal understanding of and interaction with the environment

Quotient Scores

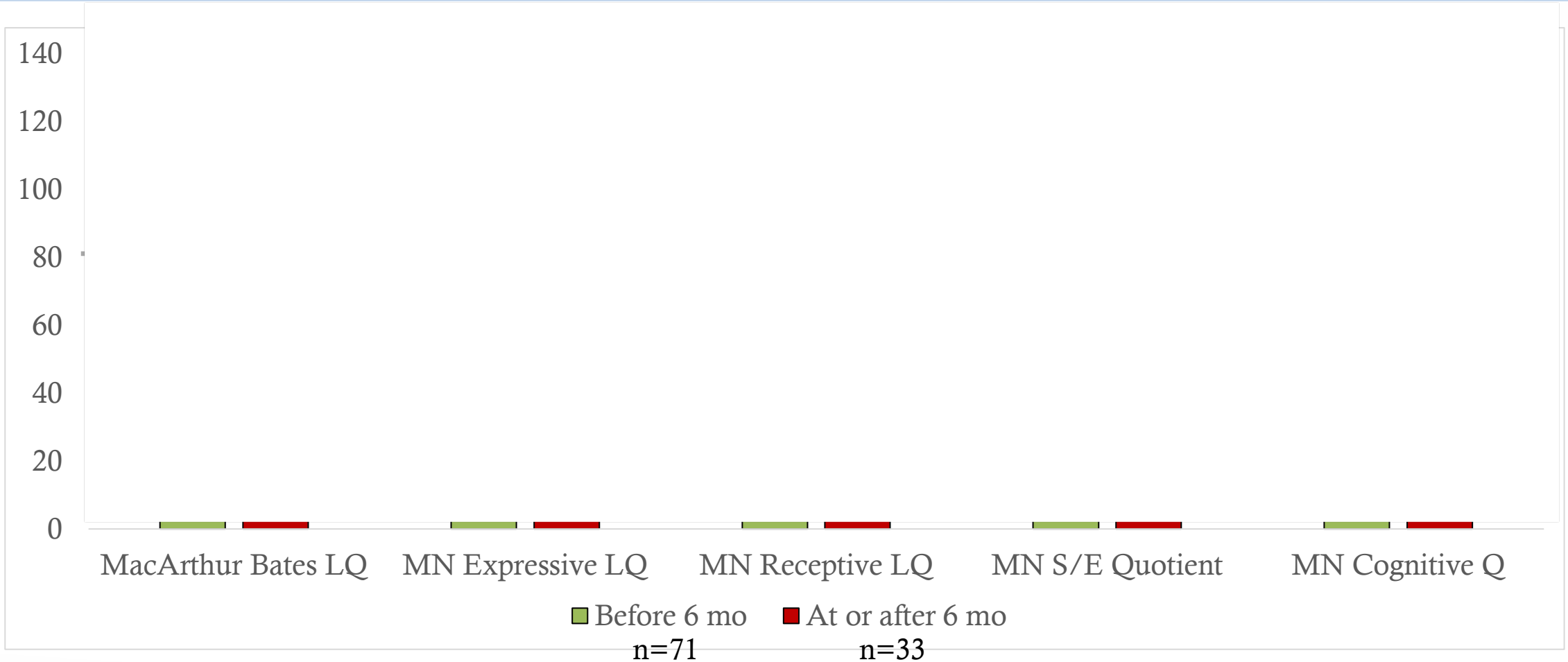
$$\frac{\text{Language Age}}{\text{Chronological Age}} \times 100 = \text{Quotient}$$

ALL PARTICIPANTS	Phase 1 Mean (Range)	Phase 2 Mean (Range)
	14.6 months n=116	31.9 months n=62

