

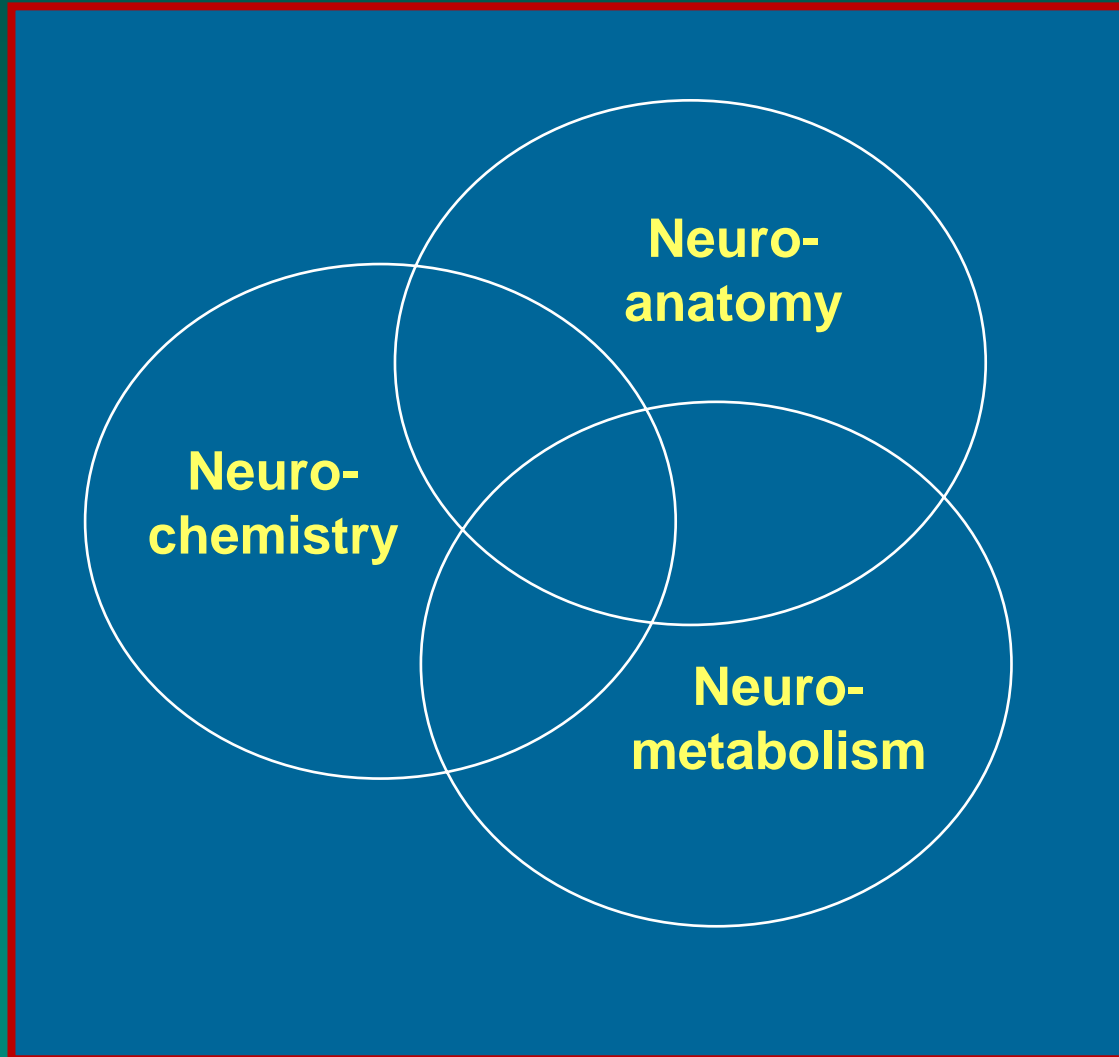
# Iron Deficiency in Infancy: Impact on Cognitive Development and Performance

