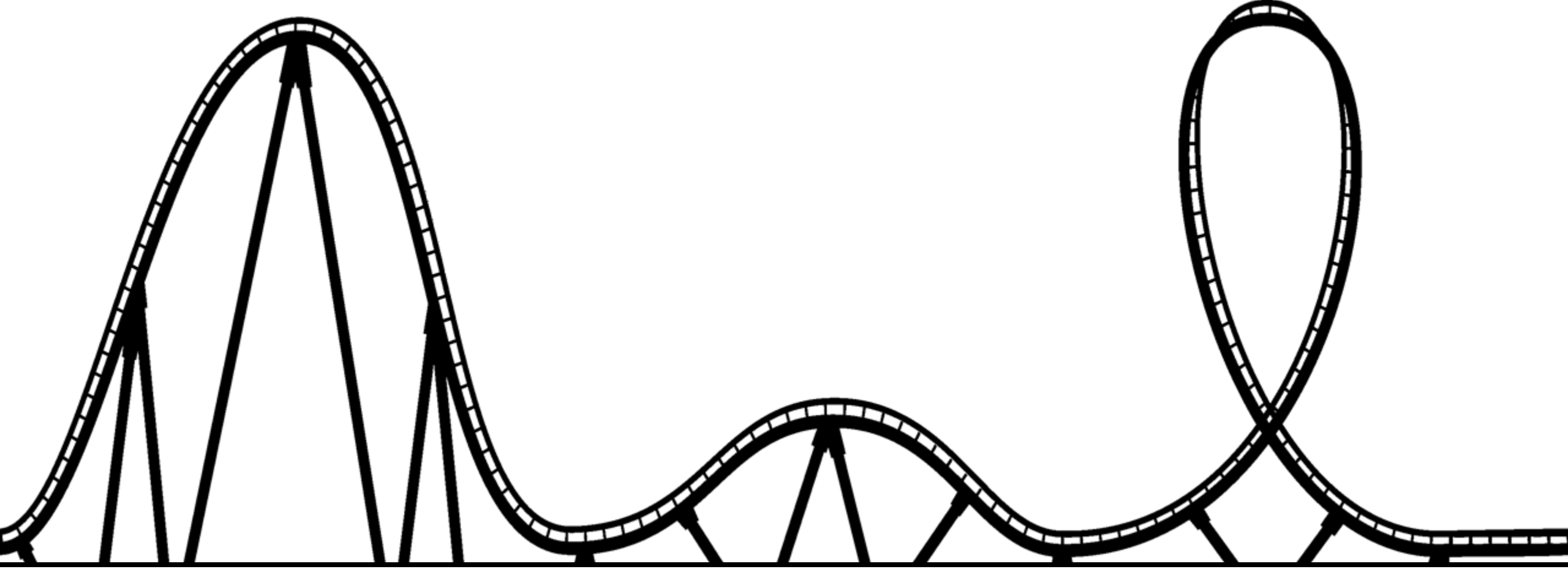
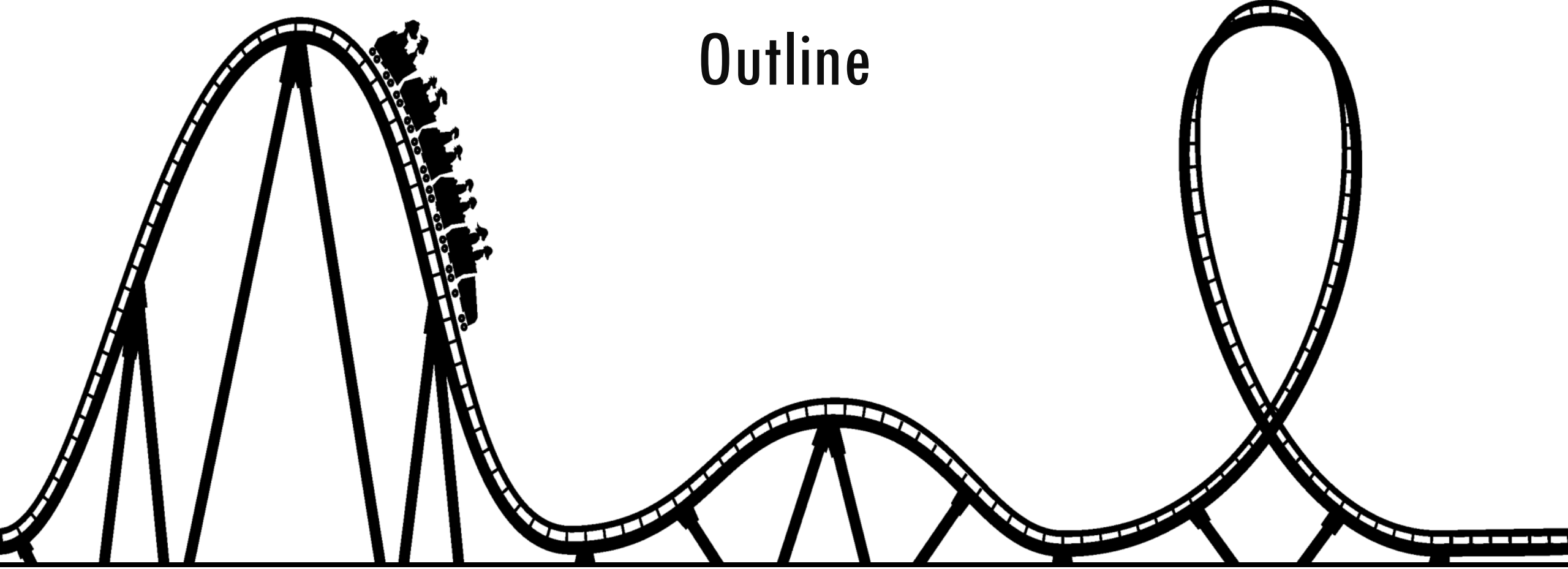