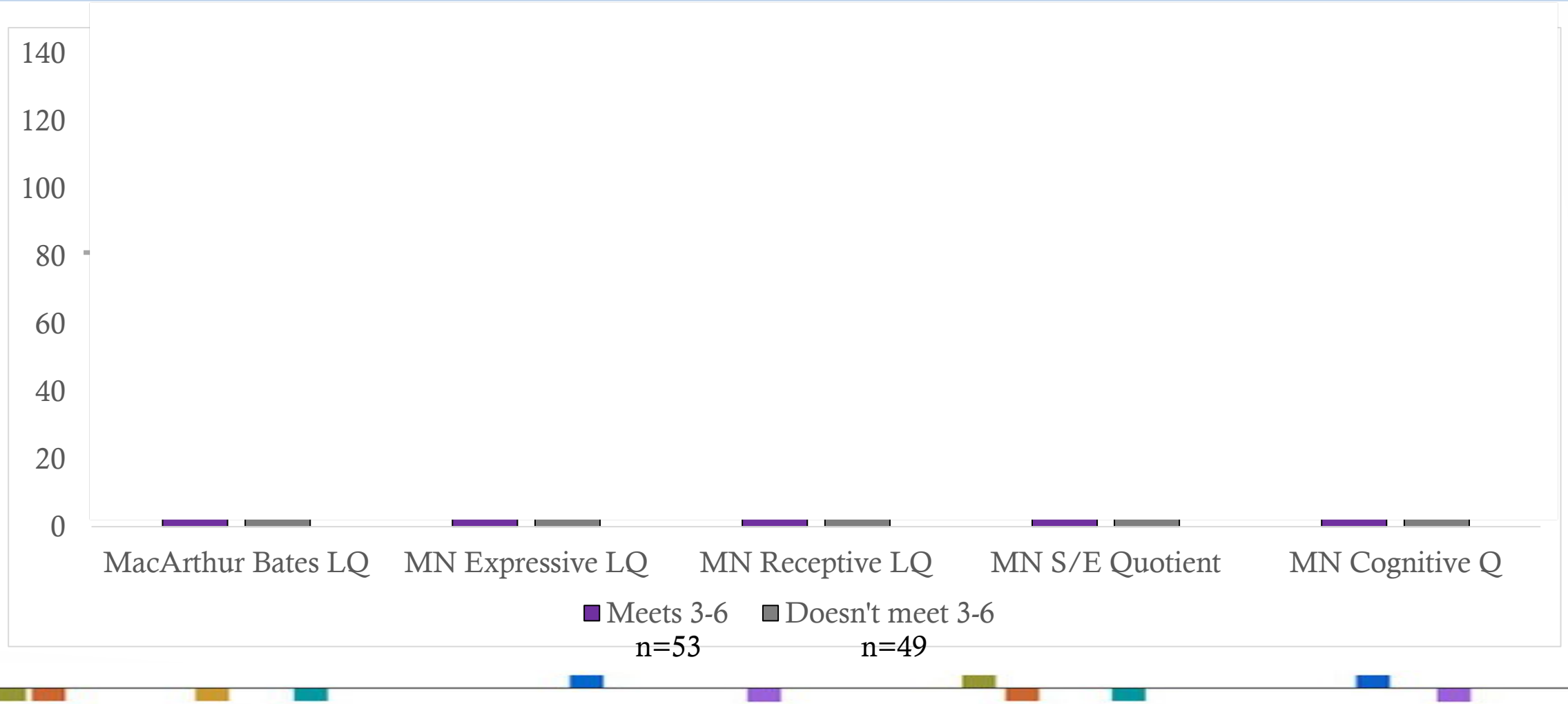
Phase 1: Meeting 3 month guideline



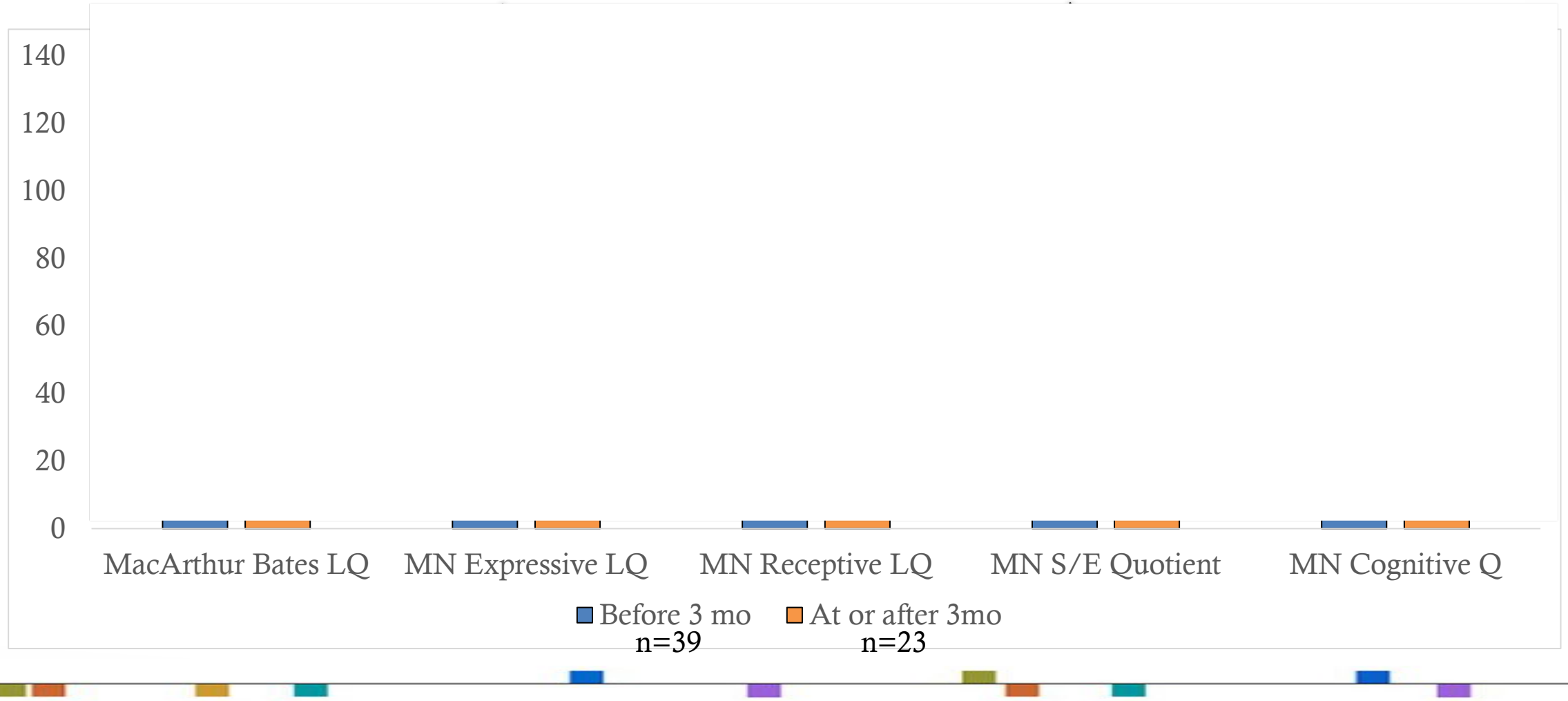
Phase 1: Meeting 6 month guideline



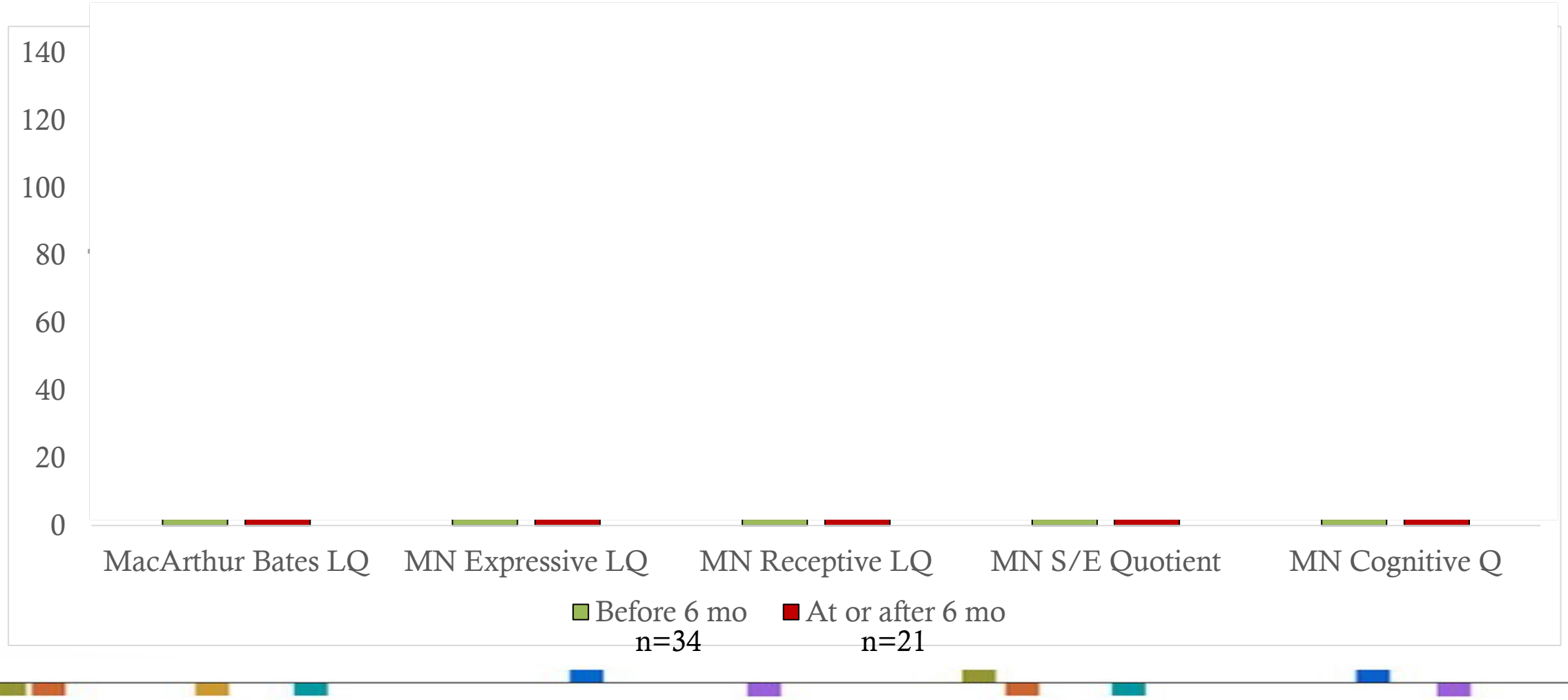
Phase 1: Meeting 3 and 6 mo. guideline