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# Iron and the Brain



# Preventive Trial in Chile

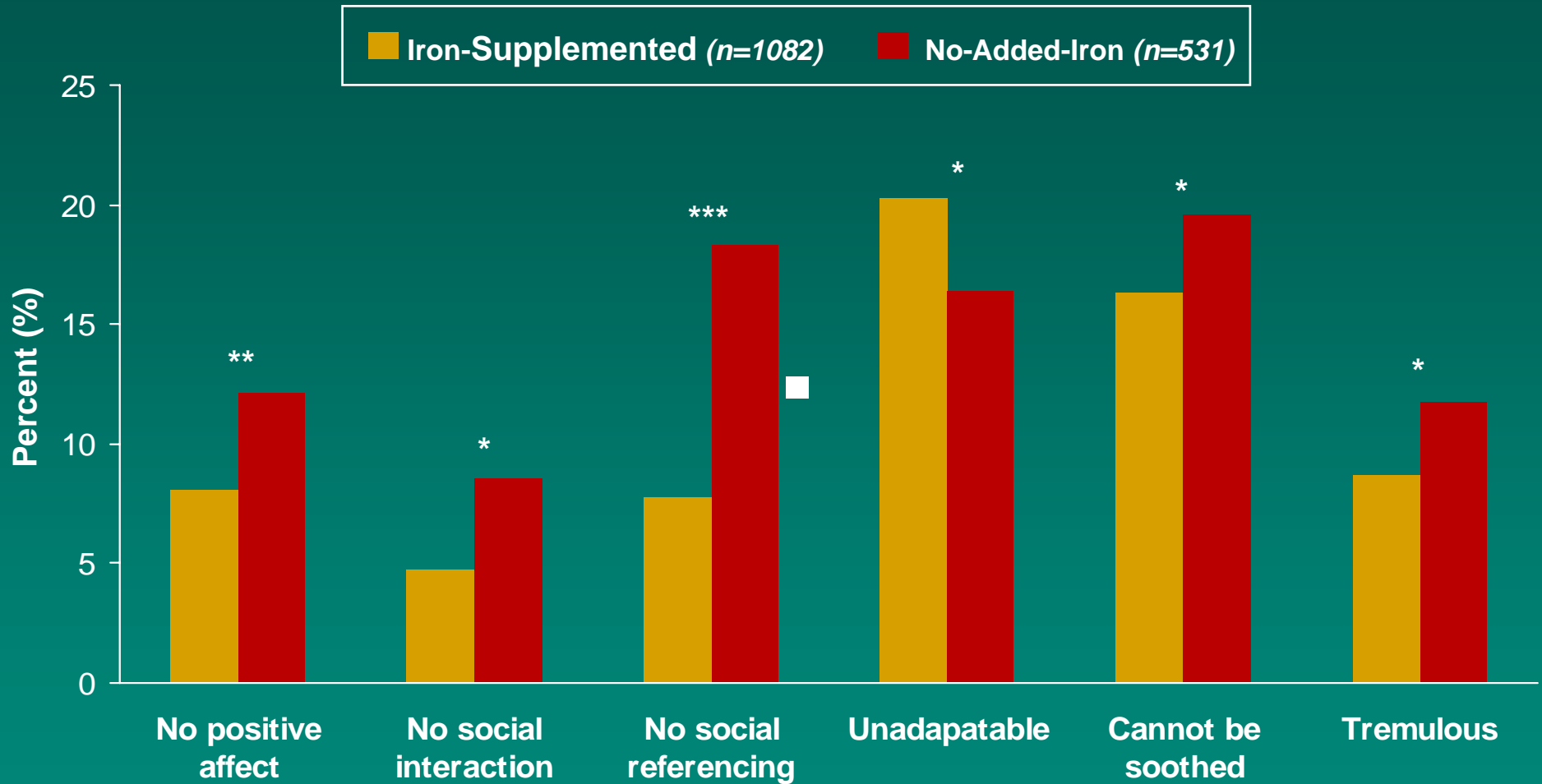


- Full-term no health problems, BW  $\geq$  3.0 kg
- Screened for anemia at 6 months
- Randomly assigned to high or low; high or no-added-iron
- Specific, sensitive measures
- 1657 healthy infants completed trial

