Cuneus Cortex Mediates Lower Cognitive Performance in Adolescents Born Premature

Georgia Tech Scheller College of Business

Arya Shah, Dawn Jensen, PhD., Vince Calhoun, PhD., Jingyu Liu, PhD.

Georgia Institute of Technology, Georgia State University, TReNDS Center

TReNDS Translational Research in Neuroimaging & Data Science

Introduction

Background:
Preterm birth affects about 1 in 10 babies and is associated with later differences in brain development and cognition.

While **full term birth is typically 39–40 weeks**, our study compares adolescents born full-term, **moderately premature (32–37 weeks)**, and **very premature (<32 weeks)**. Most research has focused on infancy, but less is known about how prematurity shapes brain~cognition pathways in adolescence.

Goal:
We wanted to know whether variation in grey matter volume helps explain lower cognitive scores in adolescents born premature using data from the Adolescent Brain Cognitive Development **(ABCD)** Study

Methodology

1 SAMPLE COHORT-1

Group	Total Subjects	Male	Female
Full-term	2,252	1,187 (52.7%)	1,065 (47.3%)
Moderately Premature	731	401 (54.9%)	330 (45.1%)
Very Premature	152	77 (50.7%)	75 (49.3%)

2 NEUROIMAGING
sMRI + moo-ICAr
100 regions GM volume

3 COGNITION
NIH Toolbox
7 cognitive tests including
Picture Vocabulary Test

4 LMER MODELS
Test GM differences by gestational group
- Fixed effects = sex, gestational age
- Random effects = site

5 LMER MODELS
Test cognition differences by gestational group
- Fixed effects = sex, gestational age
- Random effects = site

6 Found 5 significant regions

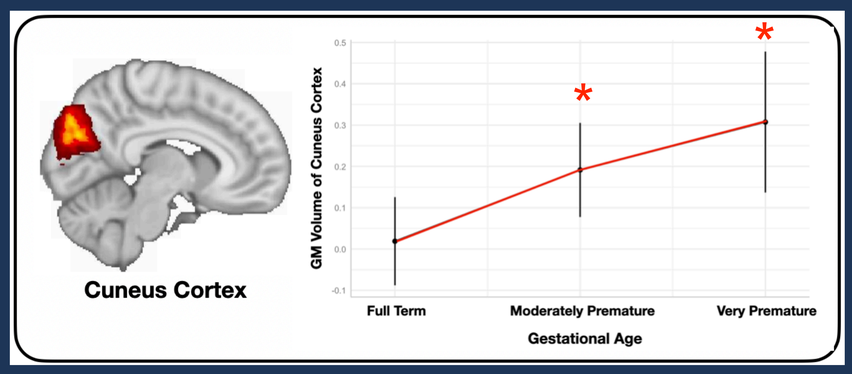
7 LMER: BRAIN ↔ COGNITION
Linking brain structure to cognitive performance

8 MEDIATION ANALYSIS
Testing the pathway from gestational age to cognition through brain structure

Gestational Age (Weeks) → Cuneus Cortex (GM Volume) → Picture Vocabulary Test Score

Results

GM ~ group + sex + gestational age

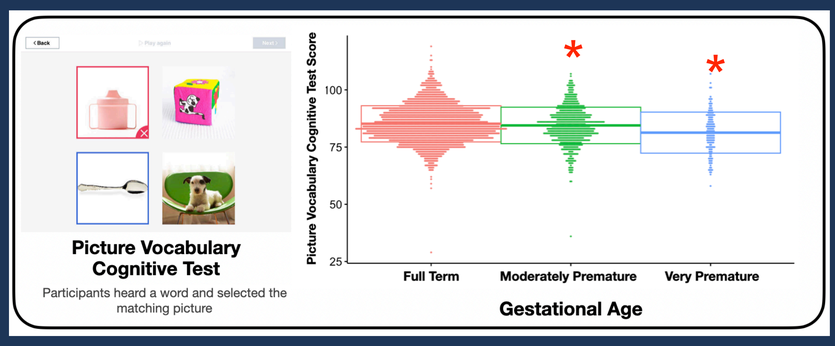


t = 4.36, p < 1.3e-5
Moderately Premature

t = 3.84, p < 1.2e-4
Very Premature

Premature adolescents show **higher cuneus grey matter volume** compared to full term