Phase 2: Meeting 3 month guideline



Phase 2: Meeting 6 month guideline



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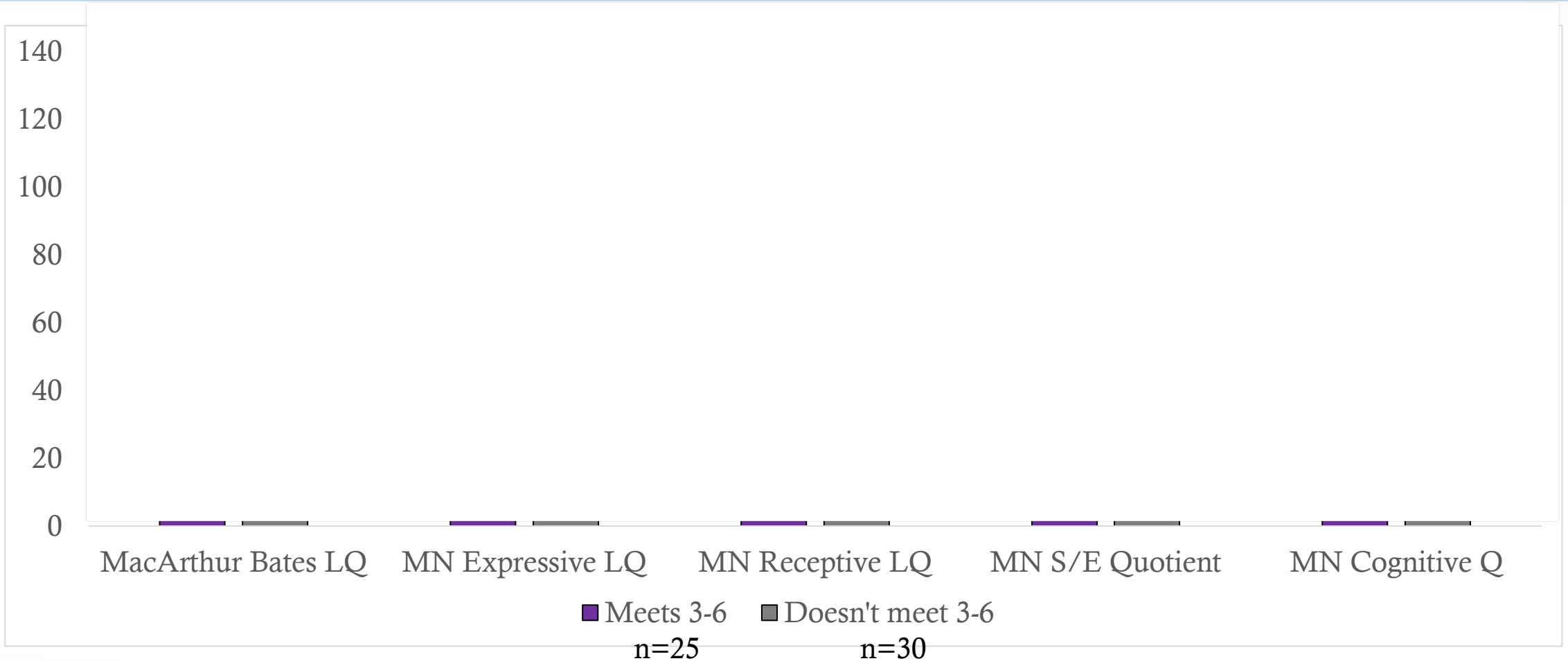
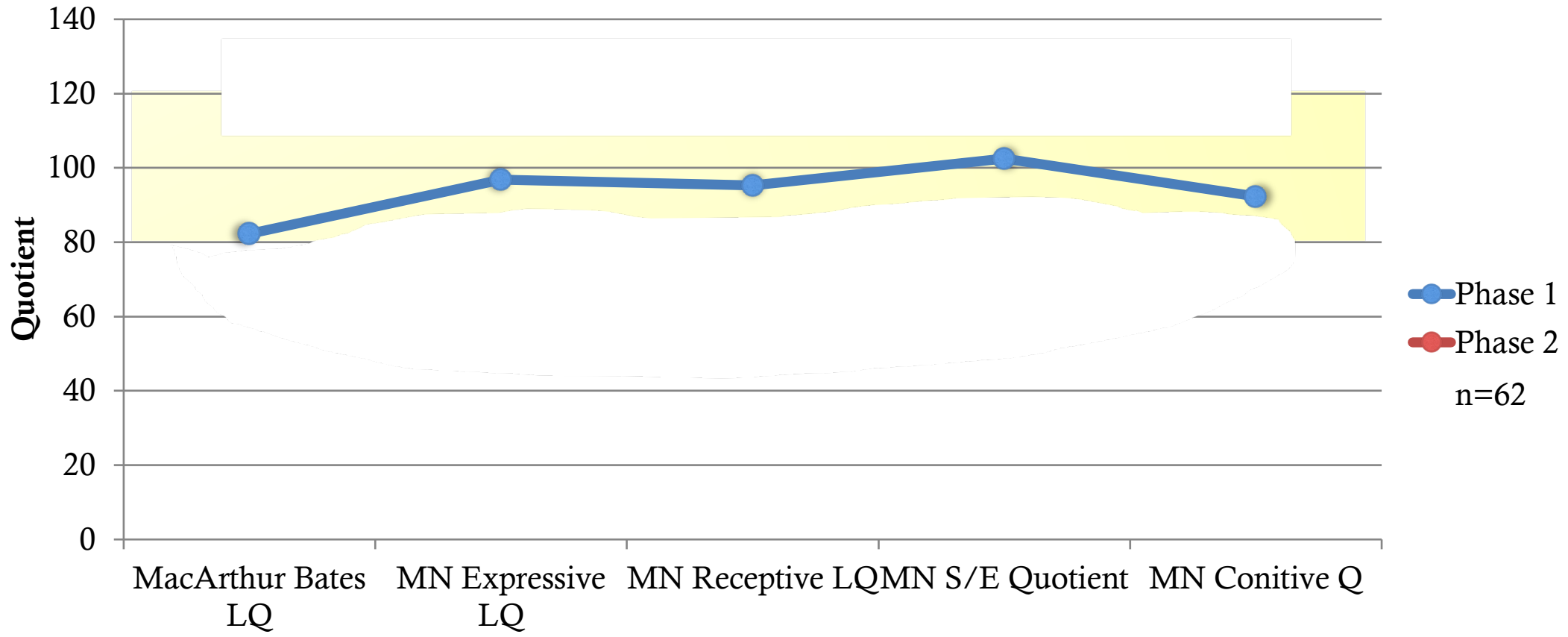


