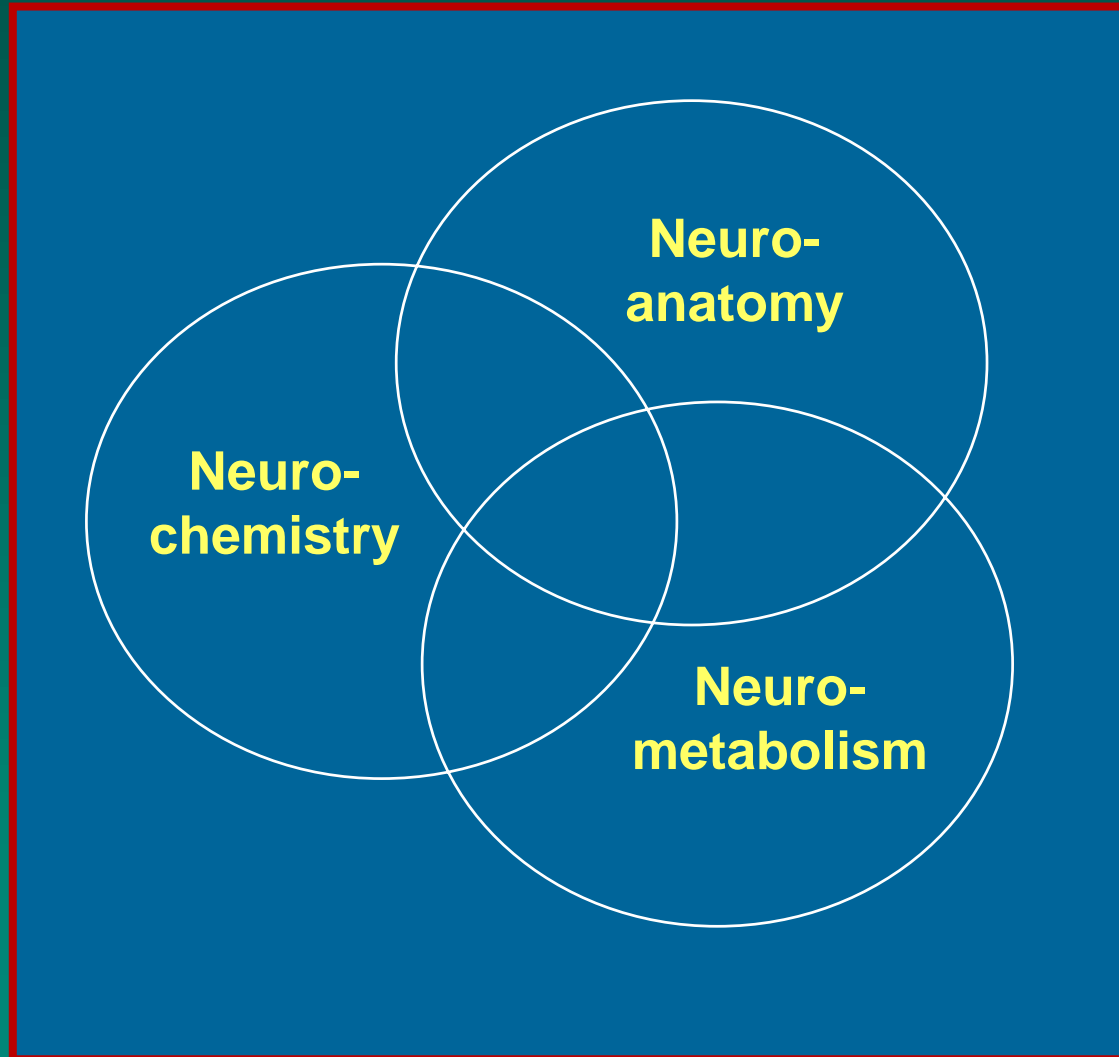


Iron Deficiency in Infancy: Impact on Cognitive Development and Performance

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Working Group
Ottawa, Canada
September 2002