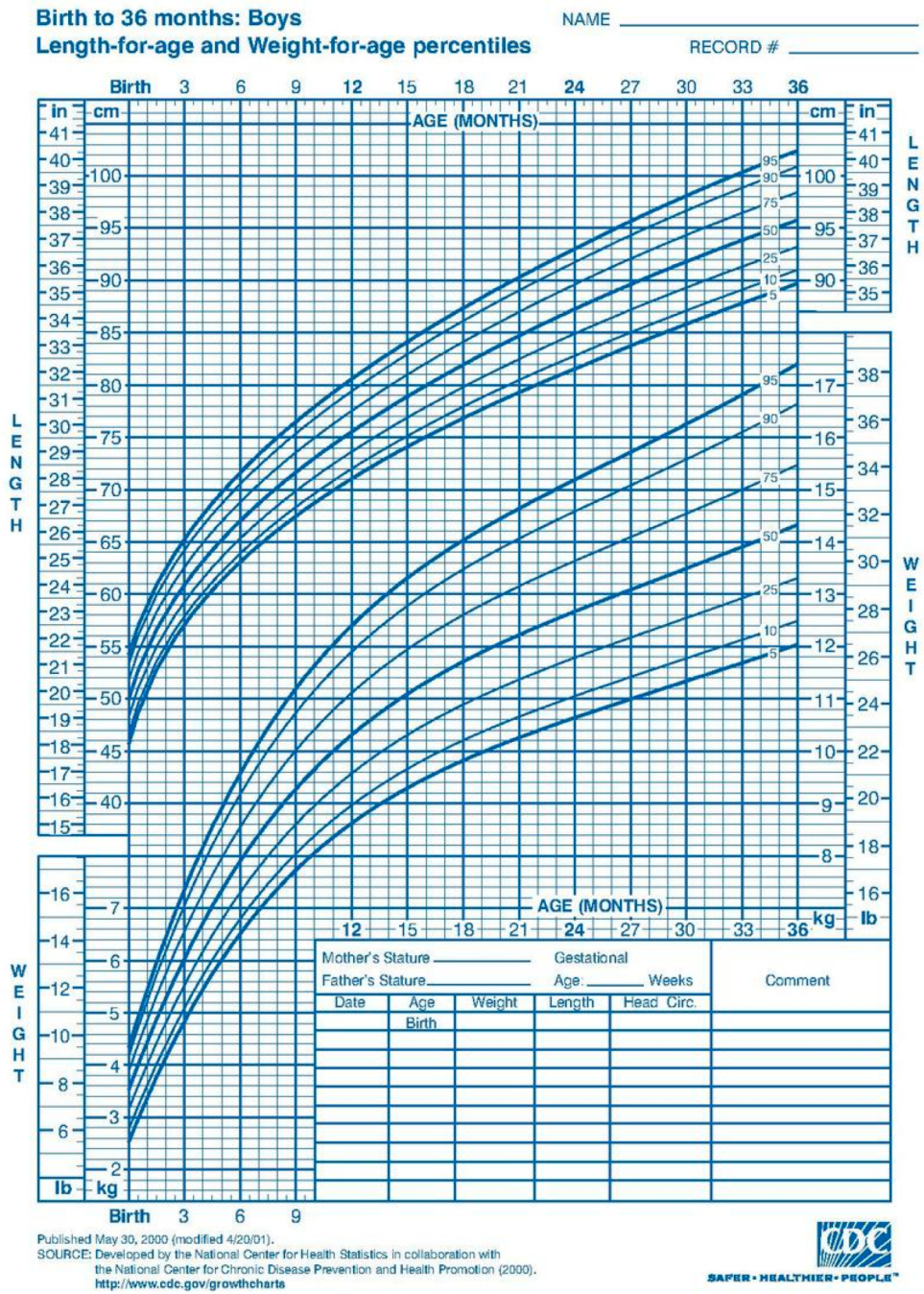
ADOLESCENT BRAIN DEVELOPMENT AND MENTAL HEALTH

Kate Mills, Jenn Pfeifer, and Nick Allen
Department of Psychology
University of Oregon

