Low-level prenatal alcohol exposure: Longitudinal effects on adolescent development

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BACKGROUND

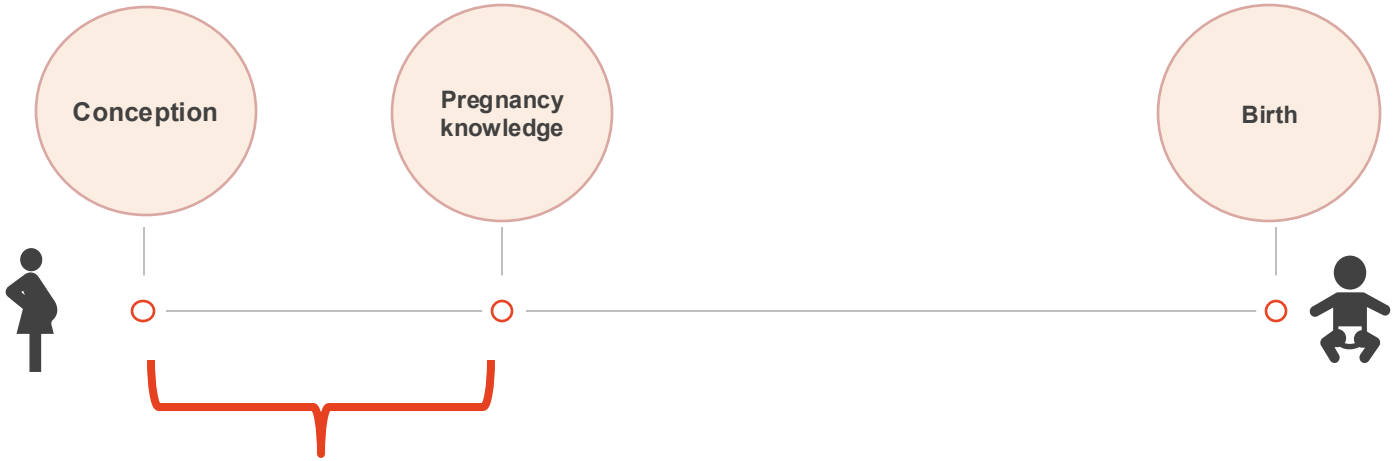
PRENATAL ALCOHOL EXPOSURE

Globally, 9.8% of women consume alcohol during pregnancy

Heavy prenatal alcohol exposure (PAE), particularly binge drinking, confers the greatest risk

One of the most disabling potential consequences of PAE IS FASD.

PRENATAL ALCOHOL EXPOSURE



50-60% of PAE occurs between conception and pregnancy knowledge (McCormac et al., 2017; Young et al., 2022)

ABCD STUDY

- Multisite (n=21) longitudinal study
- Biological and behavioural development of ~12,000 children through adolescence into early adulthood
- Incredibly well-characterised study, including most domains found to be impacted in FASD

ABCD & PAE

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Association of Prenatal Alcohol Exposure With Psychological, Behavioral, and Neurodevelopmental Outcomes in Children From the Adolescent Brain Cognitive Development Study

Briana Lees, B.Psych. (Hons), Louise Mewton, Ph.D., Joanna Jacobus, Ph.D., Emilio A. Valadez, Ph.D., Lexine A. Stapinski, Ph.D., Maree Teesson, Ph.D., Susan F. Tapert, Ph.D., and Lindsay M. Squeglia, Ph.D. | AUTHORS INFO & AFFILIATIONS