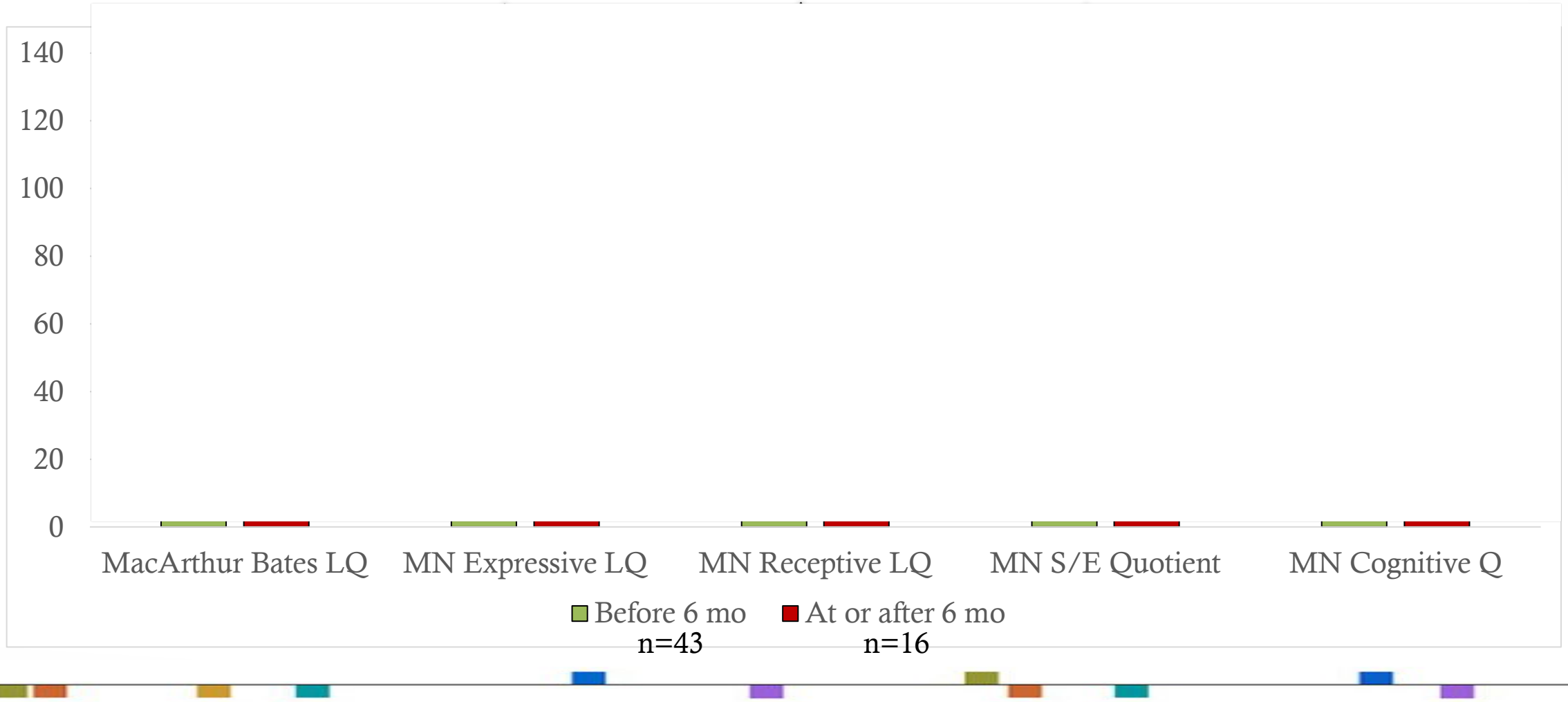
Phase 1 vs. Phase 2



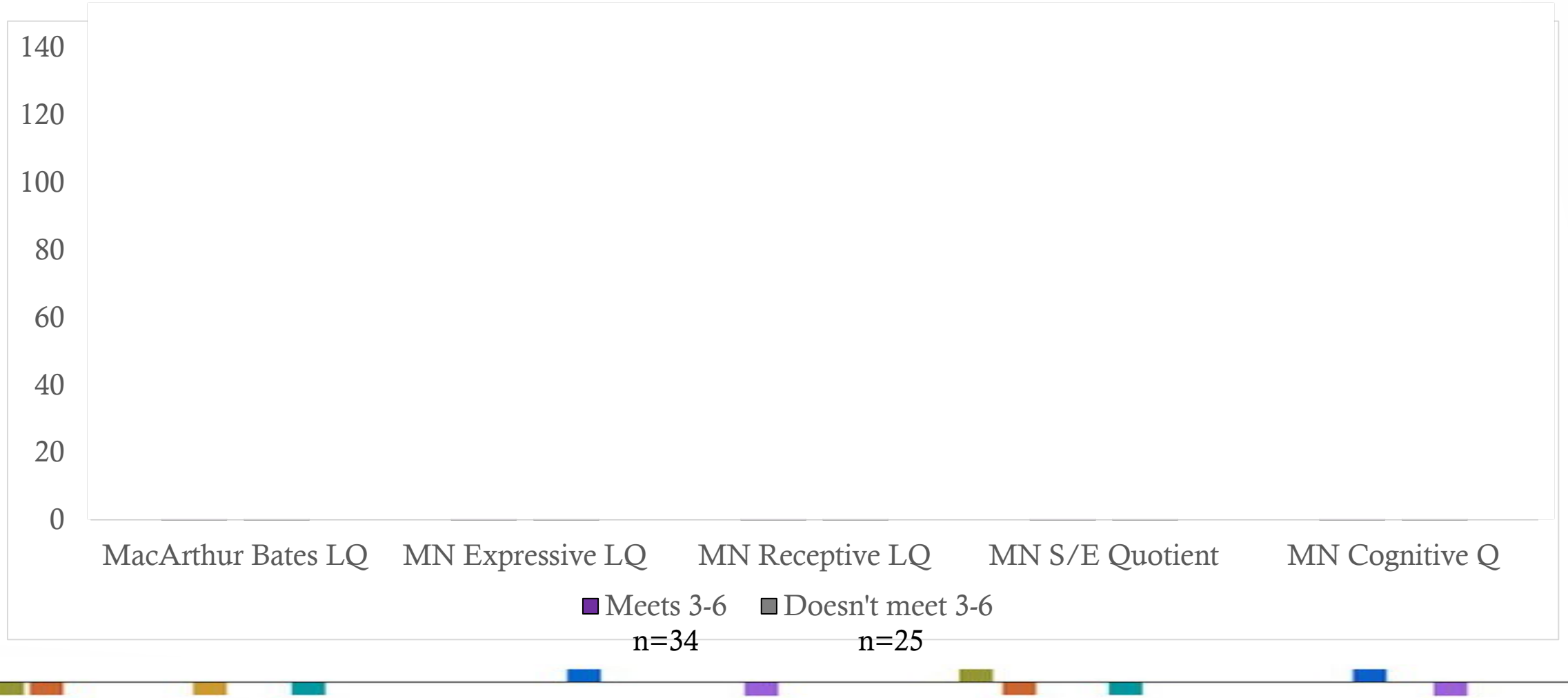
PARTICIPANTS with BILATERAL HEARING LOSS and NO ADDITIONAL DISABILITIES	Phase 1 Mean (Range)	Phase 2 Mean (Range)
	14.7 months n=66	31.4 months n=33