Cognition ~ group + sex + gestational age

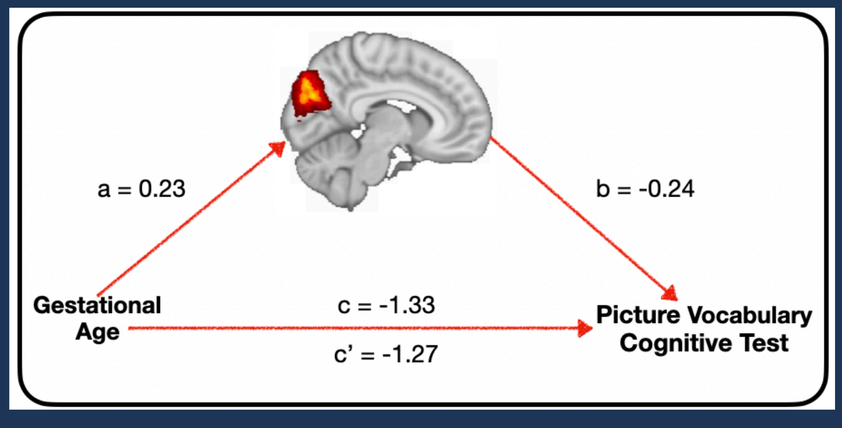


t = -3.13, p = < 1.77e-3
Moderately Premature

t = -5.59, p = < 2.45e-8
Very Premature

Picture Vocabulary performance was **lower** in premature adolescents

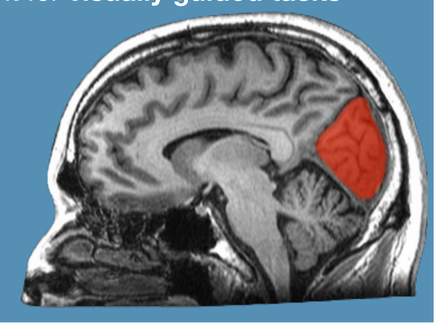
Cuneus *mediates* the association between gestational age and cognition



Cuneus cortex mediated **4.1%** of the association between gestational age and Picture Vocabulary performance

Cuneus Cortex

- Located in occipital lobe
- Involved in **visual processing**
- Supports **visual attention**
- Important for **visually guided tasks**



Conclusion

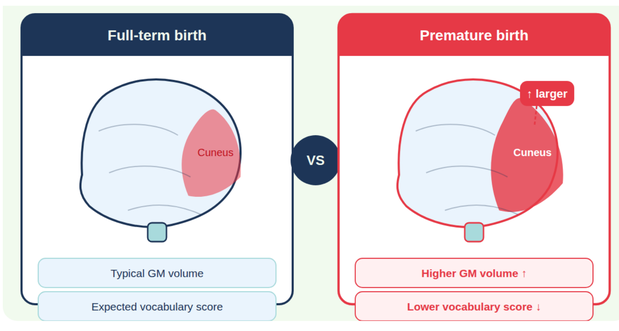
Prematurity
↓
Higher cuneus grey matter volume
↓
Lower Picture Vocabulary performance

This suggests that less mature cuneus development may link preterm birth to lower cognitive performance.

Key Takeaways
- Premature adolescents may show a less mature developmental pattern in the cuneus cortex
- Altered cuneus development may help explain lower performance on visually guided cognitive tasks like Picture Vocabulary.

Future Work
- Examine additional grey matter regions
- Test broader visual and attention networks

Cuneus Develops Differently



Acknowledgements

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