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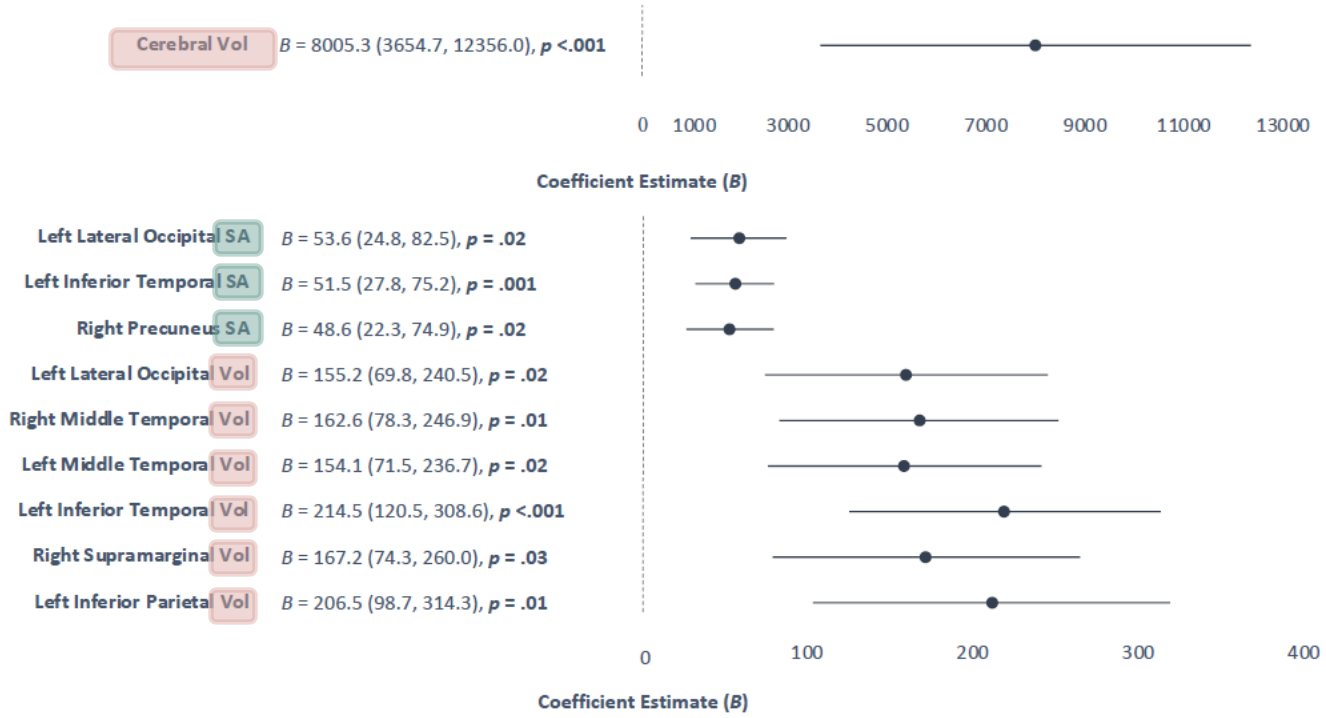
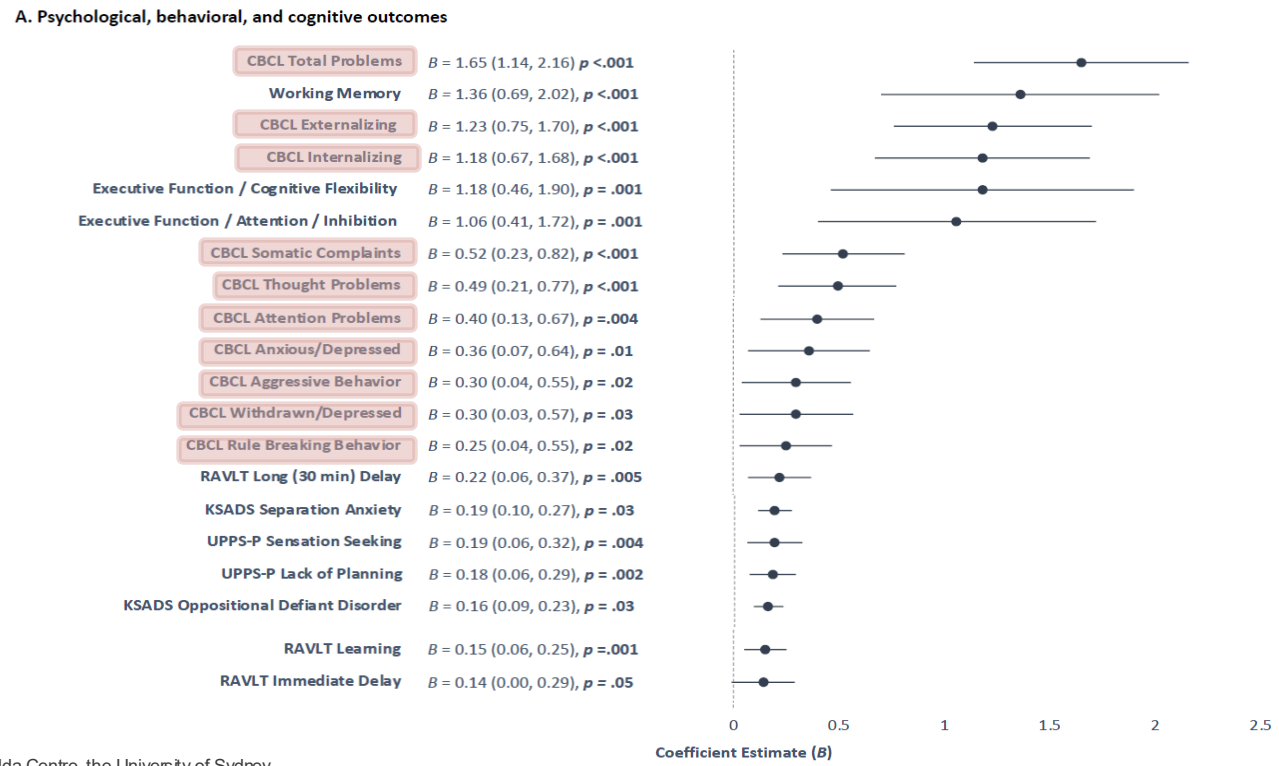
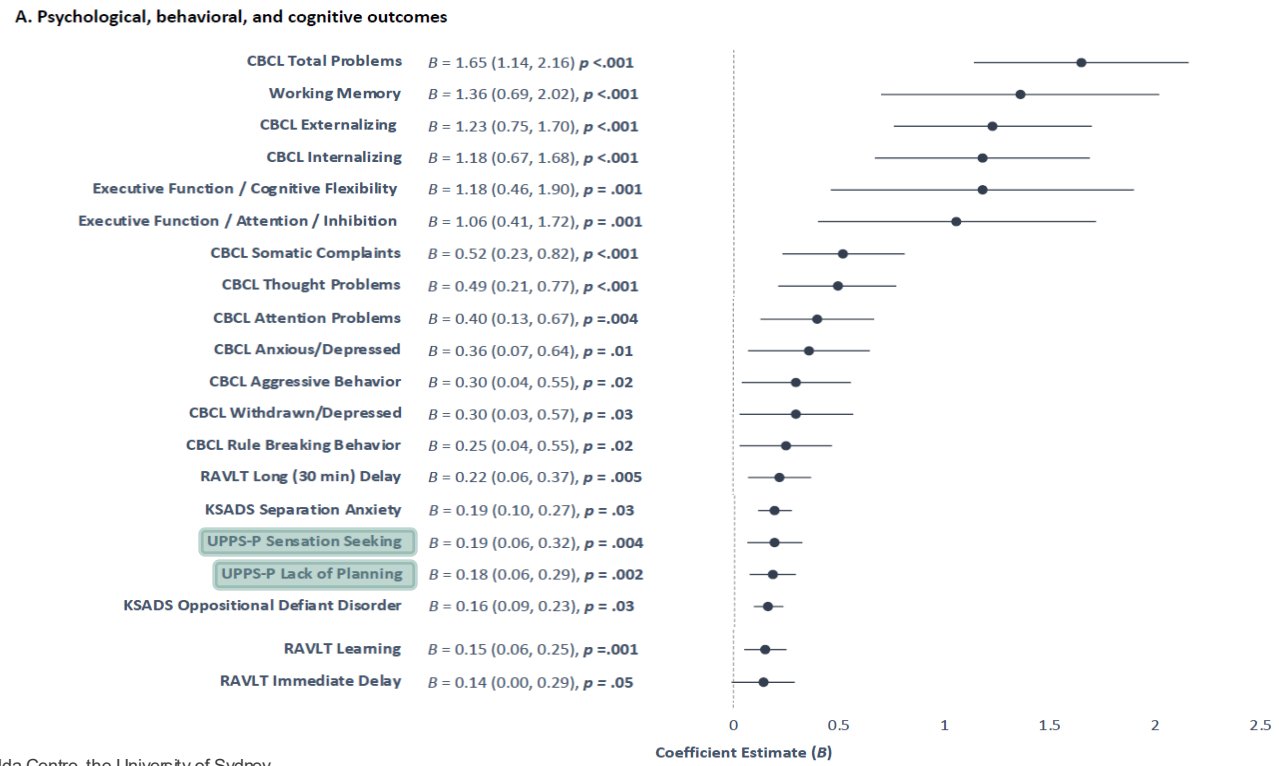

Cerebral Vol
B = 8005.3 (3654.7, 12356.0), p <.001
0
1000
3000
5000
7000
9000
11000
13000
Coefficient Estimate (B)
Left Lateral Occipital SA
B = 53.6 (24.8, 82.5), p = .02
Left Inferior Temporal SA
B = 51.5 (27.8, 75.2), p = .001
Right Precuneus SA
B = 48.6 (22.3, 74.9), p = .02
Left Lateral Occipital Vol
B = 155.2 (69.8, 240.5), p = .02
Right Middle Temporal Vol
B = 162.6 (78.3, 246.9), p = .01
Left Middle Temporal Vol
B = 154.1 (71.5, 236.7), p = .02
Left Inferior Temporal Vol
B = 214.5 (120.5, 308.6), p <.001
Right Supramarginal Vol
B = 167.2 (74.3, 260.0), p = .03
Left Inferior Parietal Vol
B = 206.5 (98.7, 314.3), p = .01
0
100
200
300
400
Coefficient Estimate (B)