Phase 1: Meeting 3 month guideline

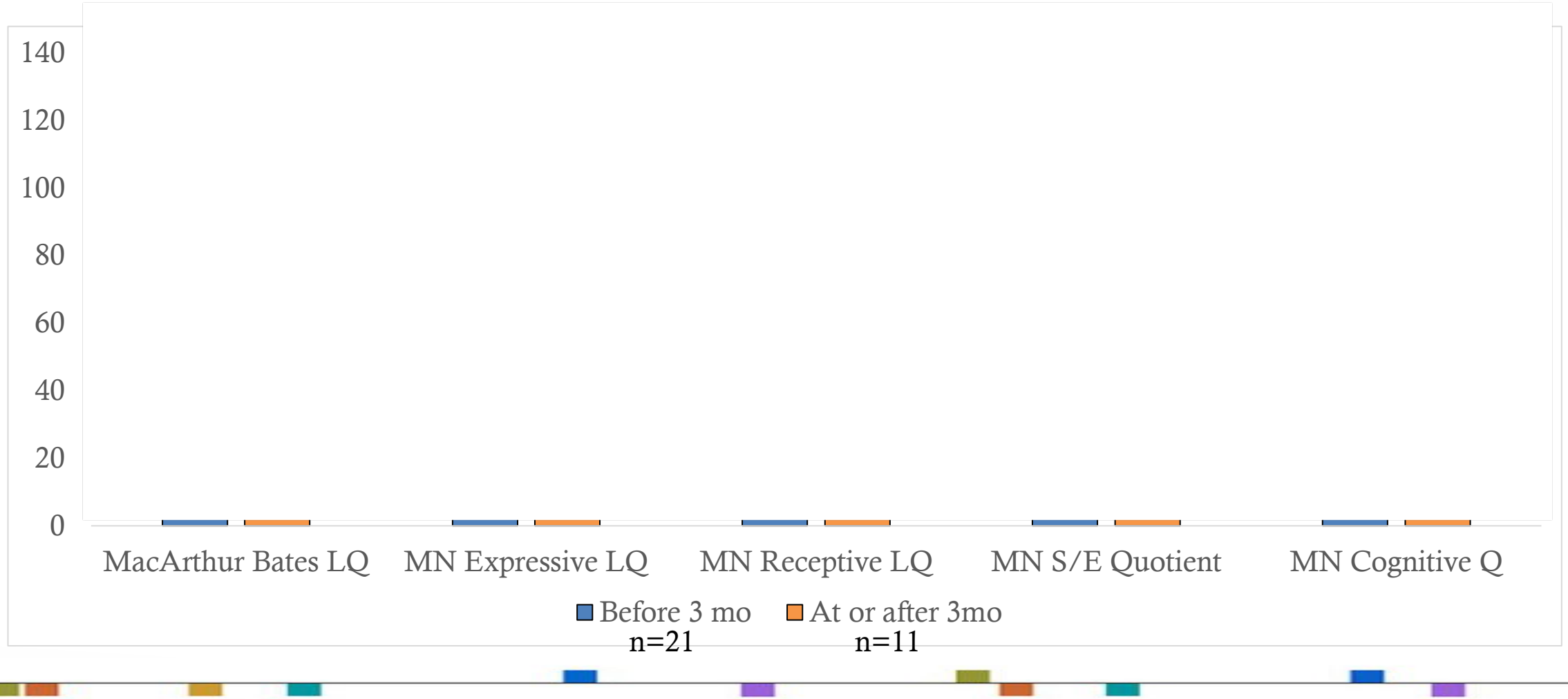
Phase 1: Meeting 6 month guideline



Phase 1: Meeting 3 and 6 mo. guideline



Phase 2: Meeting 3 month guideline



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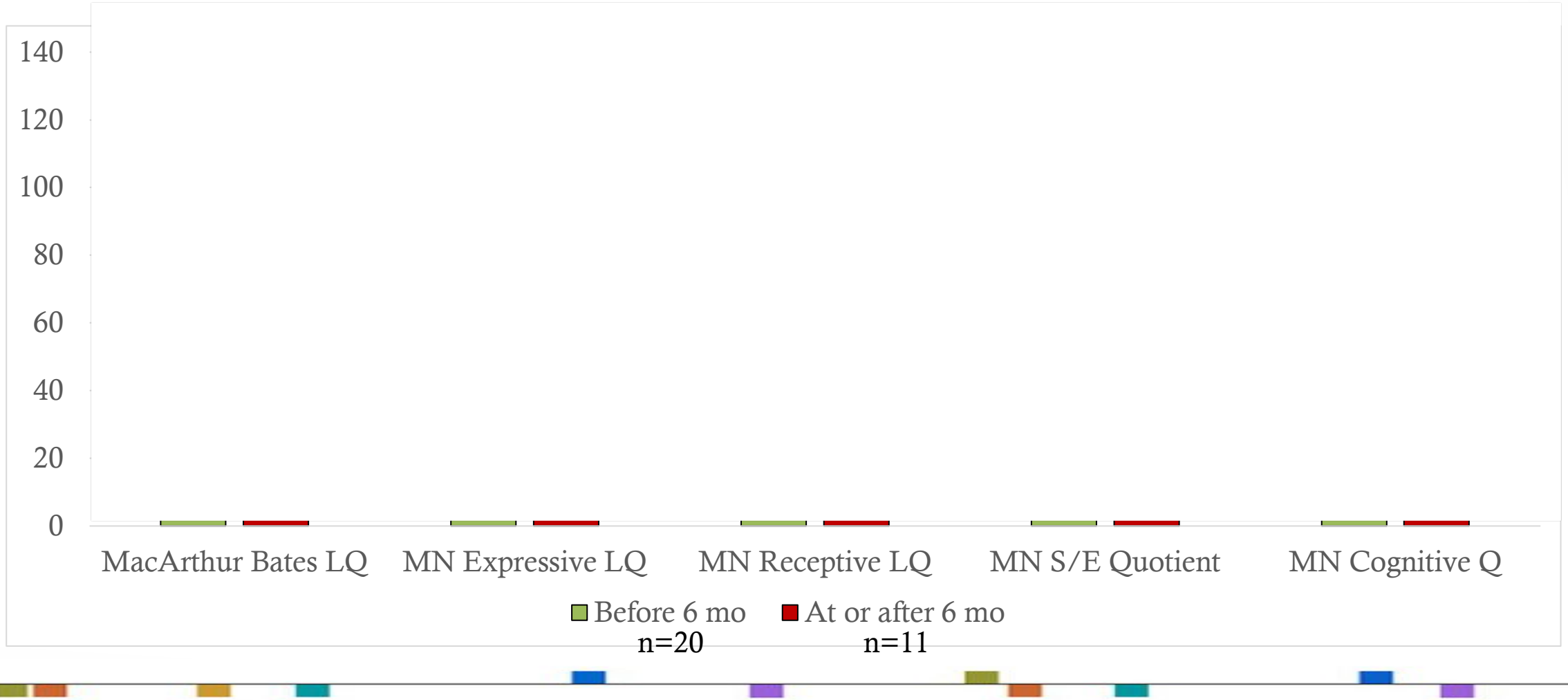

