

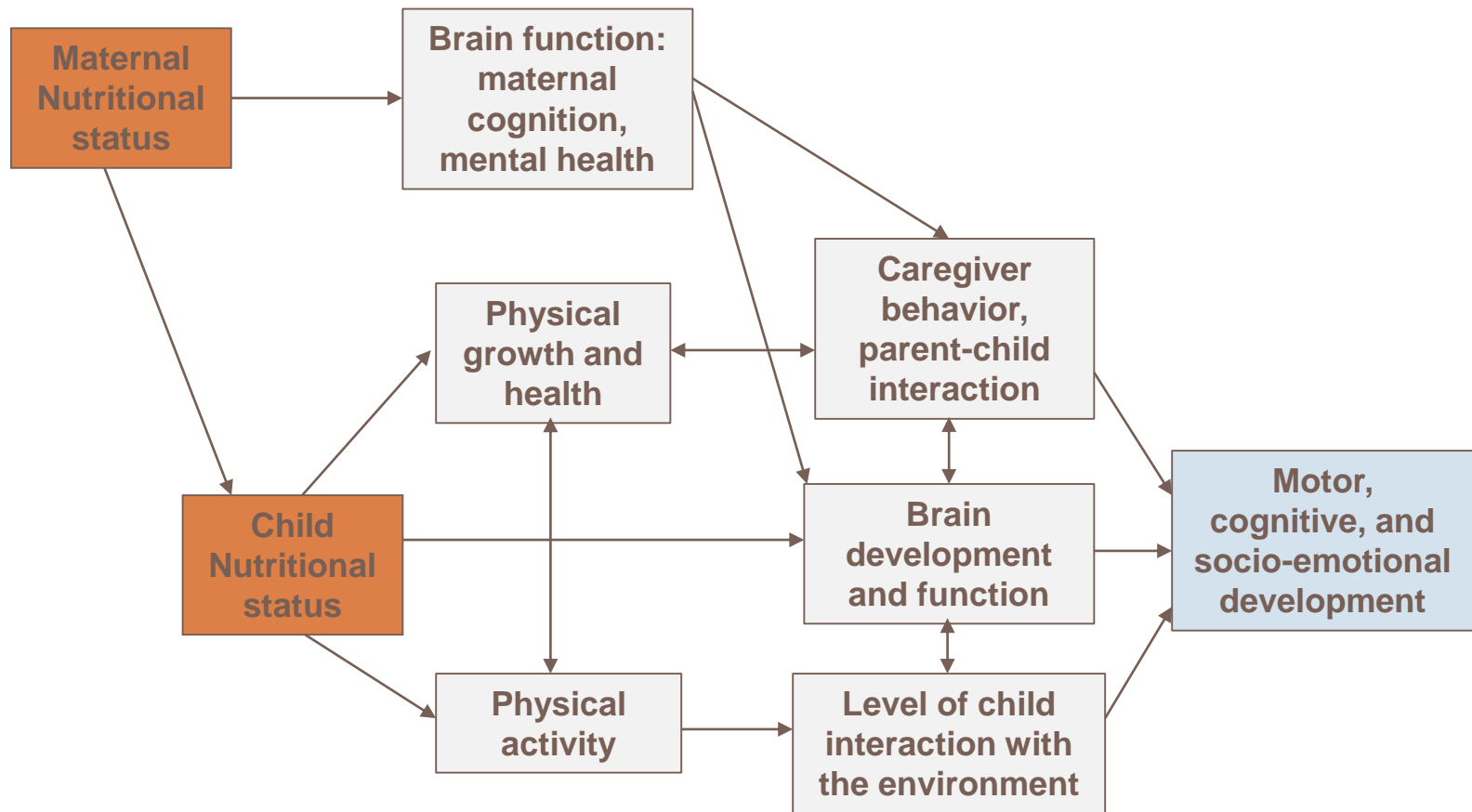
# LINKS BETWEEN MATERNAL NUTRITION, MATERNAL COGNITION AND MENTAL HEALTH, AND CAREGIVING

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# Potential Pathways from Nutrition to Child Development