Outline

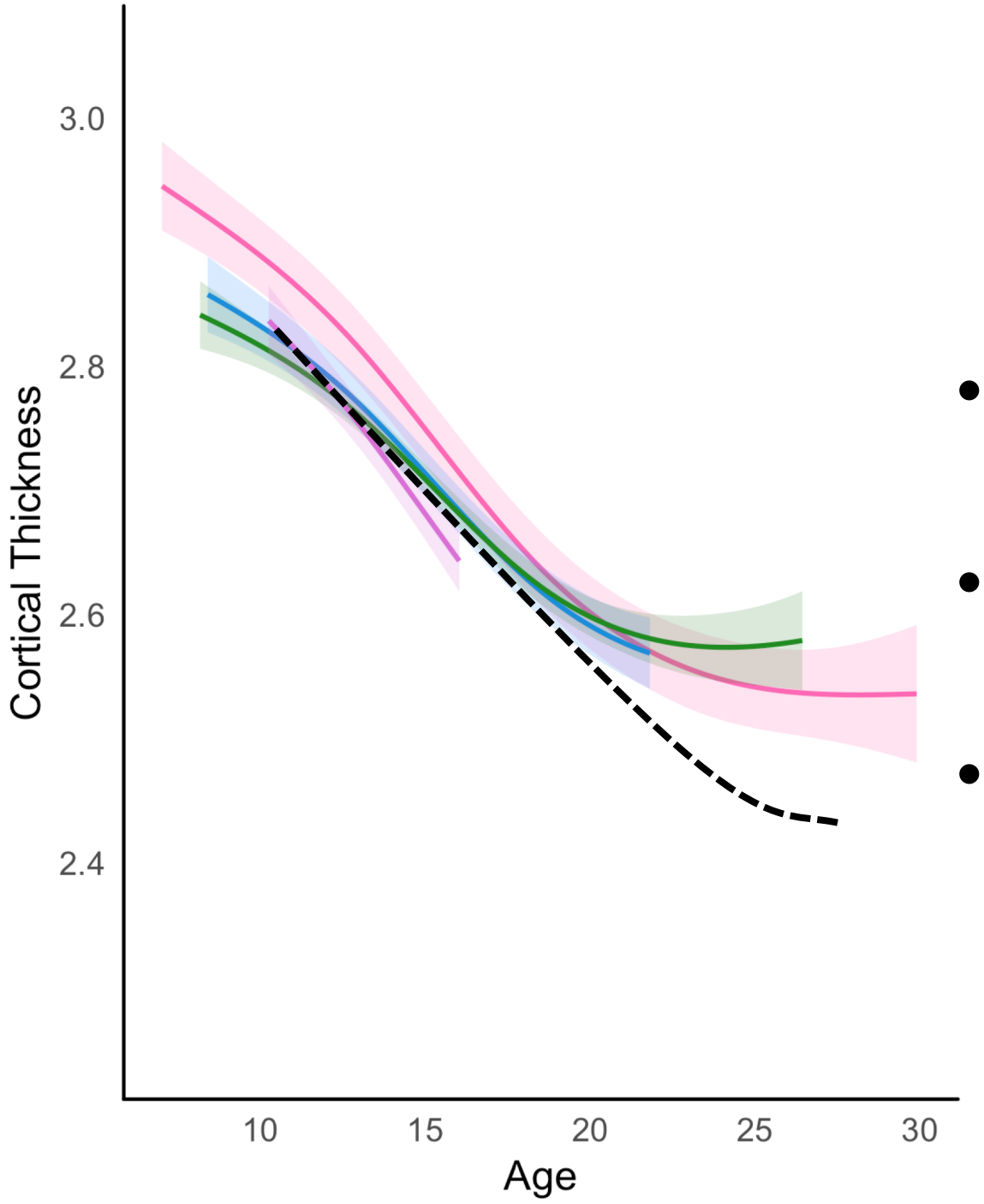


1. Structural brain development and individual differences
2. Task-based fMRI and puberty-related theories of mental health
3. Relating brain development patterns to mental health outcomes



Body Development