# Initial Analyses

- No difference in growth
- No behavior/development differences between high- and low-iron groups
  -
- Combined to form iron-supplemented group
- No differences between iron and no-iron groups on global test scores
- Effects in every other domain

# Behavior Rating Scale<sup>1</sup>



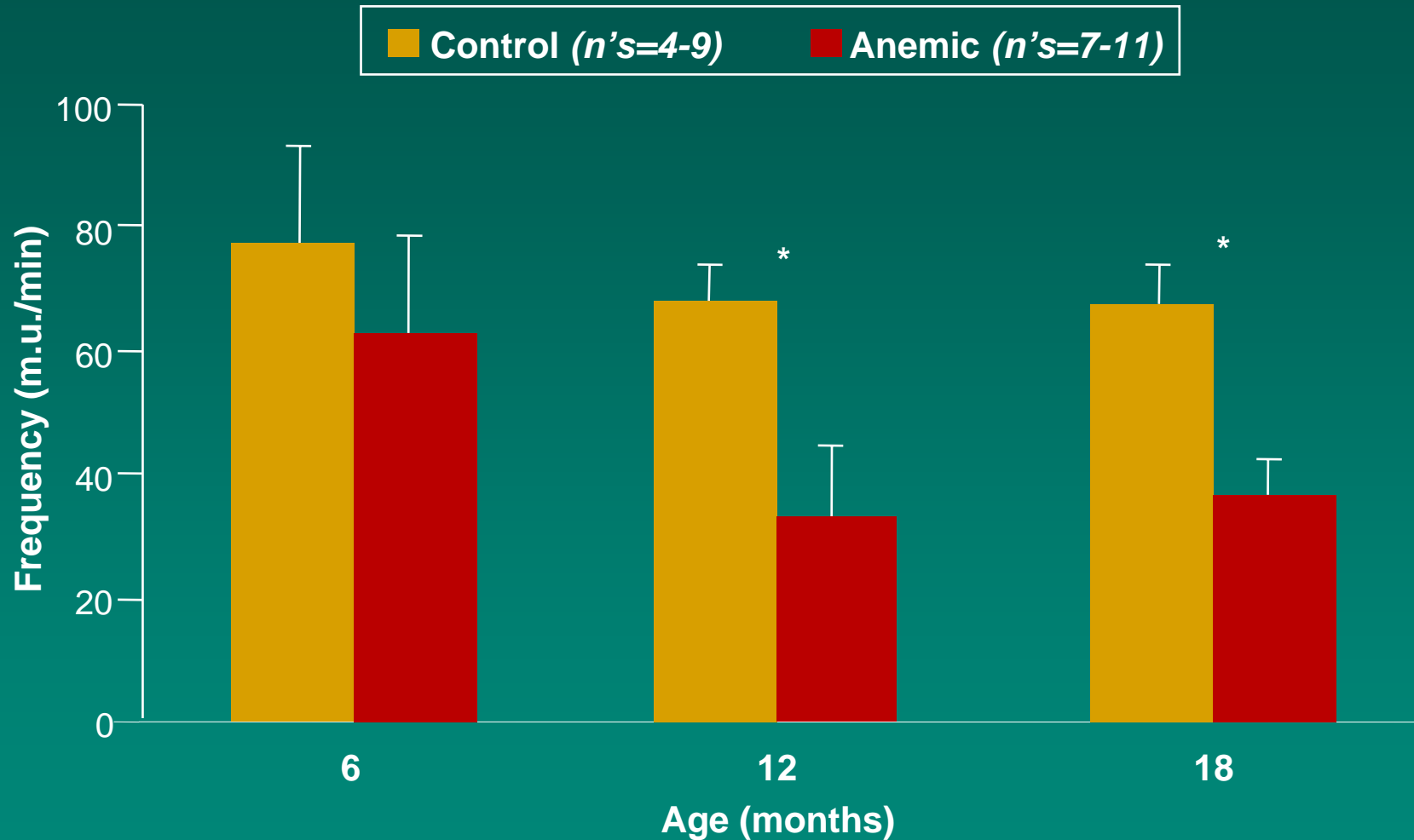
<sup>1</sup> Controlling for a comprehensive set of background factors