Iron and the Brain



Preventive Trial in Chile

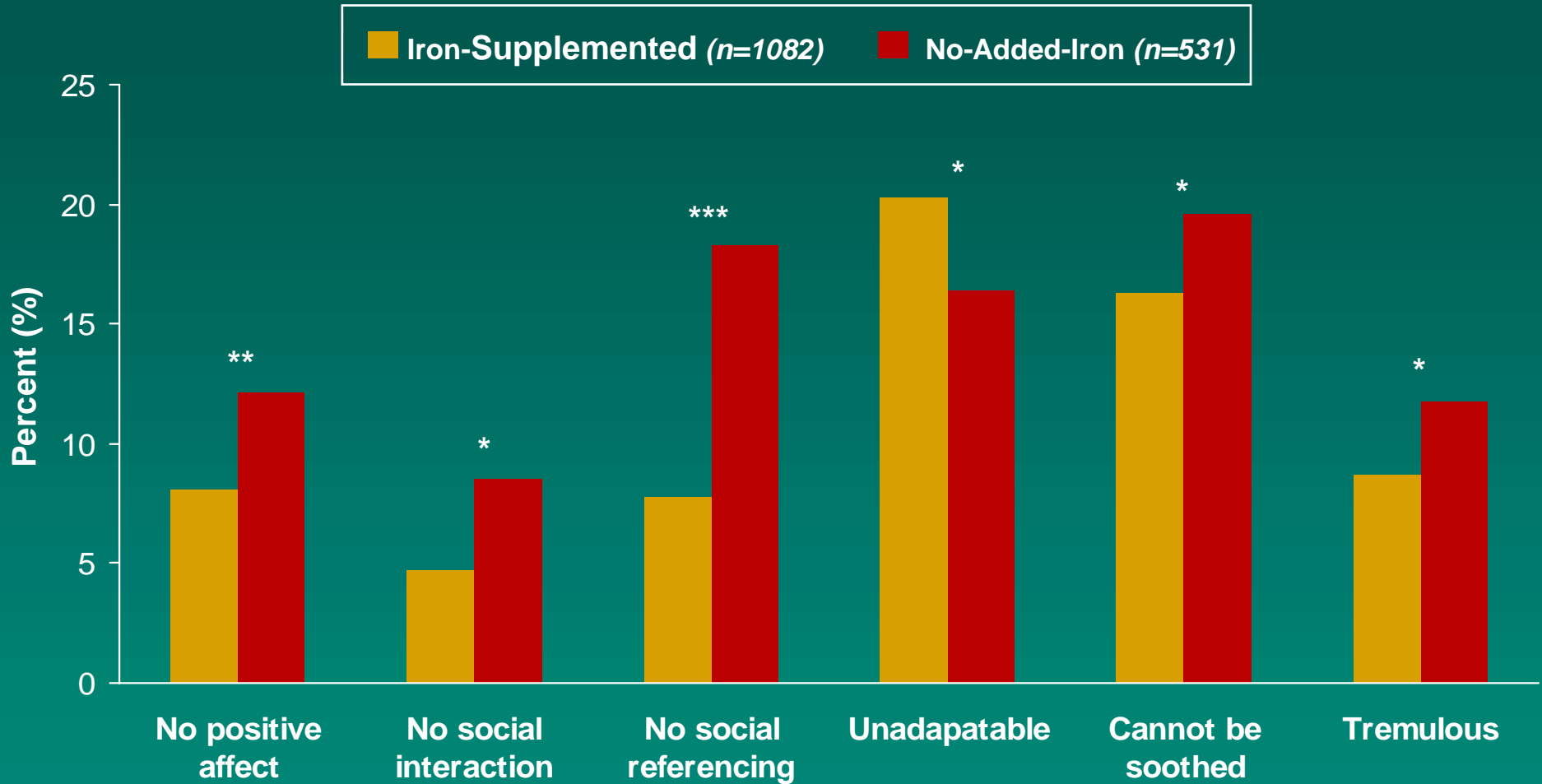


- Full-term no health problems, $BW \geq 3.0$ kg
- Screened for anemia at 6 months
- Randomly assigned to high or low; high or no-added-iron
- Specific, sensitive measures
- 1657 healthy infants completed trial