Adapted from Levitsky & Barnes (1972), Pollitt (1993), Prado & Dewey (2014)

# Maternal Nutrition and Maternal Cognition

- Nutrition and brain function in adults
- Associations in women of reproductive age
  - ▣ Iron-deficiency anemia (Murray-Kolb, 2011)
- 3 RCTs during pregnancy
  - ▣ Positive effect of iron supplements
    - 25 women in the US (Groner et al. 1986)
    - 81 women in South Africa (Beard et al. 2005)
  - ▣ Positive effect of multiple micronutrients (MMN) compared to iron/folic acid (IFA)
    - 640 women in Indonesia (Prado et al. 2012)

# Maternal Nutrition and Maternal Depression/Anxiety



## □ Associations

- Deficiencies in iron, zinc, B-vitamins and essential fatty acids have been associated with perinatal depression/anxiety (Leung & Kaplan 2009, Ramakrishnan 2011)

## □ 4 RCTs during pregnancy

- Positive effect of iron supplements in IDA women in South Africa (Beard et al. 2005)
- No effect of MMN vs IFA in Indonesia (Prado et al. 2012)
- Positive effect of MMN vs IFA in Bangladesh (Frith et al. 2009)
- Positive effect of MMN vs placebo in HIV-positive women in Tanzania (Smith Fawzi et al. 2007)



# Supplementation with Multiple Micronutrients Intervention Trial (SUMMIT), Lombok, Indonesia

262 midwives randomly assigned to distribute a daily tablet to >30,000 women, containing:

## MMN:

Iron  
Folic Acid  
Vitamin A  
Vitamin D  
Vitamin E  
Vitamin C  
Vitamin B1  
Vitamin B2

or

## IFA:

Niacin  
Vitamin B6  
Vitamin B12  
Zinc  
Copper  
Selenium  
Iodine

from

Iron  
Folic Acid

First visit to local  
pre-natal care  
clinic

to

3 months post-  
partum



## **Cognitive Participants:**

**640** (344 MMN, 296 IFA) mothers tested after a mean of **25 WEEKS** of supplementation (10% in the 1st or 2nd trimester, 39% in the 3rd trimester, 51% after birth).



# Test Selection Criteria (1) to (4) -

## Theoretical issues

- 1) Tests that are designed to primarily tap aspects of specific cognitive and other brain-related functions, particularly those that have been associated with micronutrient deficiency in previous studies.
- 2) Tests that have been tied to particular brain structures and mechanisms, particularly those in which micronutrients play a role.
- 3) Tests that play a role in practical skills important for daily life.
- 4) Tests that are well-established and widely used.

# Criteria (5) to (7) – Cross-cultural issues



- 5) Tests that are appropriate for the local setting.
- 6) Tests that are able to distinguish between different individual's abilities, so should result in a wide distribution of scores.
- 7) Tests with high reliability in the local setting.

# Criteria (8) to (10) – Logistical issues



- 8) Tests that do not require extensive training for the testers (at maximum ~ 2-3 weeks), do not require previous experience in cognitive assessment, and do not require subjective judgments from the testers, such as the type of judgments a highly trained clinician would make.
- 9) Tests that are relatively brief to administer
- 10) Tests that do not require special equipment (only paper, pencil, stopwatch, and digital recorder).

