Behavioral and ERP Measures of Executive Function in Adolescents Born Moderately Preterm

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➔ ➔Introduction ➔ ➔

The rate of preterm birth now exceeds 12% of all live births in the United States, creating a significant public health concern (Martin et al., 2009). Preterm birth is associated with increased risk for deficits in attention and executive function. Previous research has investigated children born very preterm (<31 weeks), but the majority of preterm births occur after 31 weeks.

Children born preterm also face increased risk of ADHD, a neurodevelopmental disorder strongly associated with frontal-striatal dysfunction (e.g., Astbury, Orgill, & Bajuk, 1987). A national longitudinal study examining academic skills in elementary school students born moderately preterm found their reading and math achievement was persistently lower than that of full term controls from kindergarten to fifth grade (Chyi et al., 2008). Students born moderately preterm were also more likely to receive special education services (Chyi et al., 2008). Much less is known about broader executive function skills in the large population of children born moderately preterm.

In this preliminary study, we examine inhibitory control and cognitive conflict in children born moderately preterm (31-33 weeks) using behavioral and electrophysiological responses during a Go-NoGo/ Flanker task.

➔ Hypotheses ➔ ➔

Children born between 31-33 weeks gestation will show significantly poorer accuracy and slower reaction time on cognitive conflict and inhibitory control tasks in childhood and adolescence.

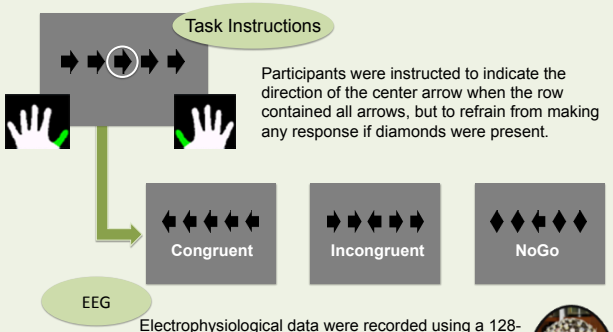
Children born moderately preterm will show electrophysiological evidence of altered brain function during cognitive conflict and inhibitory control tasks.

◆Participants ◆ ◆

Group	N	Mean Age	Gender	Mean Gestational Age
Preterm	10	12.71	4 female	32 weeks
Control	9	12.56	4 female	40 weeks

All participants were screened for serious medical conditions, learning disabilities, and psychological disorders. Majority of the children participated in a previous study of the development of infants' memory for faces that included both full term and preterm infants.

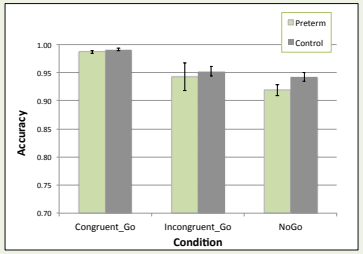
➔ ➔ ➔Methods ➔ ➔



Participants were instructed to indicate the direction of the center arrow when the row contained all arrows, but to refrain from making any response if diamonds were present.

Electrophysiological data were recorded using a 128-channel electrode net (Electrical Geodesics), with a sampling rate of 250 Hz, and offline filtering of 0.1 - 30Hz. Data were artifact corrected, segmented into trials, and baseline corrected. Grand means were calculated for each group (Preterm and Control).

◆ Behavioral Results➔➔◆



There were no group differences in accuracy on the Go-NoGo/ Flanker Task

Reaction time was slower overall during Incongruent trials compared to Congruent trials (p<.01). Preterm children were faster than Control children for both Congruent and Incongruent trials (F = 5.985, p<0.05).

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References

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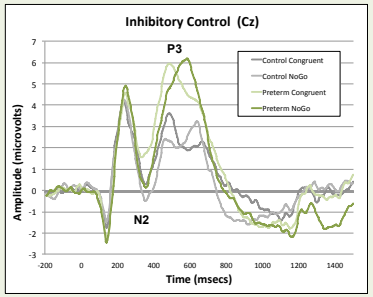
Chyi et al. (2008). School outcomes of late preterm infants: Special needs and challenges for infants born at 32 to 36 week gestation. *J Pediatr, 153(1),* 25-31.

Martin et al. (2009). Born a bit too early: Recent trends in late preterm births. *NCHS Data Brief, 24,* 1-8.

◆ ERP Results ➔➔◆



Inhibitory Control

NoGo trials elicited larger N2 amplitude than Go trials.

NoGo trials also showed longer P3 latency than Go trials.

Group Differences in Inhibitory Control

Controls showed larger N2 amplitude than Preterms. These differences did not differ by task condition.

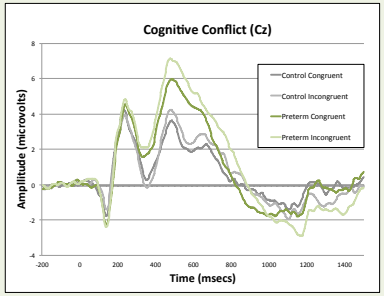
Preterms showed larger P3 amplitude than Controls for all trial types.

Cognitive Conflict

There were no significant differences in N2 or P3 for Incongruent vs Congruent trial types.

Group Differences in Cognitive Conflict

There are overall group differences in N2 and P3 amplitude, but no interaction by trial type.



➔ ➔Discussion ➔ ➔

Adolescents born moderately preterm showed no behavioral deficits in accuracy or response time on the Go-NoGo/Flanker Task. The preterm and control groups differed in the early ERP indicators of attention, with the control group showing a greater N2 amplitude for all trial types. In contrast, preterm adolescents exhibited a significantly larger P3 amplitude compared to controls.

The increased P3 amplitude in the preterm group is consistent with previous results reporting a larger P3 component in children with attention and executive function problems (ADHD) compared to typically developing children using a similar Go-NoGo/Flanker task, suggesting that the groups may differ in neural resources needed for cognitive control.

Alternatively, it is possible that the increase in P3 amplitude for preterm children reflects a reorganization of the brain as a result of early life stress, resulting in a different but equally effective neural circuit compared to children born at term.