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 Scale¹



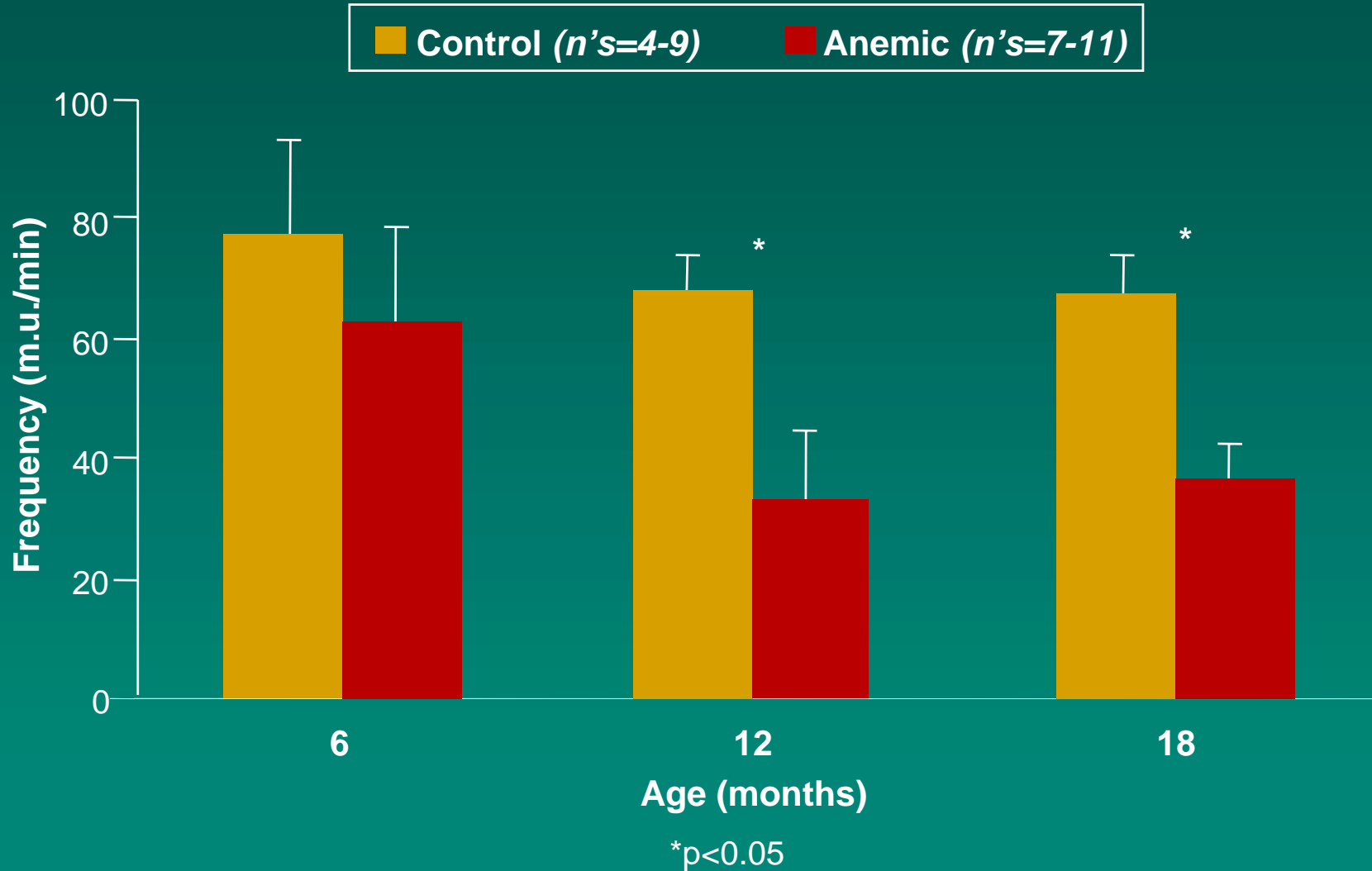
¹ Controlling for a comprehensive set of background factors