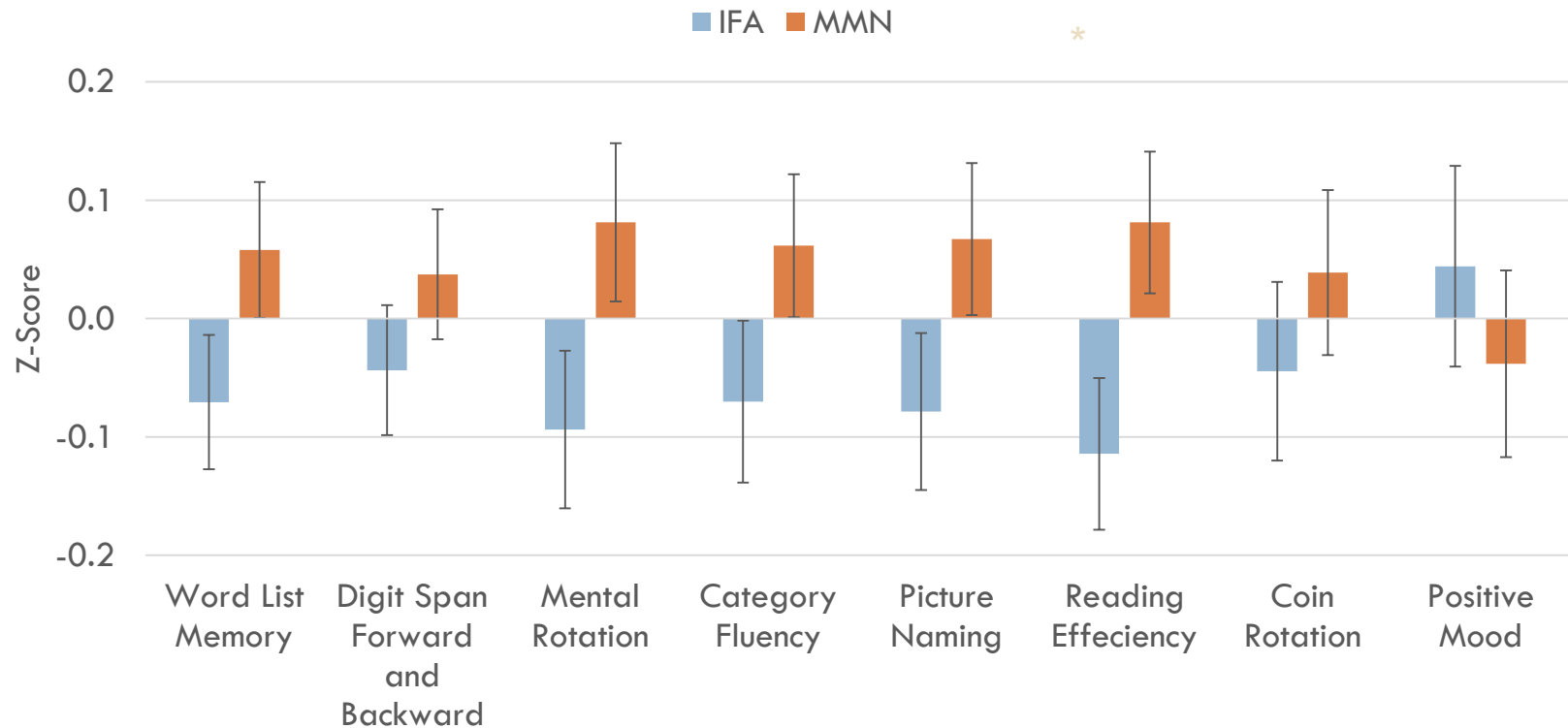




# Reliability and Validity

Test	Internal Reliability		Test-Retest Reliability			Correlation with education		
	<i>n</i>	<i>Alpha/r</i>	<i>n</i>	<i>r</i>	<i>p</i>	<i>n</i>	<i>r</i>	<i>p</i>
<b>Set X</b>								
Declarative Memory								
Word List Memory								
Immediate Recall								
Delayed Recall	468	0.64	20	0.69	<.001	351	0.45	<.001
Delayed	468	0.68	20	0.76	<.001	347	0.42	<.001
Recognition	459	0.87	20	0.73	<.001	344	0.47	<.001
Working Memory								
Digit Span Forward	467	0.67	20	0.89	<.001	350	0.31	<.001
Digit Span Backward	467	0.68	20	0.56	<.001	350	0.47	<.001
<b>Set Y</b>								
Motor Dexterity								
Coin Rotation								
Right Hand			20	0.69	<.001	244	0.23	<.001
Left Hand	307	0.61	20	0.44	.054	244	0.08	.211
Verbal Fluency								
Verbal Fluency								
Category: Food			11	0.96	<.001	243	0.09	.144
Category: Names	306	0.41	11	0.77	.005	243	0.16	.011
Depression Test (CES-D)	300	0.83	21	0.84	<.001	240	-0.14	.028
<b>Set Z</b>								
Speed of Lexical Retrieval								
Picture Naming	--	--	16	0.45	.082	414	0.42	<.001
Word Reading								
Real Words	--	--	15	0.95	<.001	353	0.53	<.001
Pseudowords	--	--	15	0.98	<.001	352	0.48	<.001
Mental Rotation Test	500	0.73	19	0.85	<.001	417	0.35	<.001