ABCD & PAE


A. Psychological, behavioral, and cognitive outcomes
CBCL Total Problems
B = 1.65 (1.14, 2.16) p <.001
Working Memory
B = 1.36 (0.69, 2.02), p <.001
CBCL Externalizing
B = 1.23 (0.75, 1.70), p <.001
CBCL Internalizing
B = 1.18 (0.67, 1.68), p <.001
Executive Function / Cognitive Flexibility
B = 1.18 (0.46, 1.90), p = .001
Executive Function / Attention / Inhibition
B = 1.06 (0.41, 1.72), p = .001
CBCL Somatic Complaints
B = 0.52 (0.23, 0.82), p <.001
CBCL Thought Problems
B = 0.49 (0.21, 0.77), p <.001
CBCL Attention Problems
B = 0.40 (0.13, 0.67), p =.004
CBCL Anxious/Depressed
B = 0.36 (0.07, 0.64), p = .01
CBCL Aggressive Behavior
B = 0.30 (0.04, 0.55), p = .02
CBCL Withdrawn/Depressed
B = 0.30 (0.03, 0.57), p = .03
CBCL Rule Breaking Behavior
B = 0.25 (0.04, 0.55), p = .02
RAVLT Long (30 min) Delay
B = 0.22 (0.06, 0.37), p = .005
KSADS Separation Anxiety
B = 0.19 (0.10, 0.27), p = .03
UPPS-P Sensation Seeking
B = 0.19 (0.06, 0.32), p = .004
UPPS-P Lack of Planning
B = 0.18 (0.06, 0.29), p = .002
KSADS Oppositional Defiant Disorder
B = 0.16 (0.09, 0.23), p = .03
RAVLT Learning
B = 0.15 (0.06, 0.25), p =.001
RAVLT Immediate Delay
B = 0.14 (0.00, 0.29), p = .05
0
0.5
1
1.5
2
2.5
Coefficient Estimate (B)

ABCD & PAE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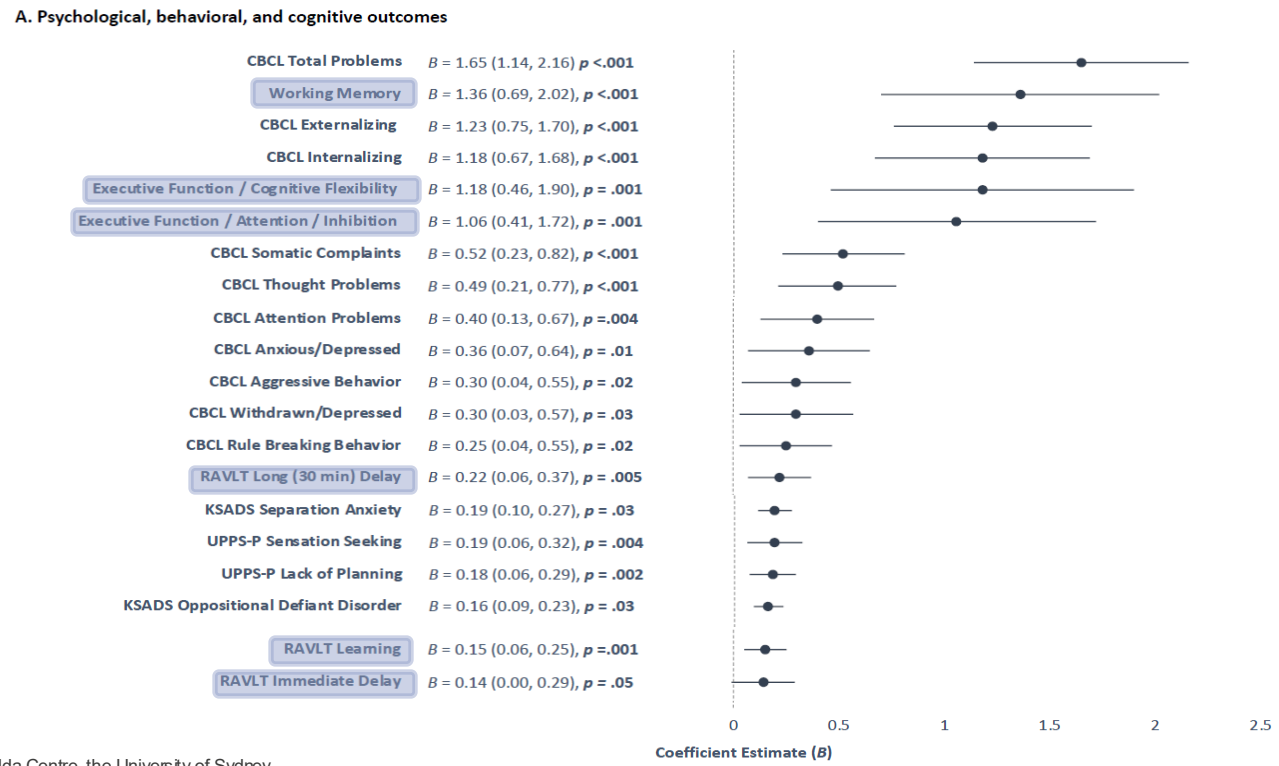
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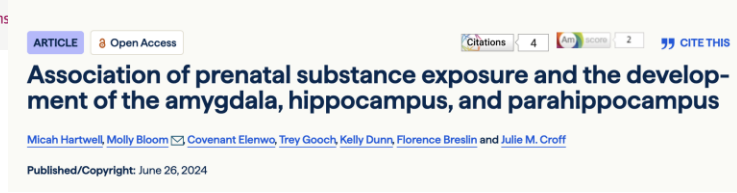
Original Investigation | Neurology

Prenatal Tobacco and Alcohol Exposure and Cortical Change Among Youths

Andrew T. Marshall, PhD[1,2]; Shana Adise, PhD[1,2]; Eric C. Kan, BS[1]; et al

Author Affiliations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Association of prenatal substance exposure and the development of the amygdala, hippocampus, and parahippocampus

Micah Hartwell, Molly Bloom, Covenant Elenwo, Trey Gooch, Kelly Dunn, Florence Breslin and Julie M. Croff

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Prenatal substance exposure and child health: Understanding the role of environmental factors, genetics, and brain development

Zixin Gu, Deanna M Barch, Qiang Luo Author Notes

PNAS Nexus, Volume 3, Issue 1, January 2024, pgae003,

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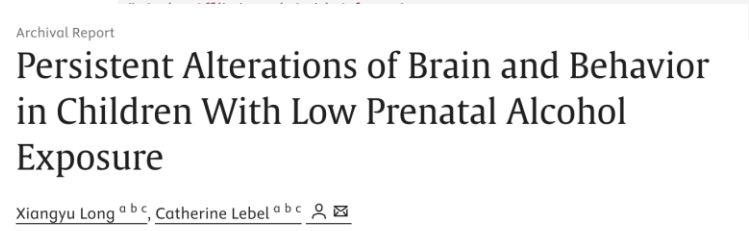
Evaluation of Brain Alterations and Behavior in Children With Low Levels of Prenatal Alcohol Exposure

Xiangyu Long, PhD[1,2,3]; Catherine Lebel, PhD[1,2,3]


Archival Report

Persistent Alterations of Brain and Behavior in Children With Low Prenatal Alcohol Exposure

Xiangyu Long [a b c], Catherine Lebel [a b c]