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

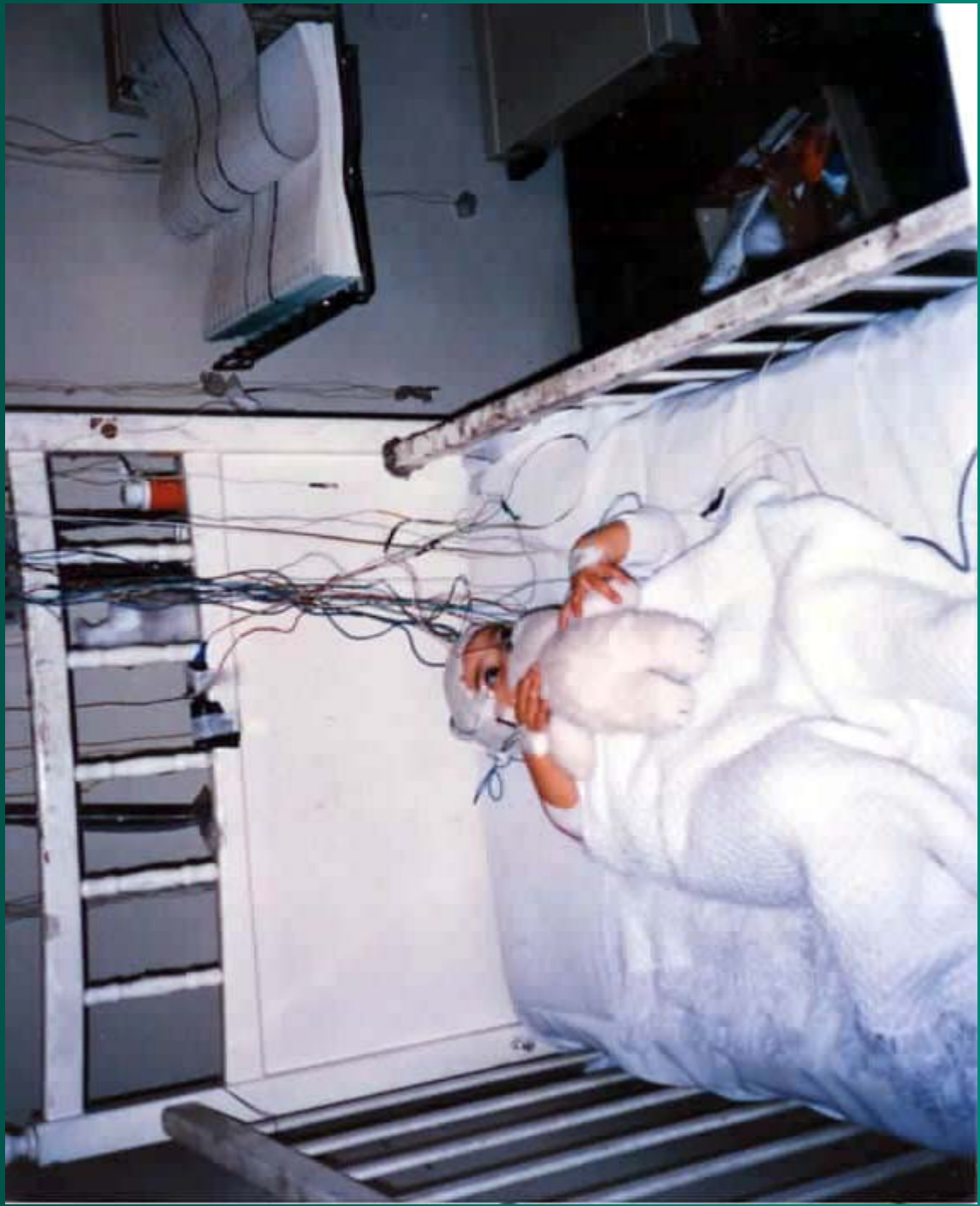
Role of Dopamine

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

Total Motor Activity Around a Daytime Nap in the Laboratory



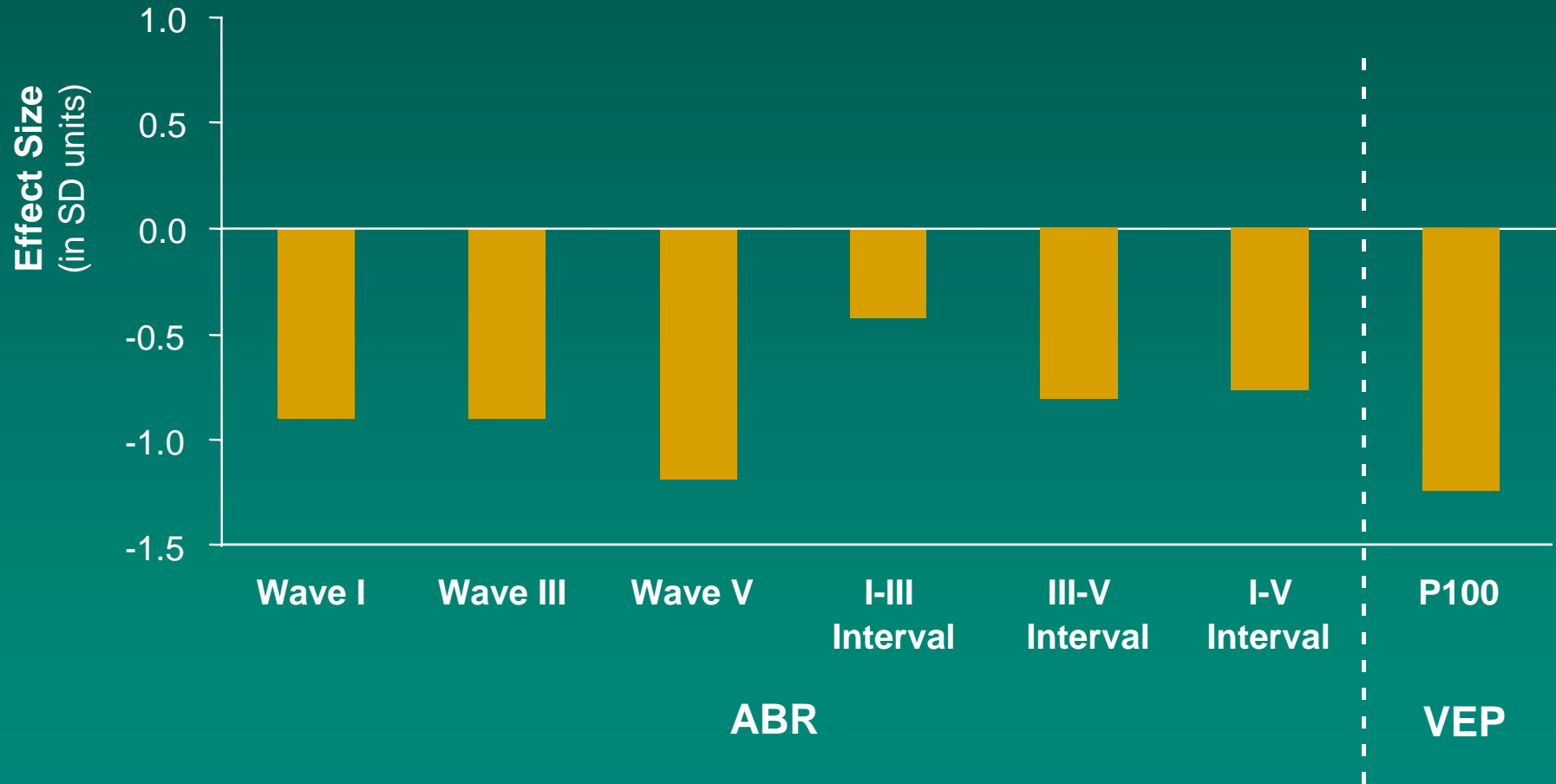
Source: Angulo-Kinzler, et al. (2002). Spontaneous motor activity in