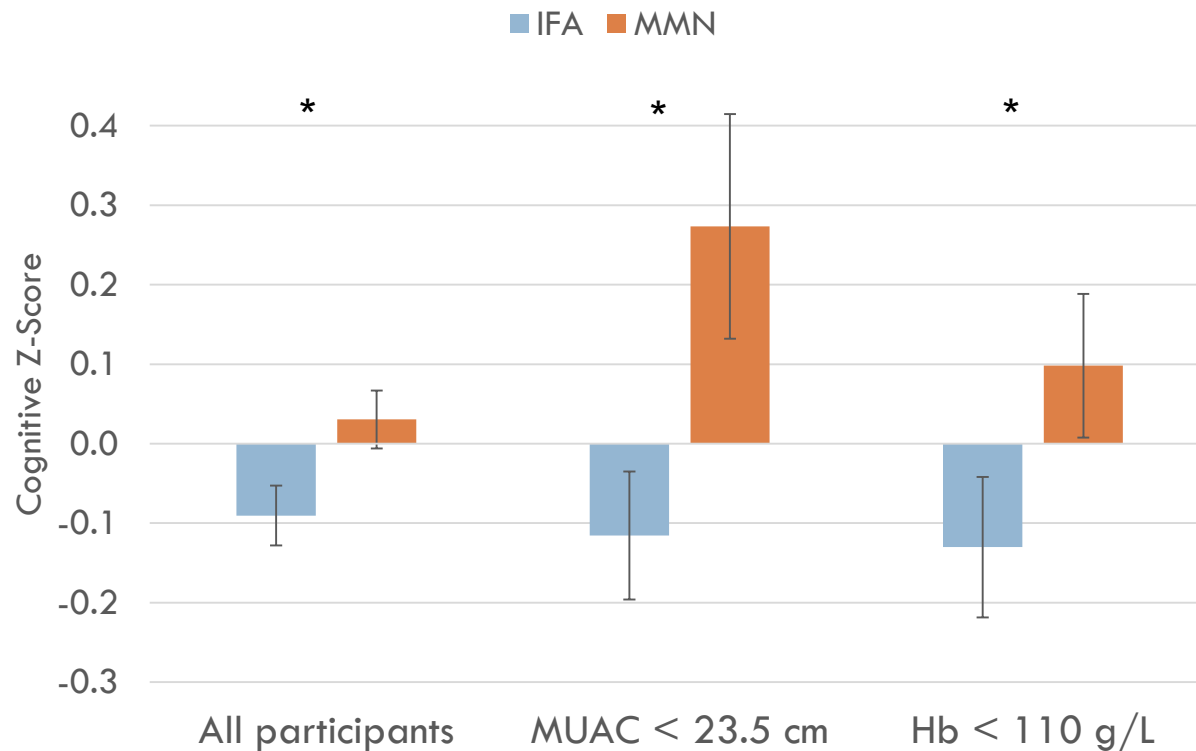
# Effect of MMN on each Cognitive Motor, and Mood Test



Prado, E. L., et al. (2012). "The effect of maternal multiple micronutrient supplementation on cognition and mood during pregnancy and postpartum in Indonesia: a randomized trial." [PloS one 7\(3\): e32519.](#)

# Effect of MMN on Maternal Cognition

- Mean z-score across all cognitive tests



# Maternal Cognition and Caregiving

- Positive associations between maternal cognition and
  - ▣ Infant and toddler dietary intake in Peru, Egypt, Kenya (Wachs et al. 2001, 2005; Bhargava et al. 2003)
  - ▣ HOME Inventory scores in Jamaica (Baker-Henningham et al. 2003)
  - ▣ listening and reading comprehension of general health messages in Zambia (Stuebing et al. 1997)