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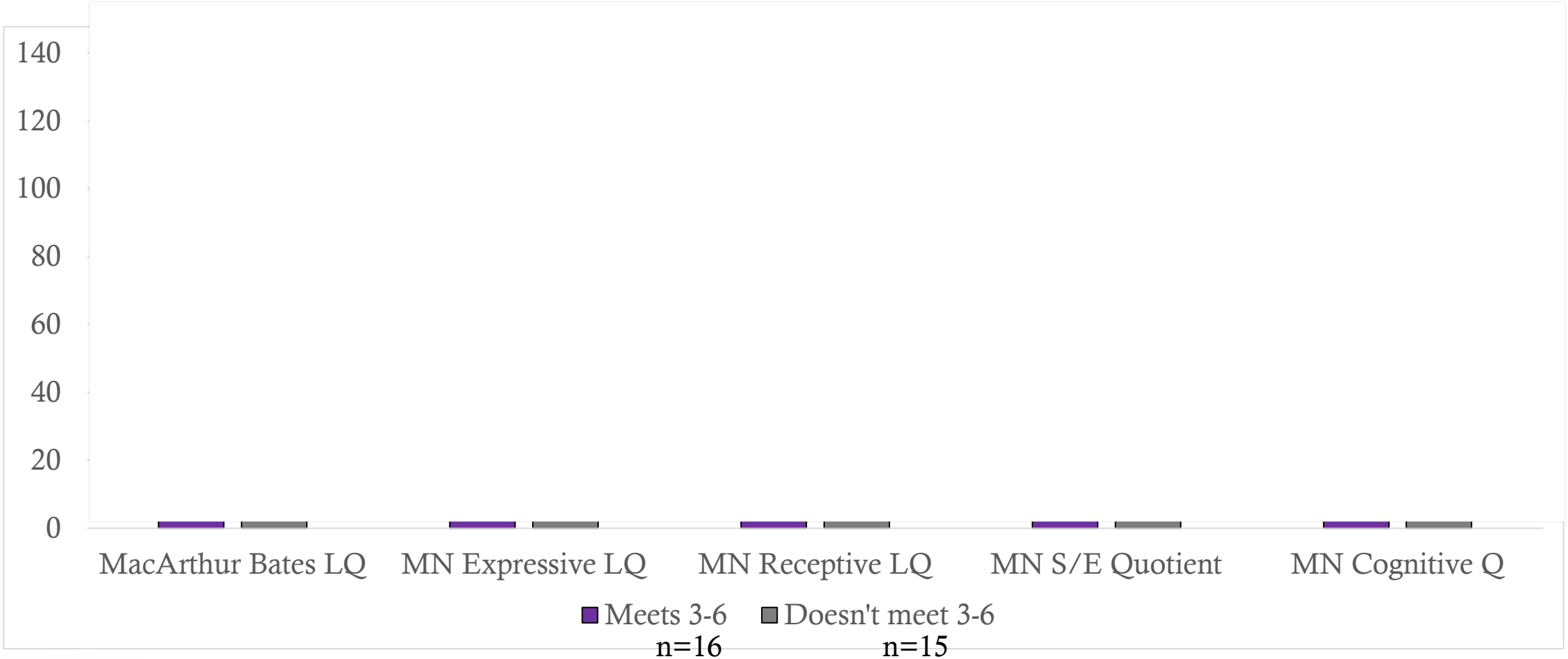
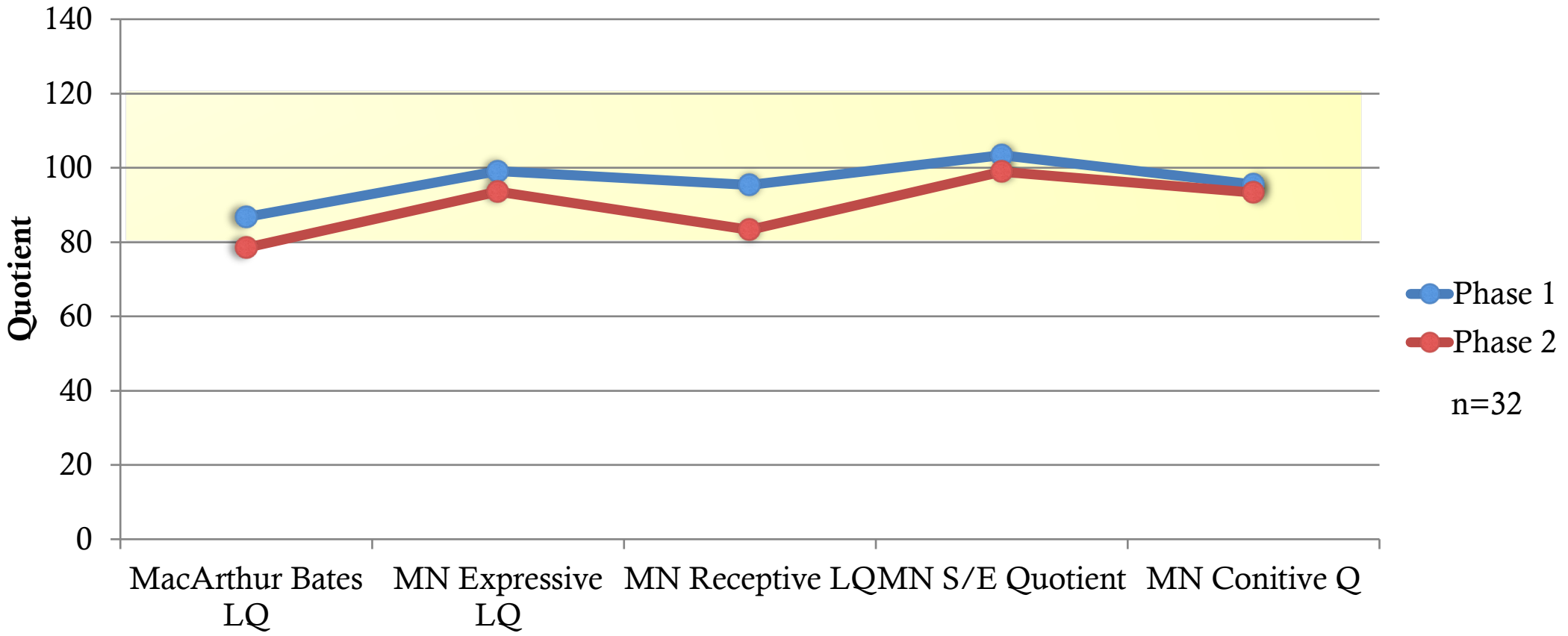
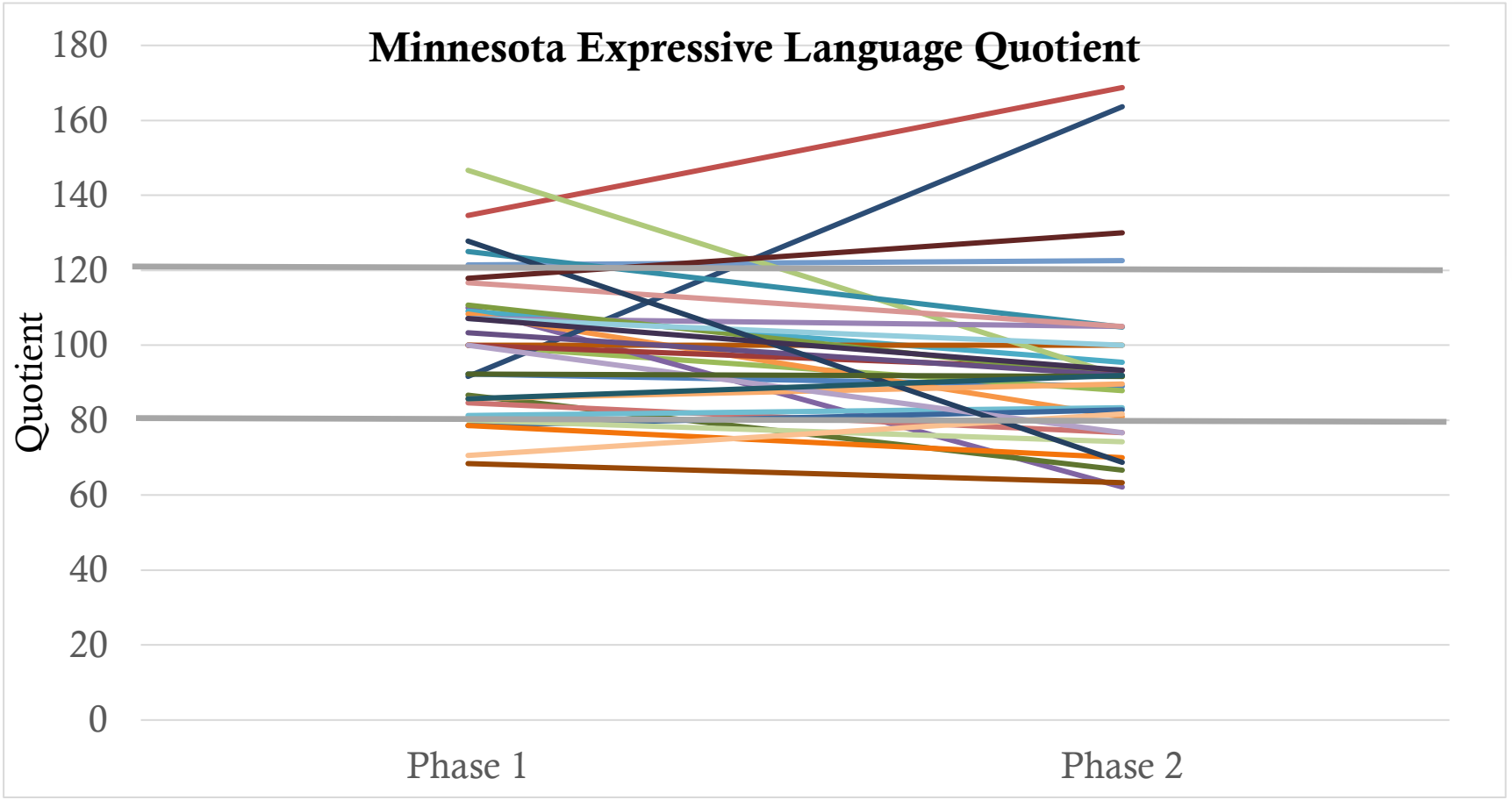