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

# Role of Dopamine

- Extraneous motor movements
  - Tremor
- Behavioral activation/inhibition;  
inherent reward
  - Affective changes
  - Social referencing
  - Adaptability

# Total Motor Activity Around a Daytime Nap in the Laboratory



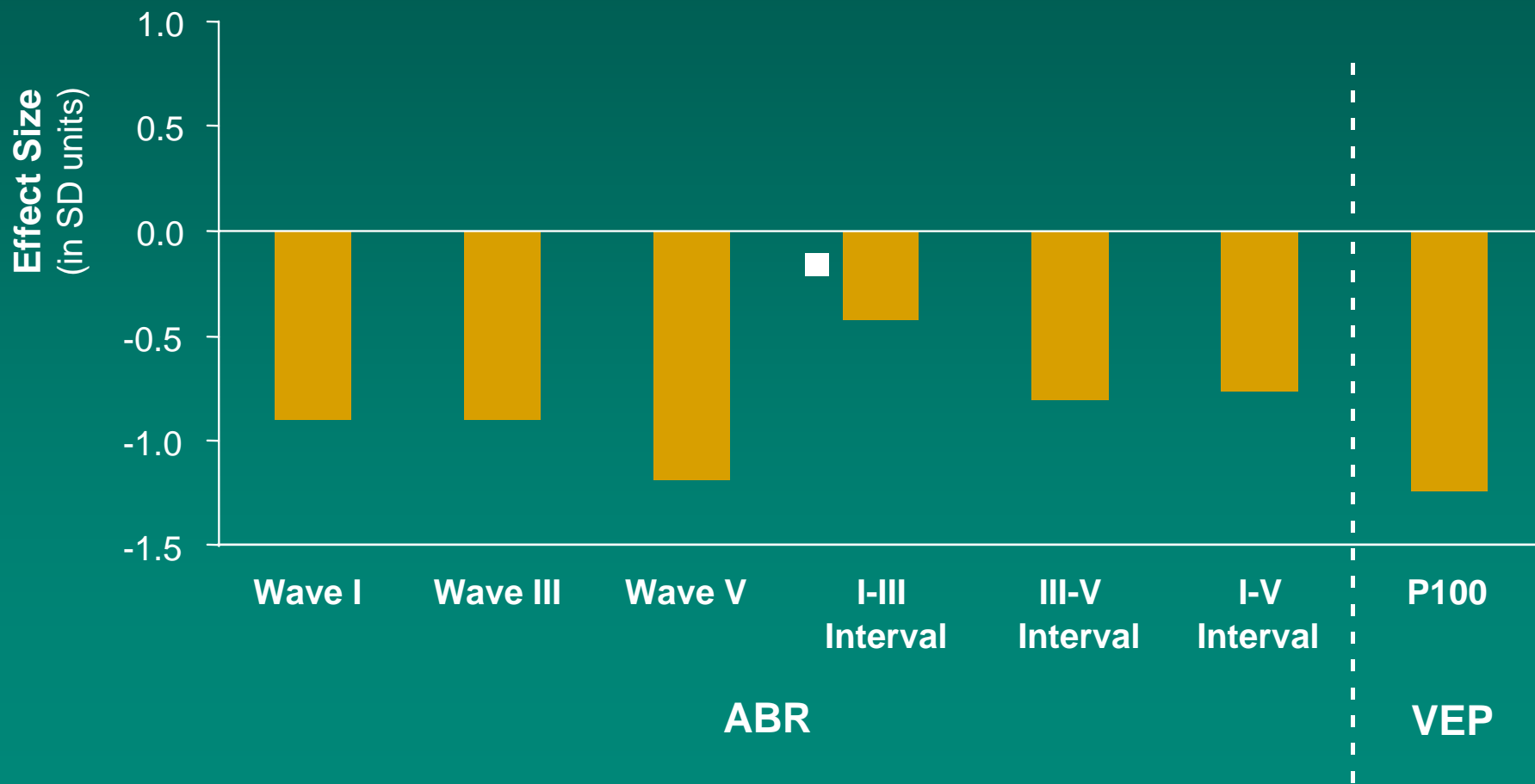
Source: Angulo-Kinzler, et al. (2002). Spontaneous motor activity in human infants with iron-deficiency anemia. *Early Human Development*. 66: 67-79.