- Characterizing typical growth
- Identifying atypical growth
- Example: Failure to Thrive



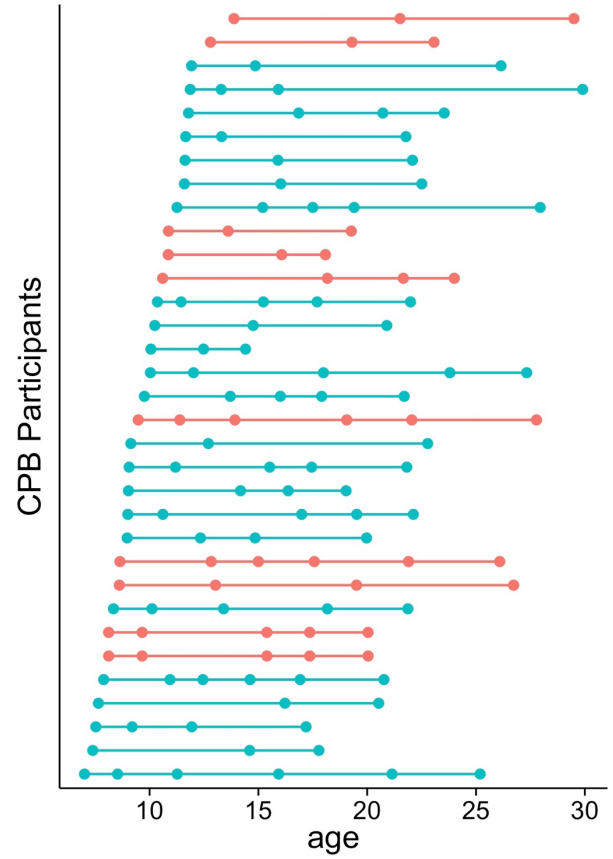
Brain Development

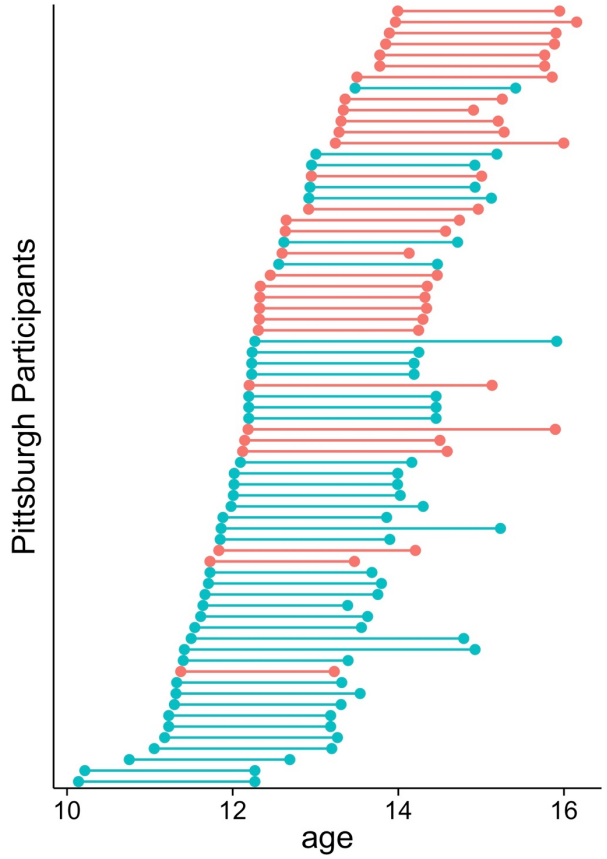
- Characterizing typical growth
- Identifying atypical growth
- Example: Schizophrenia