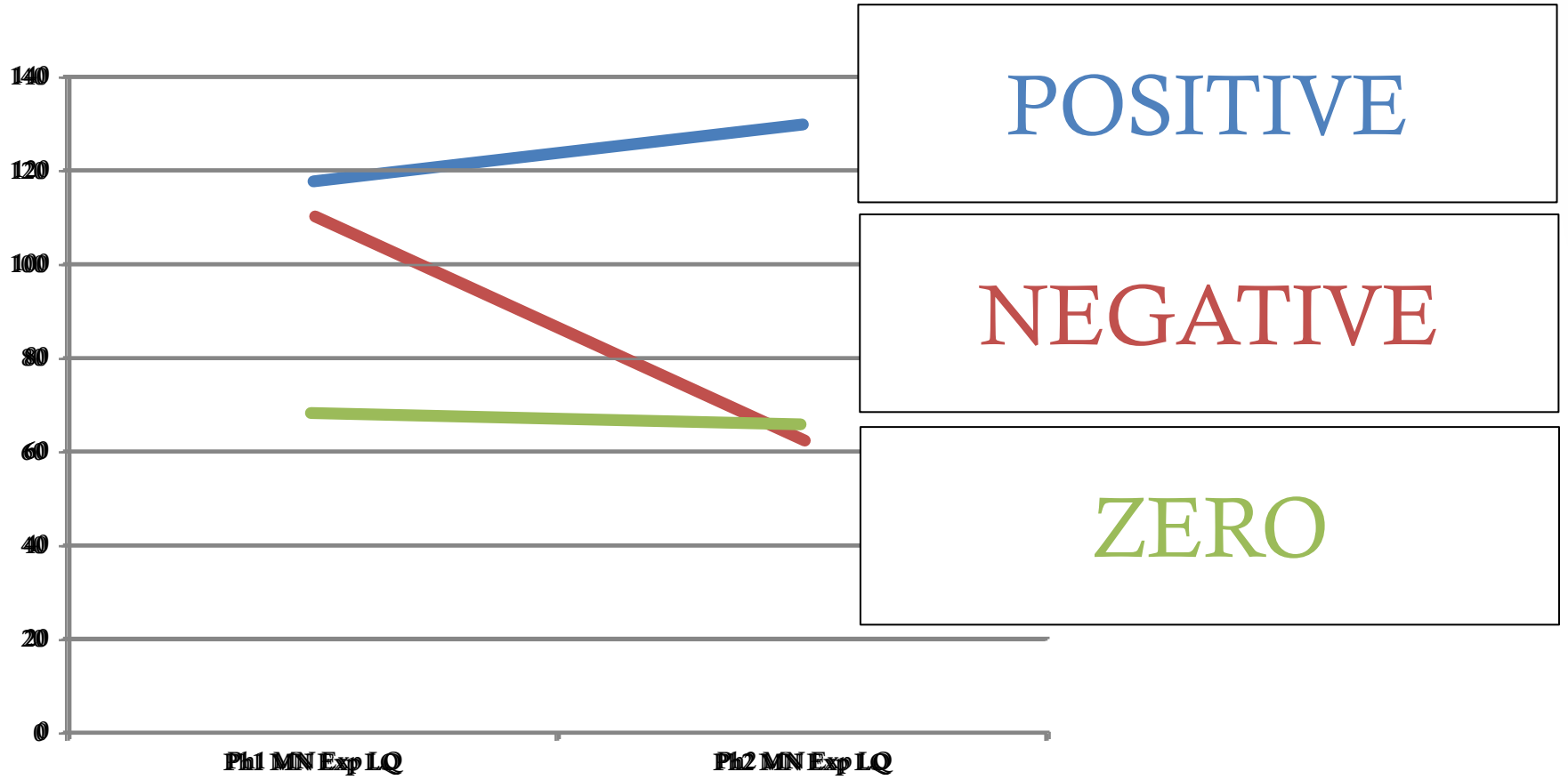
Phase 1 vs. Phase 2



Individual Trajectories



Change Scores



Longitudinal Results

- Almost all children had negative change scores on all outcome measures.
- Looking at the MN Expressive LQ, using the change score and controlling for maternal education and degree of hearing loss, the only significant predictor ($p=0.03$) of having a change score that was closer to zero (or positive) was being identified with hearing loss before 3 months of age.