# Long-Term Effects on Nerve Conduction

- 3- to 4-year-olds with or without IDA in infancy
- Auditory brainstem responses (ABRs) in former IDA children (n=29) and controls (n=35)
- Visual evoked potentials (VEPs) in former IDA children (n=40) and controls (n=40)

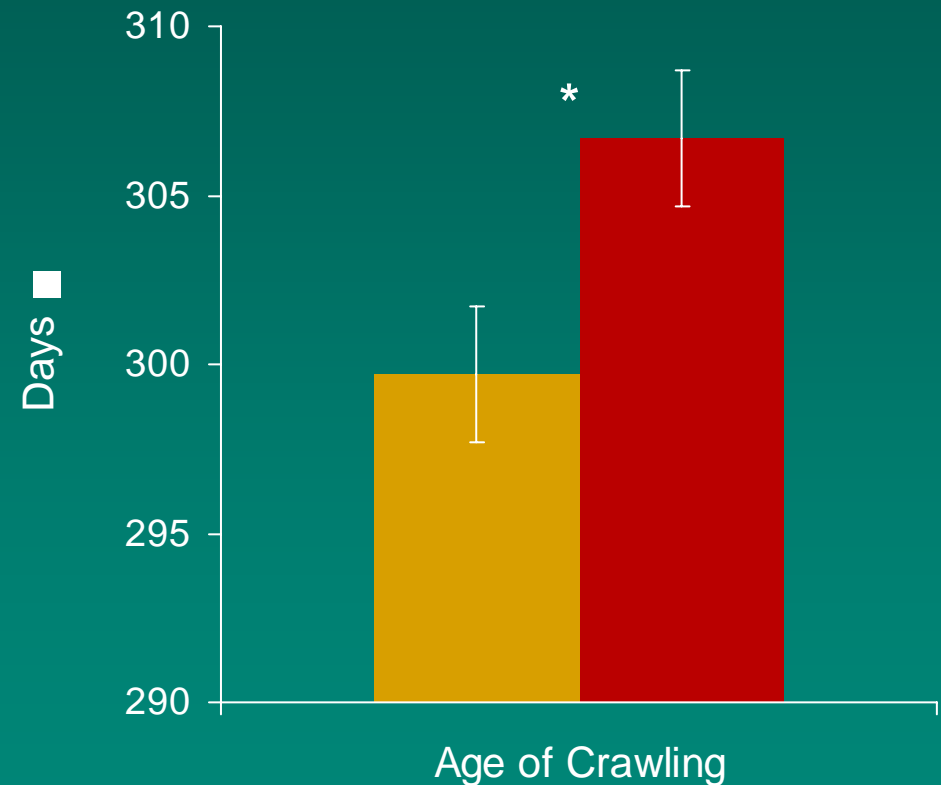
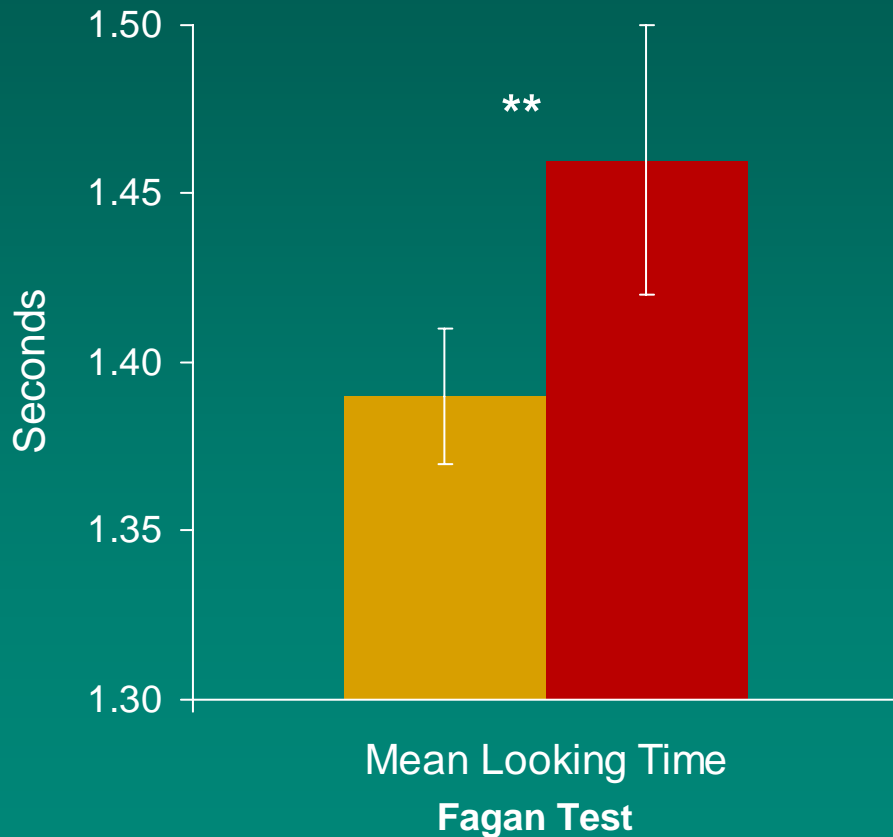
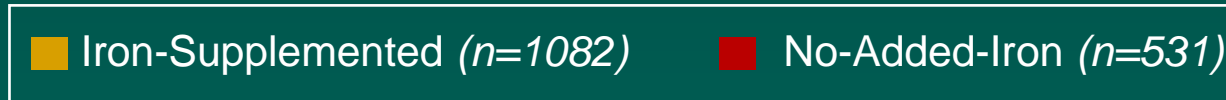
# Evoked Potential Latencies at 3 - 4 Years: Differences between Former IDA Children and Control



# Inferences Regarding Myelination

- Differences in latency but not amplitude suggests altered myelination
- Long-lasting differences in at least 2 sensory systems
- Other intracerebral effects seem likely
- Impaired myelination could underlie other poorer outcomes