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Psychiatry
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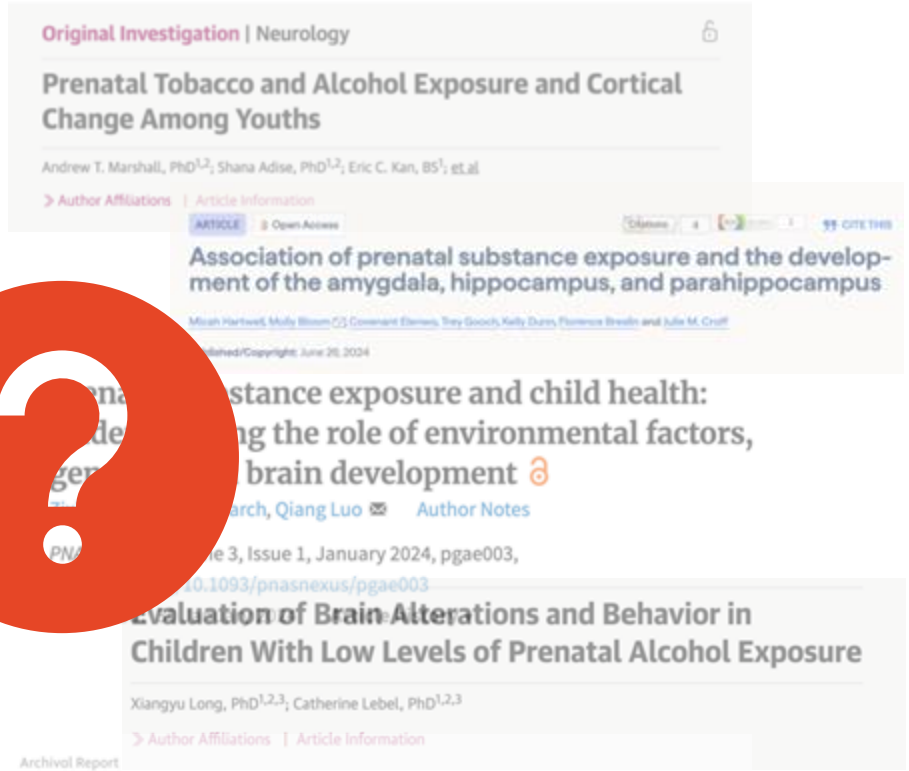
Original Investigation | Neurology
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RESEARCH QUESTIONS

Is any PAE associated with age-based trajectories of neurobiological, psychological, behavioural, and cognitive outcomes from age 9 through to age 17?

Is there evidence of a dose-response relationship between PAE and age-based trajectories in these outcomes?

Is the timing of prenatal alcohol exposure (e.g., early in pregnancy versus throughout pregnancy) differentially associated with age-based trajectories in these outcomes?

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METHODS

PARTICIPANTS

Adolescent Brain Cognitive Development Study

- Multisite (n=21) longitudinal study
- Biological and behavioural development of ~12,000 children through adolescence into early adulthood
- Incredibly well-characterised study
- 6.0 release
- PAE variables obtained at baseline (age 9-10 years)
- Outcomes obtained from all assessment waves for which they were available (age 9-17 years)

MEASURES

Any PAE
Total drinks
Patterns of PAE

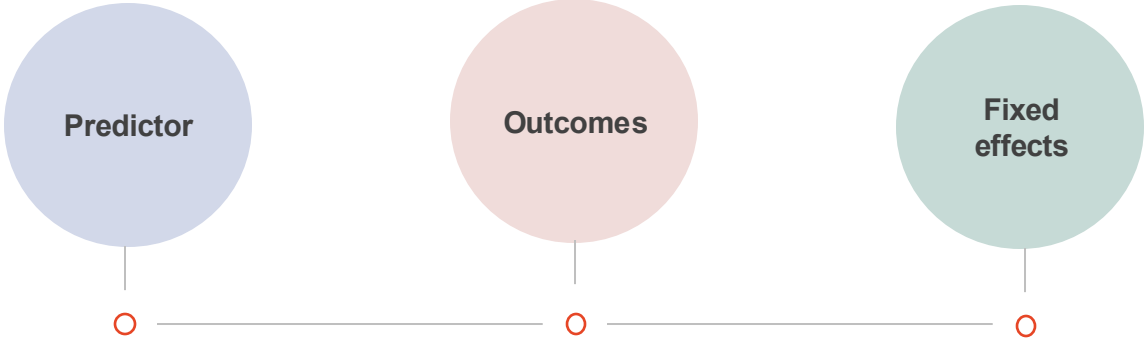
MEASURES

Any PAE
Total drinks
Patterns of PAE

Cortical volume (n=68)
Cortical thickness (n=68)
Cortical surface area (n=68)
Subcortical volume (n=14)
Psychopathology (n=14)
Impulsivity (n=5)
Motivation (n=4)
Cognition (n=7)

Total = 234

MEASURES



Any PAE
Total drinks
Patterns of PAE

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Psychopathology (n=14)
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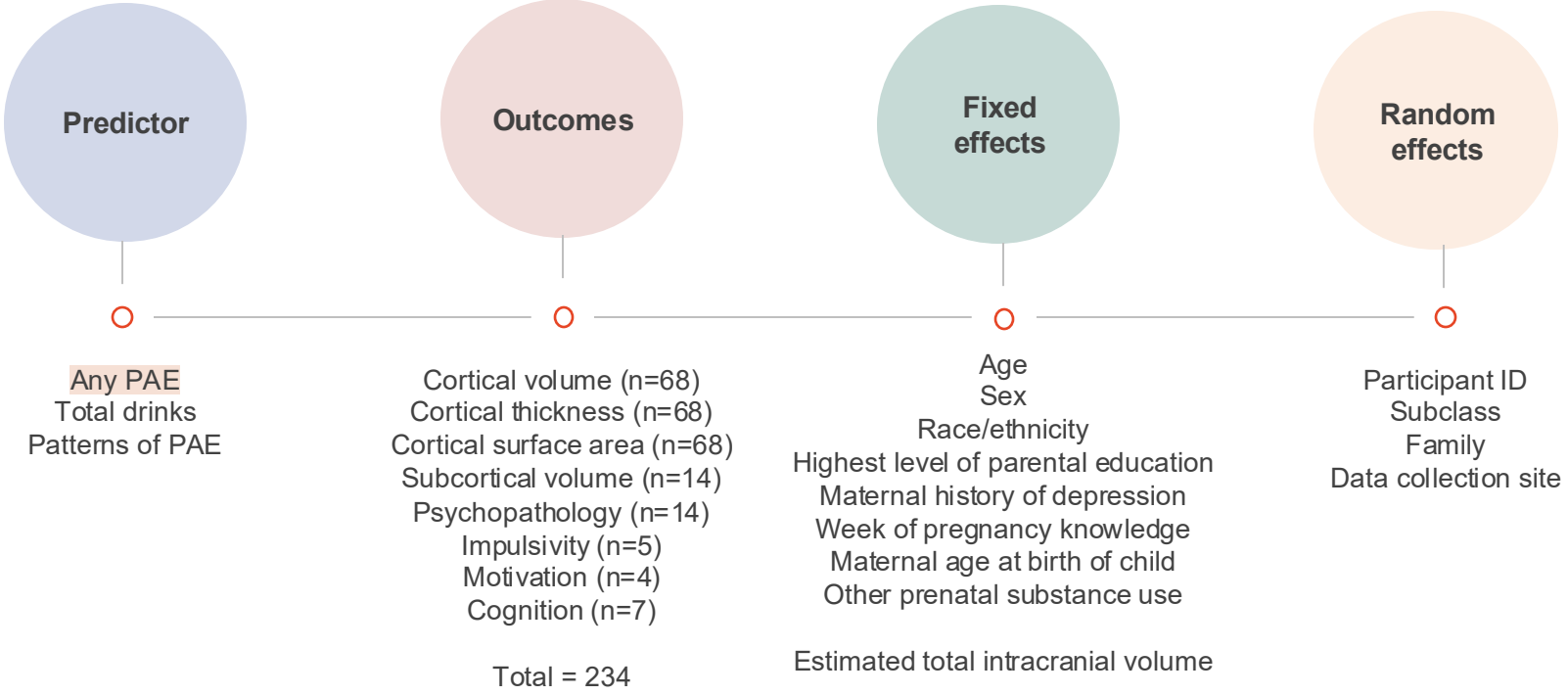
Cognition (n=7)