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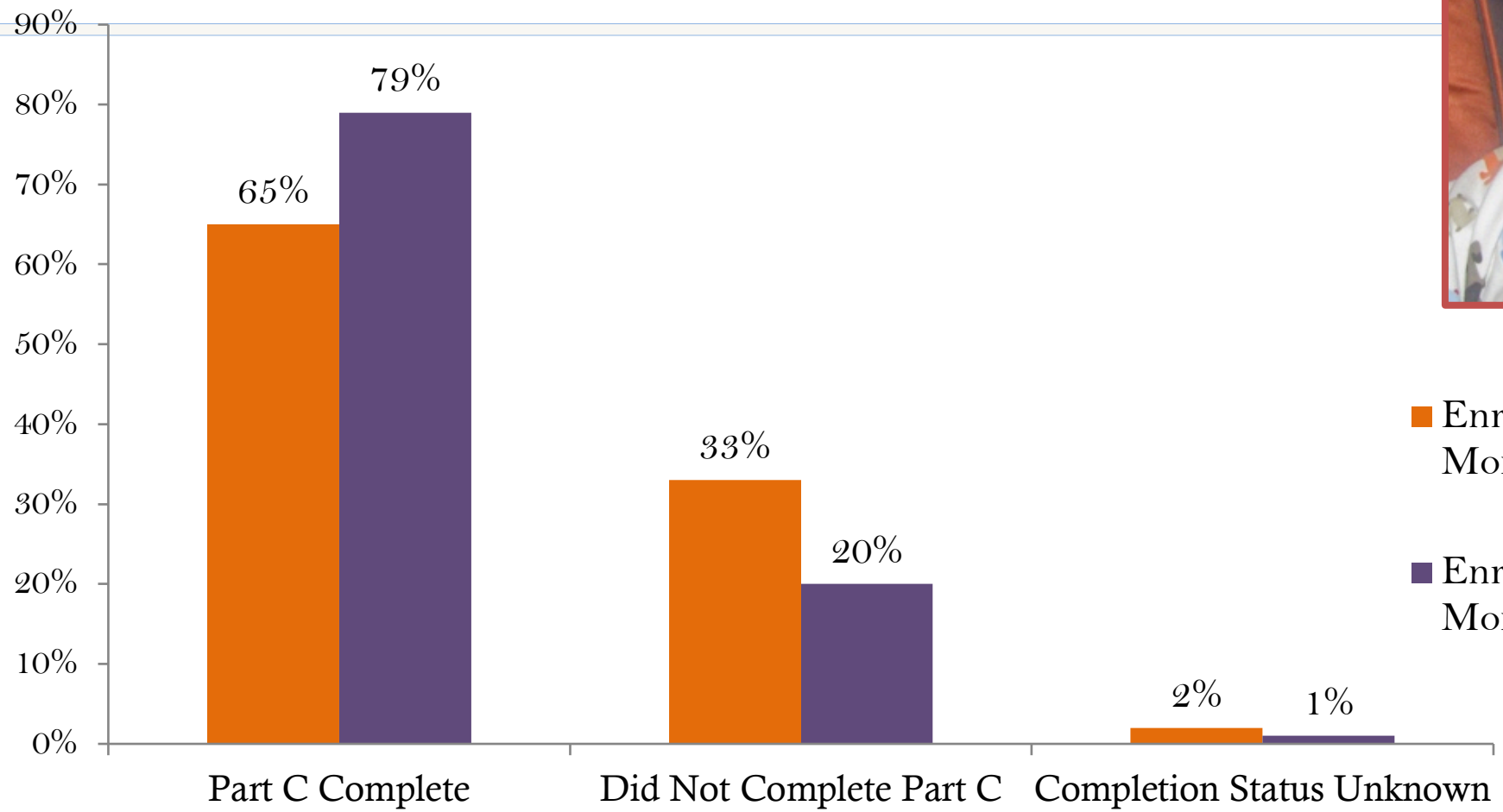
Potential Implications

- **Clinical-** need to have clinicians who know how to serve children who are D/HH and their families
- **Programmatic/Systems-**
  - - enroll children earlier and keep them enrolled
  - - continue to support EI programs in providing relevant services
  - - others?

EI Data


90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
65%
79%
33%
20%
2%
1%
Part C Complete
Did Not Complete Part C
Completion Status Unknown
Enrolled in Intervention Before 6 Months (N=82)
Enrolled in Intervention After 6 Months (N=70)

What's the Plan?

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Conclusions

Attendees will be able to:

1) Identify the demographic variables of the study population

   → **Group of WI children at 2 time points, receiving EI, ~50% met 3:6**

2) Describe the results of the research study

   → **Normal range results at 14 mo., different trajectories apparent at 30 mo.**

   → **Only significant predictor of better expressive language was ID by 3 mo.**

3) Discuss system and clinical implications of this research

   → **need to know more about EI services to interpret findings**

Future Directions

- Continue analyses, publications to address EHDI Outcomes research questions not being reported here today:
  - **1. What is the impact of different types of EHDI collaboration with the Part C EI program in Wisconsin on age of enrollment in EI ?**
  - **2. Compare models of service/early intervention support to determine programmatic directions**
  - **3. Examine intensity of EI services**

- Analyze Phase 3 pilot data to look at pre-literacy skills with
  - AEIOu participants at ~ 5 years (60 months) of age →
  - **1. re-contact and re-consent families**
  - **2. both parent and direct assessments by SLP**
  - **3. construct developmental trajectories**

Study Team/Collaborators

- Connie Stevens, Recruitment Coordinator
- Rebecca Martin, Data collection
- LEND/UCEDD Trainees, Tracy Henning
- Allison Sedey, Christine Yoshinaga-Itano (University of Colorado)
- Roseanne Clark, Consultant
- Linda Tuchman-Ginsberg, Anne Heintzelman (retired)

Acknowledgements

- Thank you to all of the families that participated in this research.
- This research is the result of collaboration between the Waisman Center UCEDD at UW-Madison, the WI Department of Health Services, and the National Early Childhood Assessment Project (NECAP) at the University of Colorado – Boulder.
- This research was funded in part by grants from the Maternal & Child Health Bureau of the Health Resources and Services Administration, U.S. Department of Health and Human Services and from the Disability Research and Dissemination Center through it's cooperative agreement from the Centers for Disease Control.

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