human infants with iron-deficiency anemia. *Early Human Development*, 66: 67-79.



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

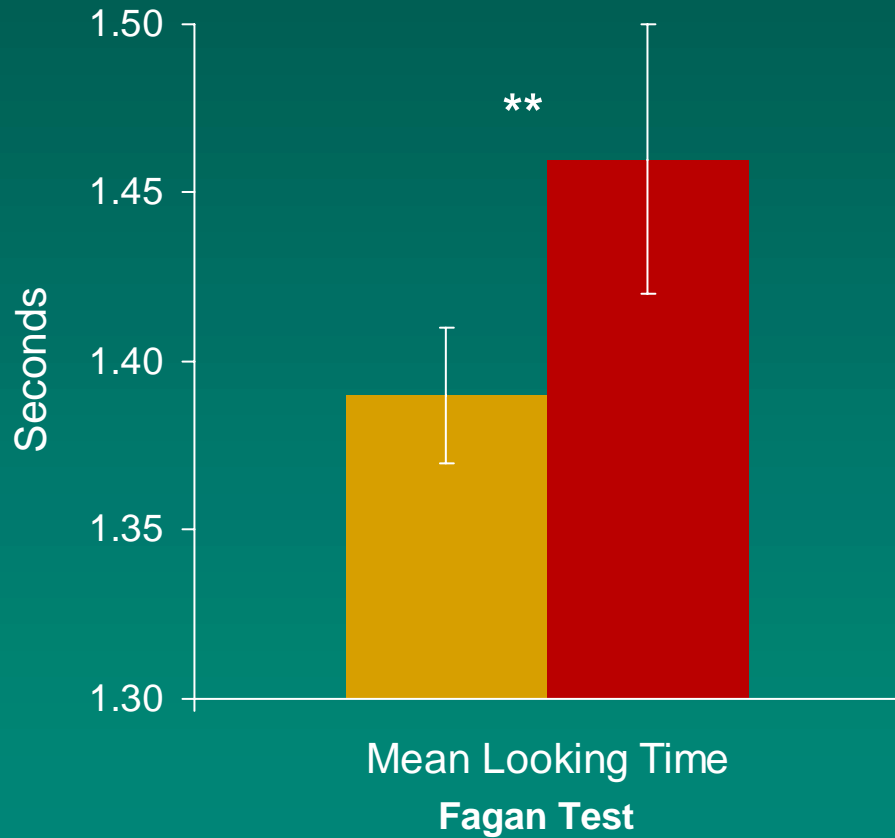


Inferences Regarding Myelination

- 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 Months¹

■ Iron-Supplemented (*n*=1082) ■ No-Added-Iron (*n*=531)