Total = 234

Age
Sex
Race/ethnicity
Highest level of parental education
Maternal history of depression
Week of pregnancy knowledge
Maternal age at birth of child
Other prenatal substance use

Estimated total intracranial volume

MEASURES


Predictor
Outcomes
Fixed effects
Random effects
Any PAE
Total drinks
Patterns of PAE
Cortical volume (n=68)
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Age
Sex
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Highest level of parental education
Maternal history of depression
Week of pregnancy knowledge
Maternal age at birth of child
Other prenatal substance use
Estimated total intracranial volume
Participant ID
Subclass
Family
Data collection site

ANALYSIS

1:1 Matched sample

Neuroimaging harmonisation

Generalised additive mixed models

FINDINGS

PARTICIPANTS

4,872 participants

9.93 years at baseline

49.6% female

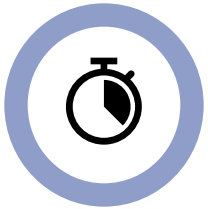
2,436 adolescents with PAE

2,436 adolescents without PAE

Average number of drinks consumed across pregnancy was 25.01

Range = 0 to 88

1-10 drinks = 661
11-20 drinks = 512
21-40 drinks = 502
41+ drinks = 419



Abstinent = 2,423

Light stable use = 1,273 (M=45.11 drinks)

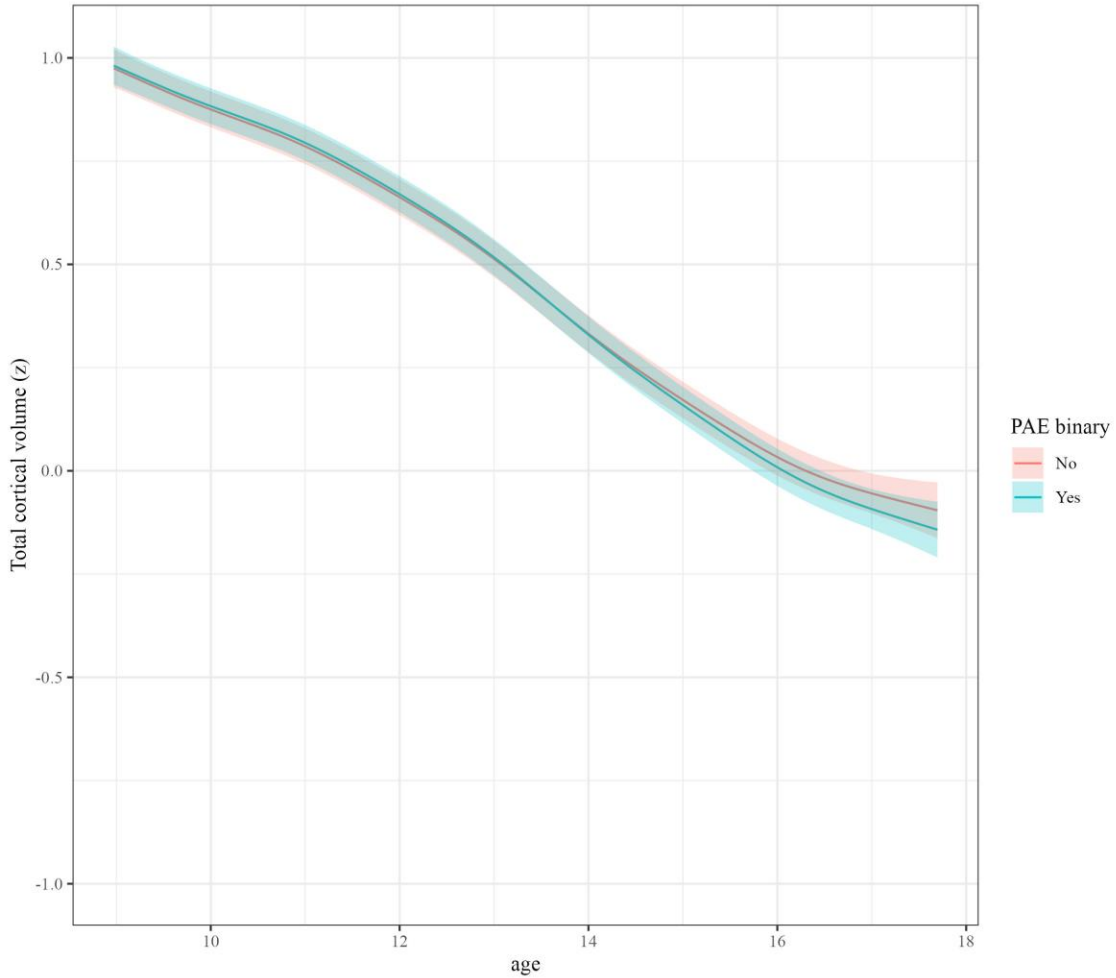
Light reducing use = 759 (M=15.70 drinks)

Heavy reducing use = 91 (M=37.13 drinks)