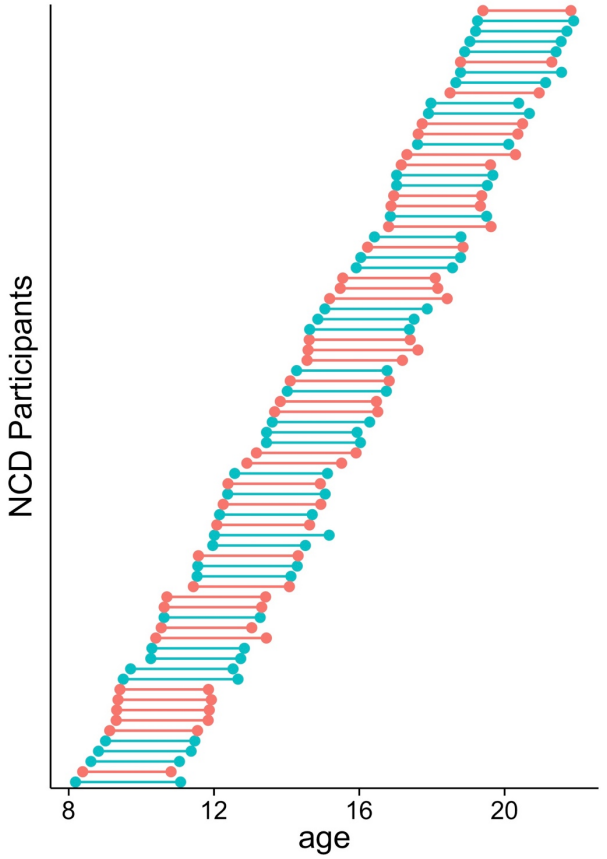
Tamnes et al., 2017
Data from Four Labs Collaboration

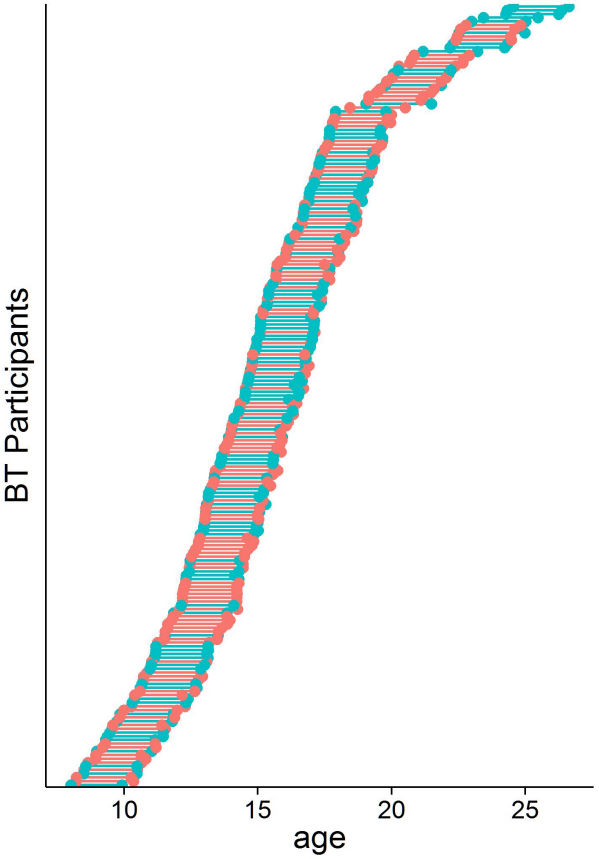
Establishing replicable patterns of typical brain development