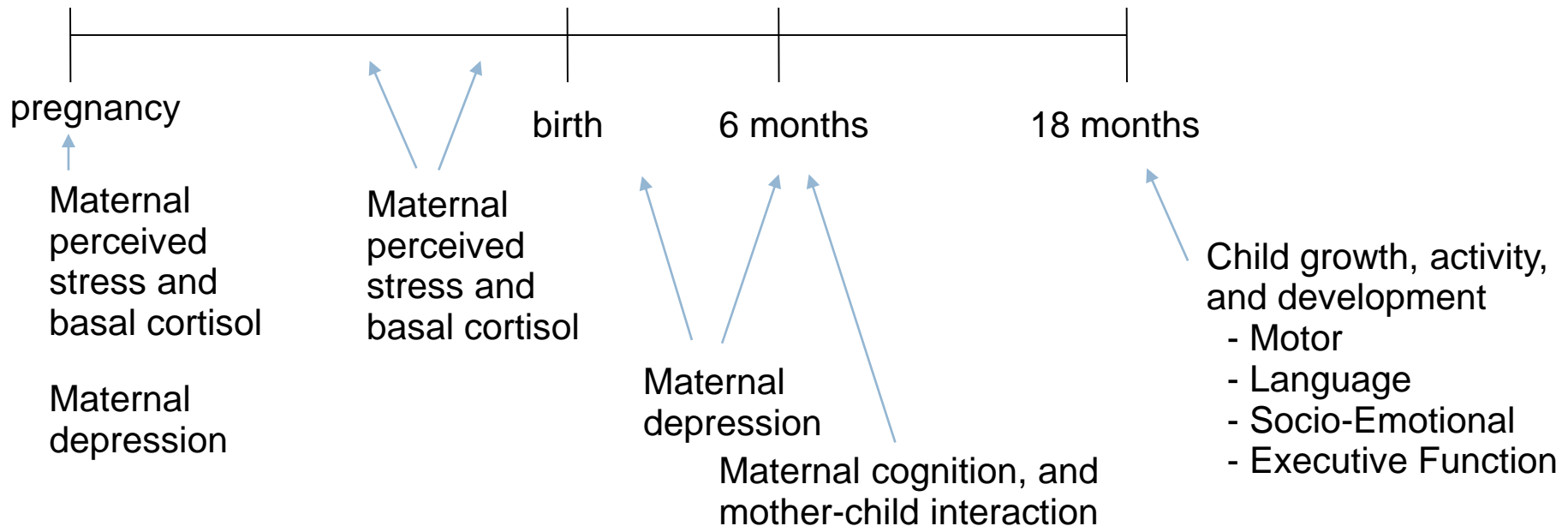
# Maternal Depression/Anxiety and Caregiving

- Association between maternal depression/anxiety and
  - Lower HOME Inventory scores in Jamaica (Baker-Henningham et al. 2003)
  - Reduced preference for breastfeeding in Barbados (Galler et al. 1999)
  - Use of health services in India (depressed mother were more likely to use health services than non-depressed mothers) Patel et al. (2002)