# Specific Developmental Outcomes at 12 Months<sup>1</sup>



<sup>1</sup> Controlling for a comprehensive set of background factors

\**p*<0.05, \*\**p*<0.01

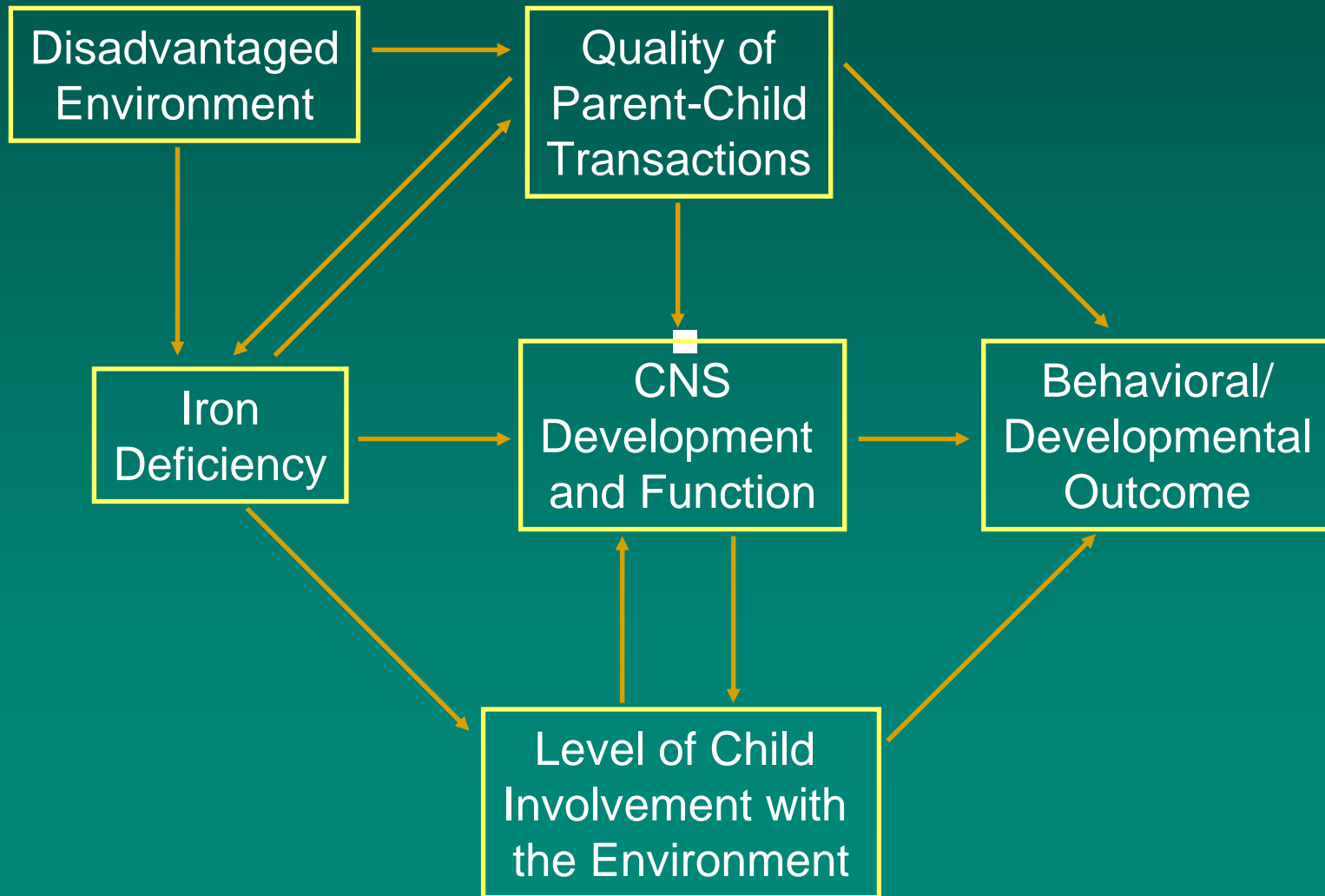
## Overall Impact

- Delayed or mistimed sensory input
- Less seeking/receiving stimulation
- Reduced input from physical/social environment ■

## Consequences

- Secondary effects on brain structure and function

# Functional Isolation



# Brain and Behavior in Early Iron Deficiency

## Unresolved Issues

- Specific CNS alterations
- Iron deficiency without anemia
- Reversibility <sup>■</sup> with iron therapy
- Timing and duration
- Causal connections
- Underlying mechanisms