¹ Controlling for a comprehensive set of background factors

p*<0.05, *p*<0.01

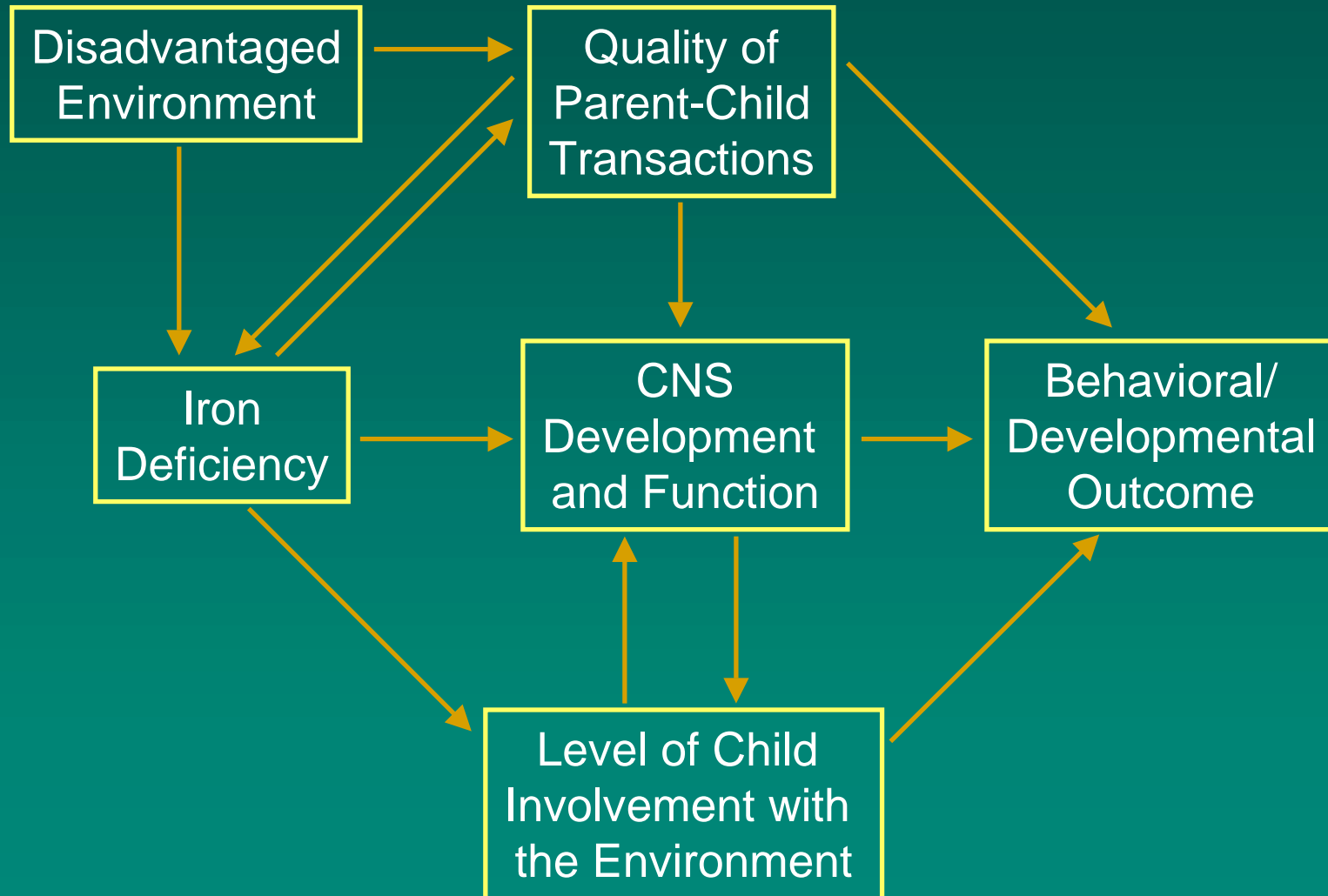
Overall Impact

- 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 with iron therapy
- Timing and duration
- Causal connections
- Underlying mechanisms