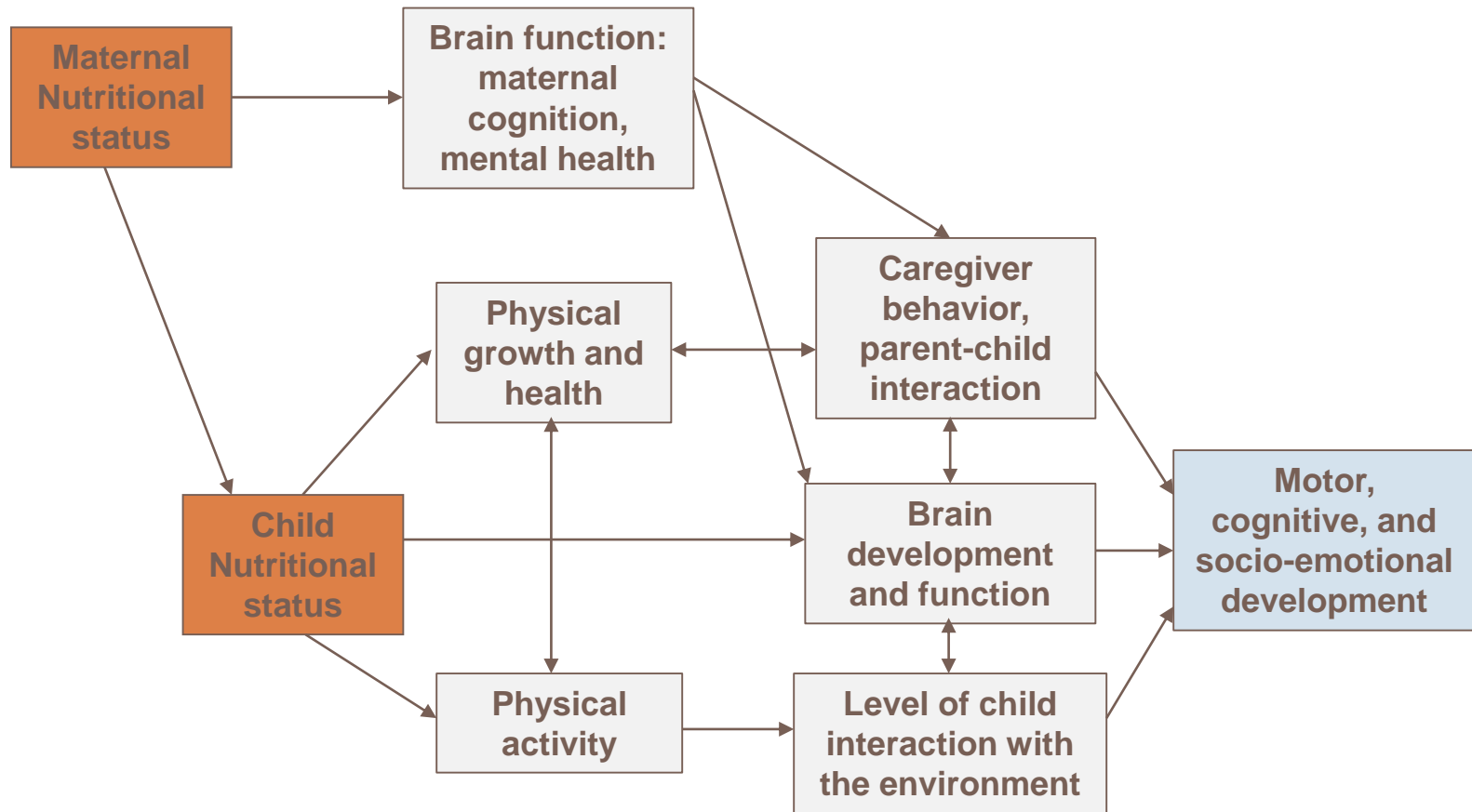
# International Lipid-Based Nutrient Supplements (iLiNS) Project, Malawi



864 pregnant women randomized to 3 groups:



# Potential Pathways from Nutrition to Child Development



Adapted from Levitsky & Barnes (1972), Pollitt (1993), Prado & Dewey (2014)

# Methods

- Maternal Depression/Anxiety
  - ▣ WHO Self-Reporting Questionnaire
  - ▣ Edinburgh Postnatal Depression Scale
  - ▣ Perceived Stress Scale
- Maternal Cognition
  - ▣ Digit Span Forward and Backward
  - ▣ Verbal Fluency
  - ▣ Mental Rotation
  - ▣ Functional Health Literacy
- Mother-Infant interaction
  - ▣ HOME Inventory
- Activity
  - ▣ Accelerometers
- Child Development
  - ▣ Motor: Kilifi Development Inventory (KDI)
  - ▣ Language: Adapted MacArthur-Bates Communicative Development Inventory
  - ▣ Socio-Emotional: Profile of Socio-Emotional Development (PSED)
  - ▣ Executive Function: A not B task



# Thank you!

## □ **SUMMIT Team:**

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