Any prenatal alcohol exposure

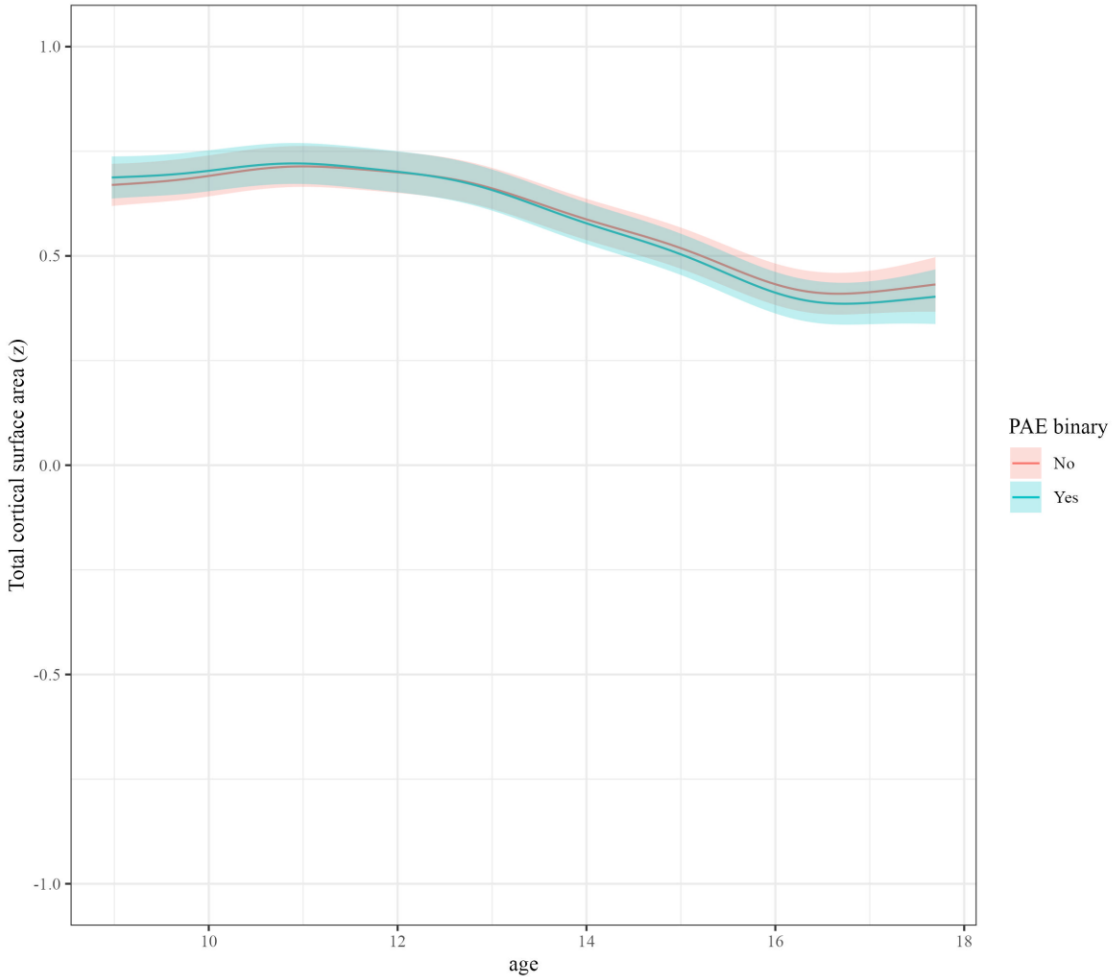
Any prenatal alcohol exposure

Total cortical volume



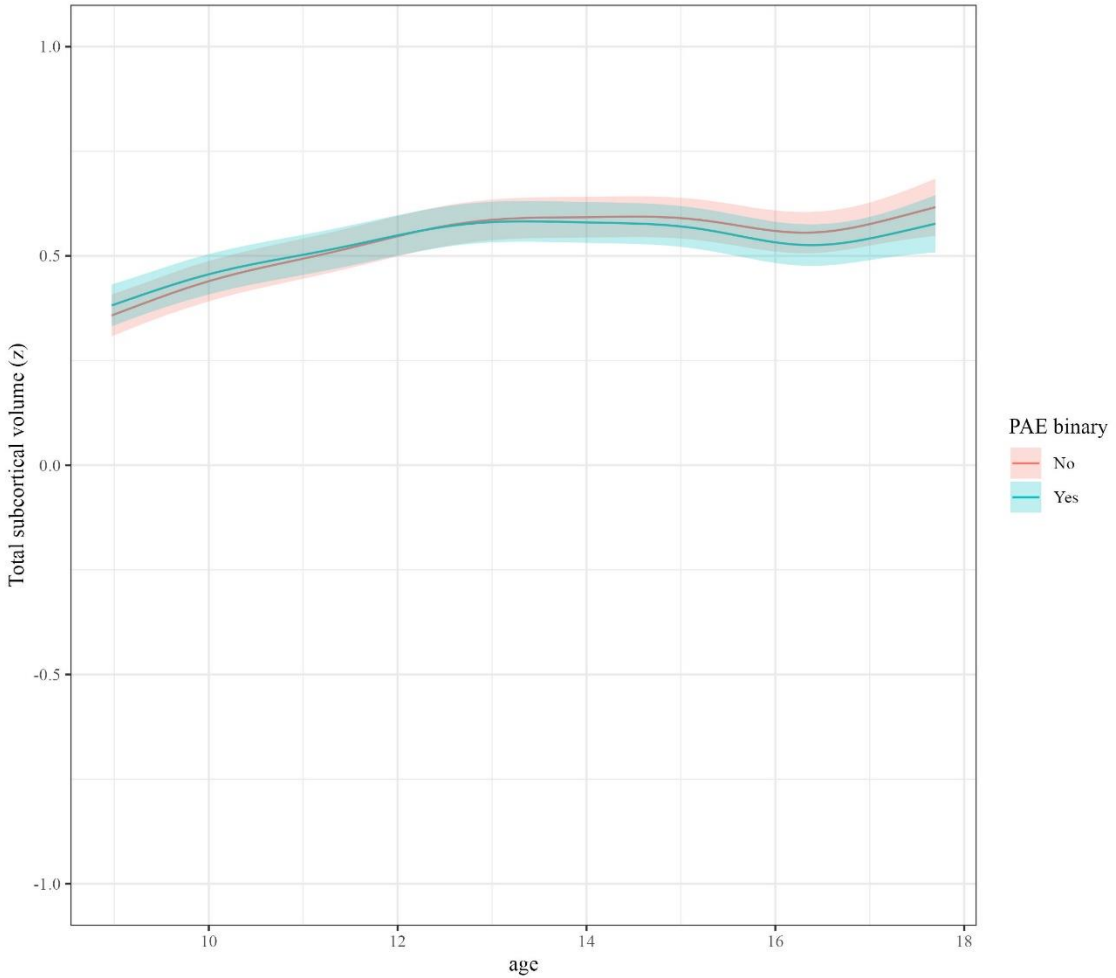
Any prenatal alcohol exposure

Total surface area



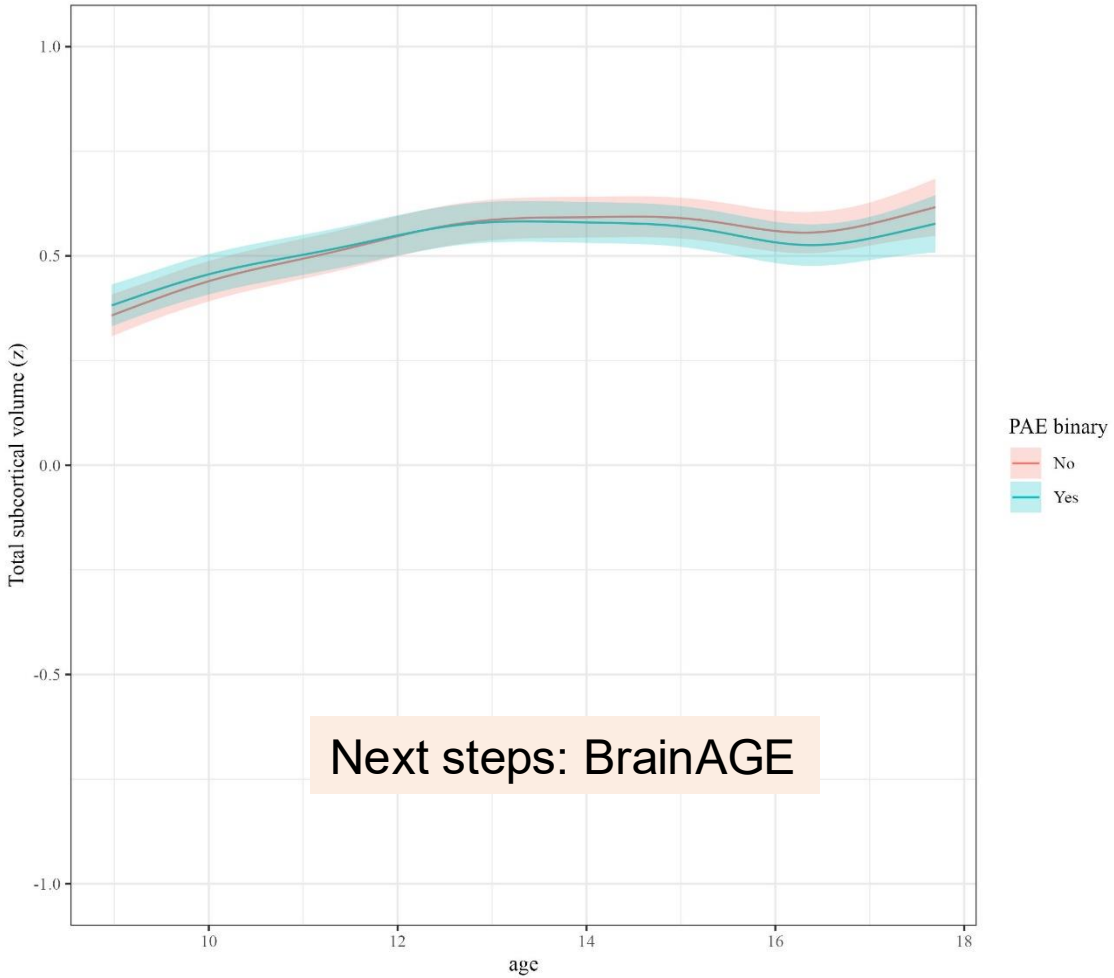
Any prenatal alcohol exposure

Total subcortical volume



Any prenatal alcohol exposure

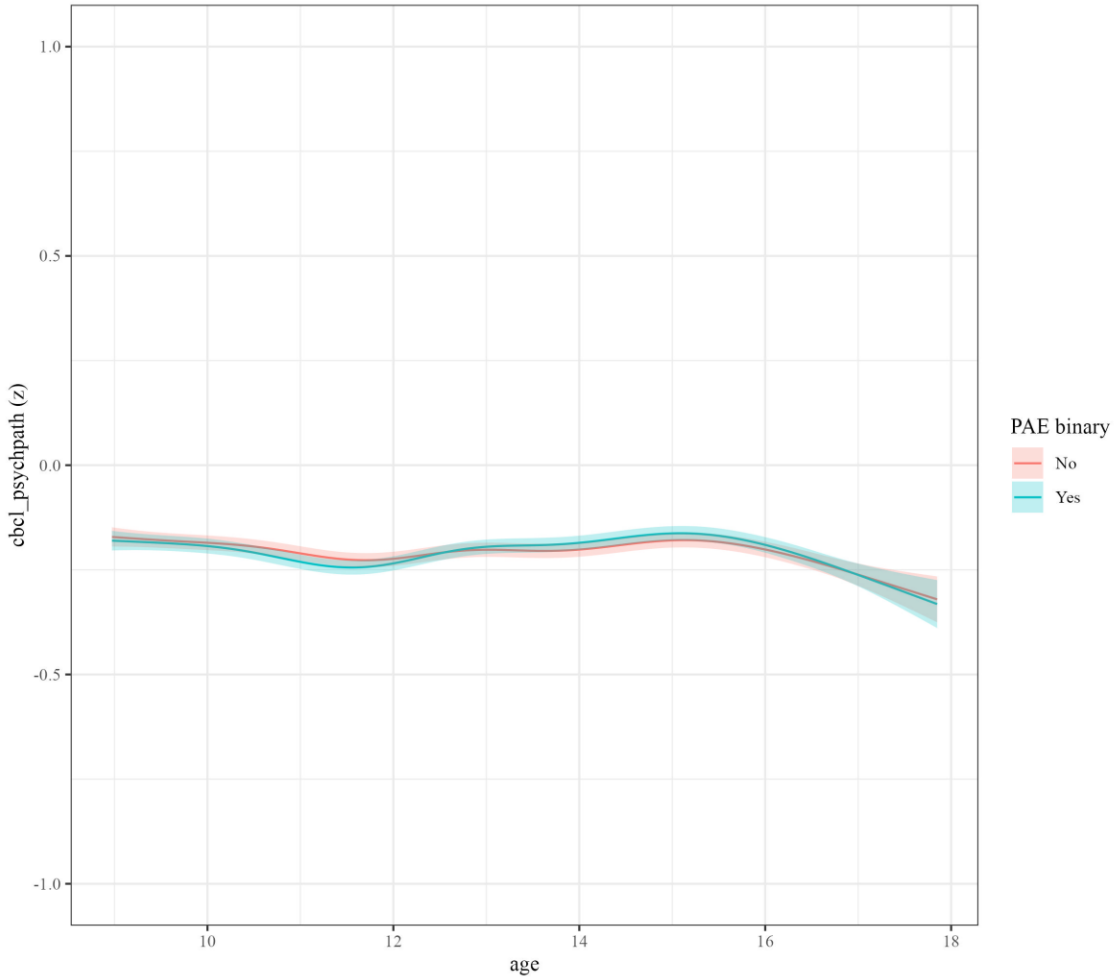
Total subcortical volume



Next steps: BrainAGE

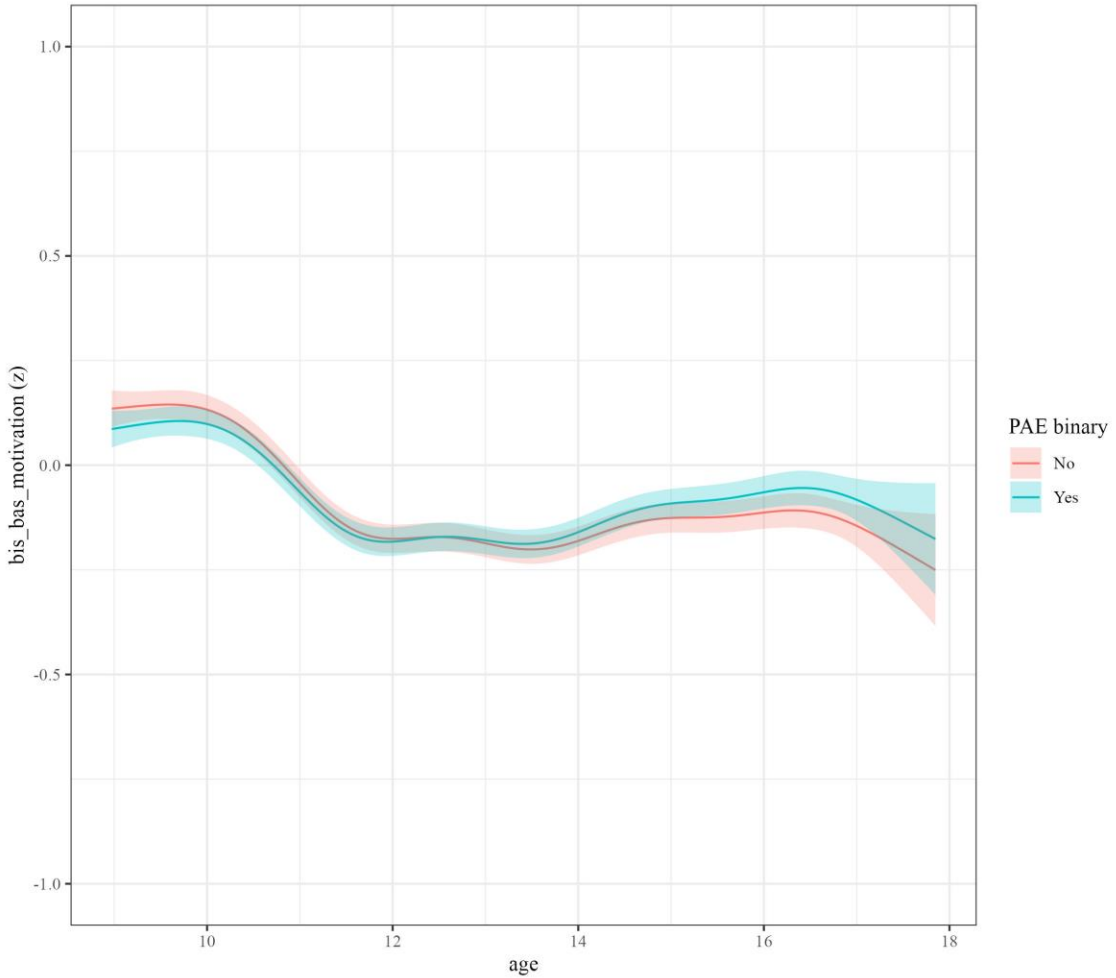
Any prenatal alcohol exposure

Psychopathology



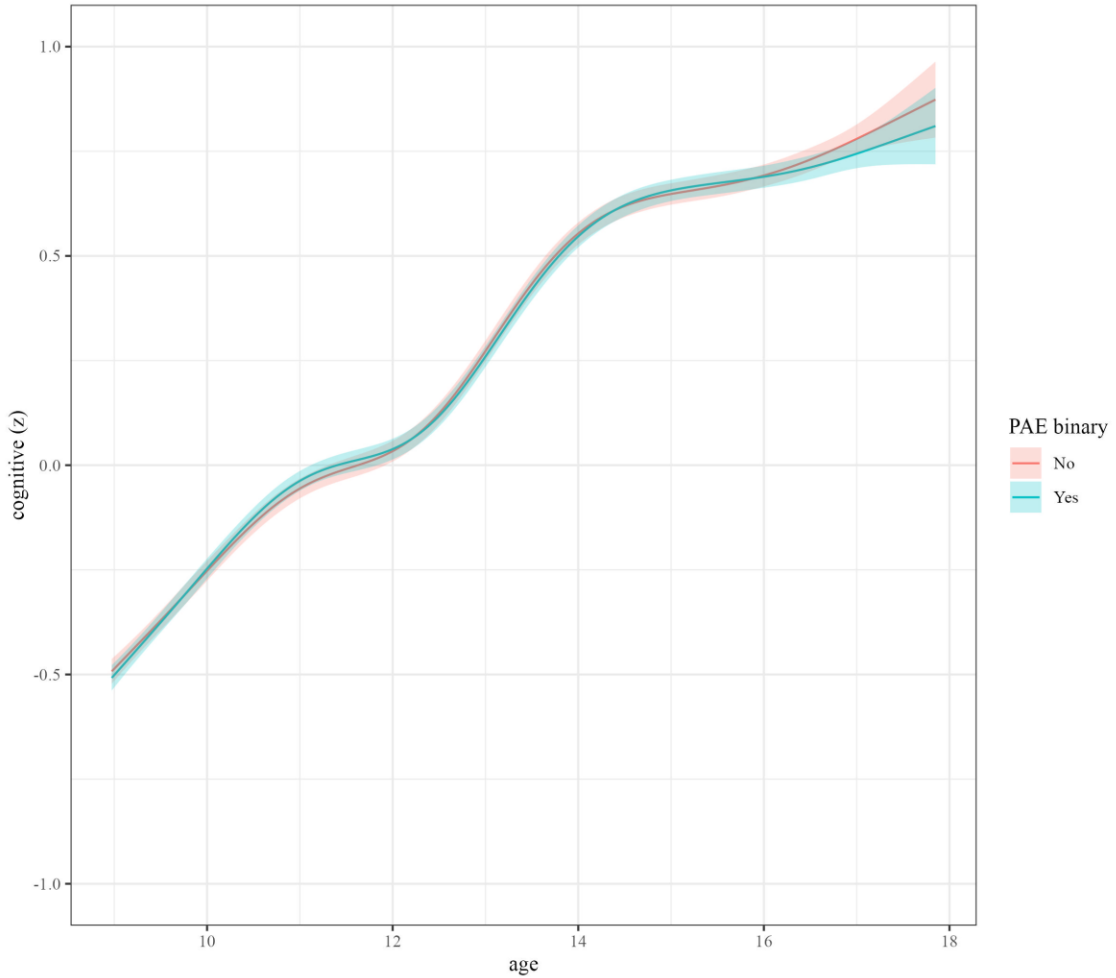
Any prenatal alcohol exposure

Motivation



Any prenatal alcohol exposure

Cognition



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KEY TAKEAWAYS

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Unique developmental trajectories amongst those with PAE, even at these low levels

Minimal evidence of dose-response effect at these low-levels

Minimal evidence for timing effect at these low-levels

CONSIDERATIONS

Strengths include:

- Large, representative, and well-characterized sample
- Ability to examine dose and timing of PAE
- Robust statistical analysis

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- Ability to examine dose and timing of PAE
- Robust statistical analysis

Limitations include:

- Recall bias associated with our prenatal alcohol exposure measure
- Reporting bias associated with our prenatal alcohol exposure measure

WHERE TO NEXT

Adolescent Brain Cognitive Development®
Teen Brains. Today's Science. Brighter Future.

Baby teeth collected as part of the ABCD Study

WHERE TO NEXT

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HBCD
HEALthy Brain and Child Development
Babies · Brains · Bright Futures

Follows mothers prospectively asking them to recall past week alcohol use

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Learning with FASD universal school-based prevention program

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James H. Conigrave
Rachel Visontay
Hollie Byrne
Julia Riches
ReJoyce Green
Katy Tobin
Maree Teesson
Nicola C. Newton
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