Samples



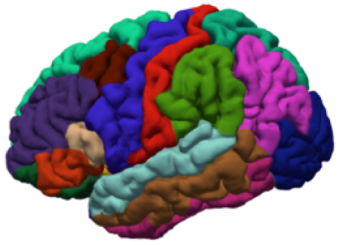




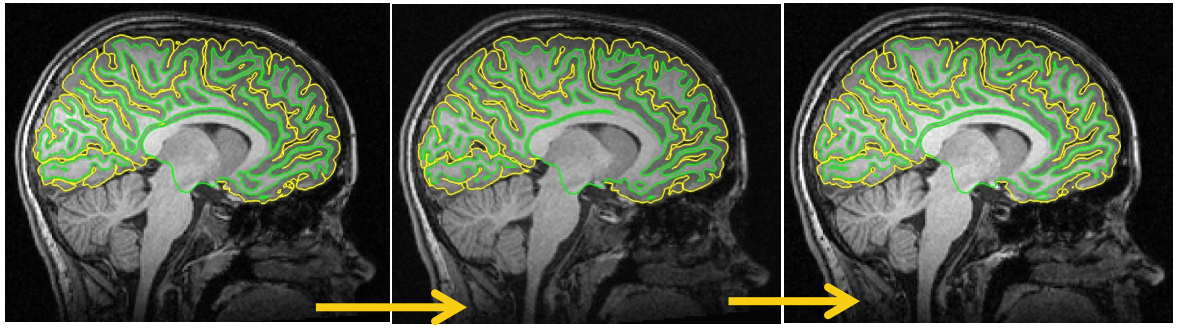


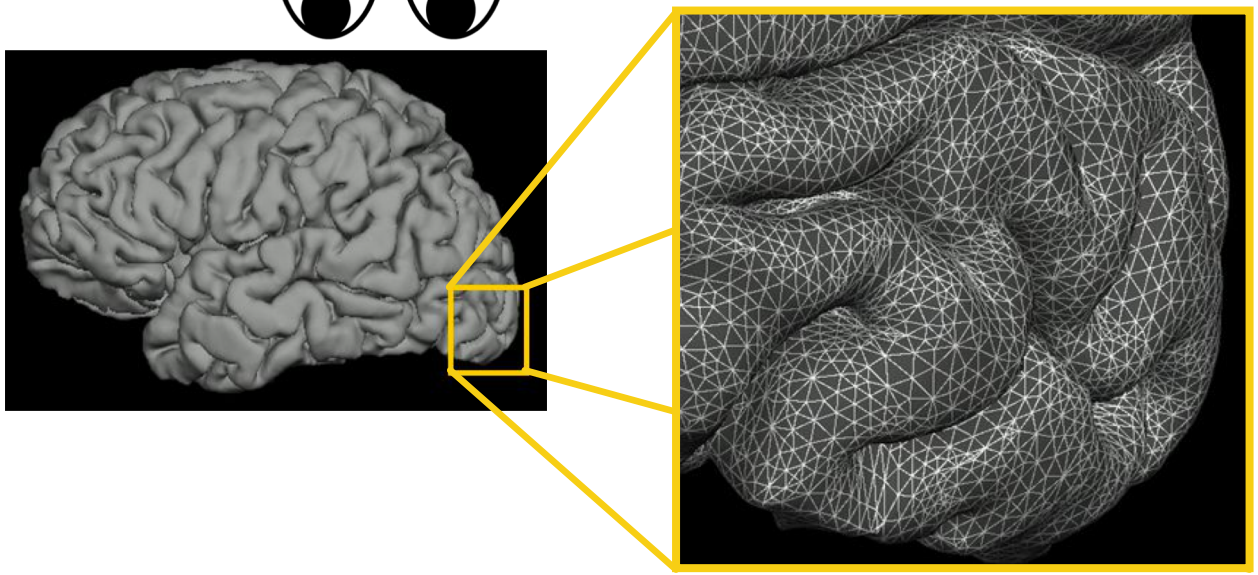
Establishing replicable patterns of typical brain development

Methods



FreeSurfer

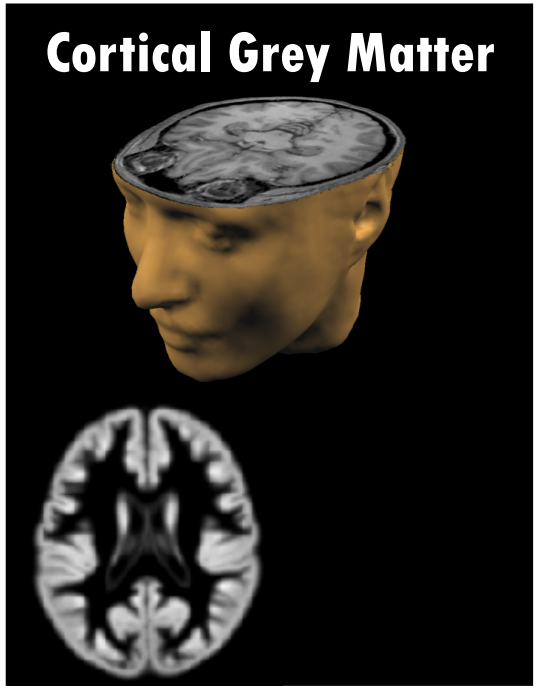




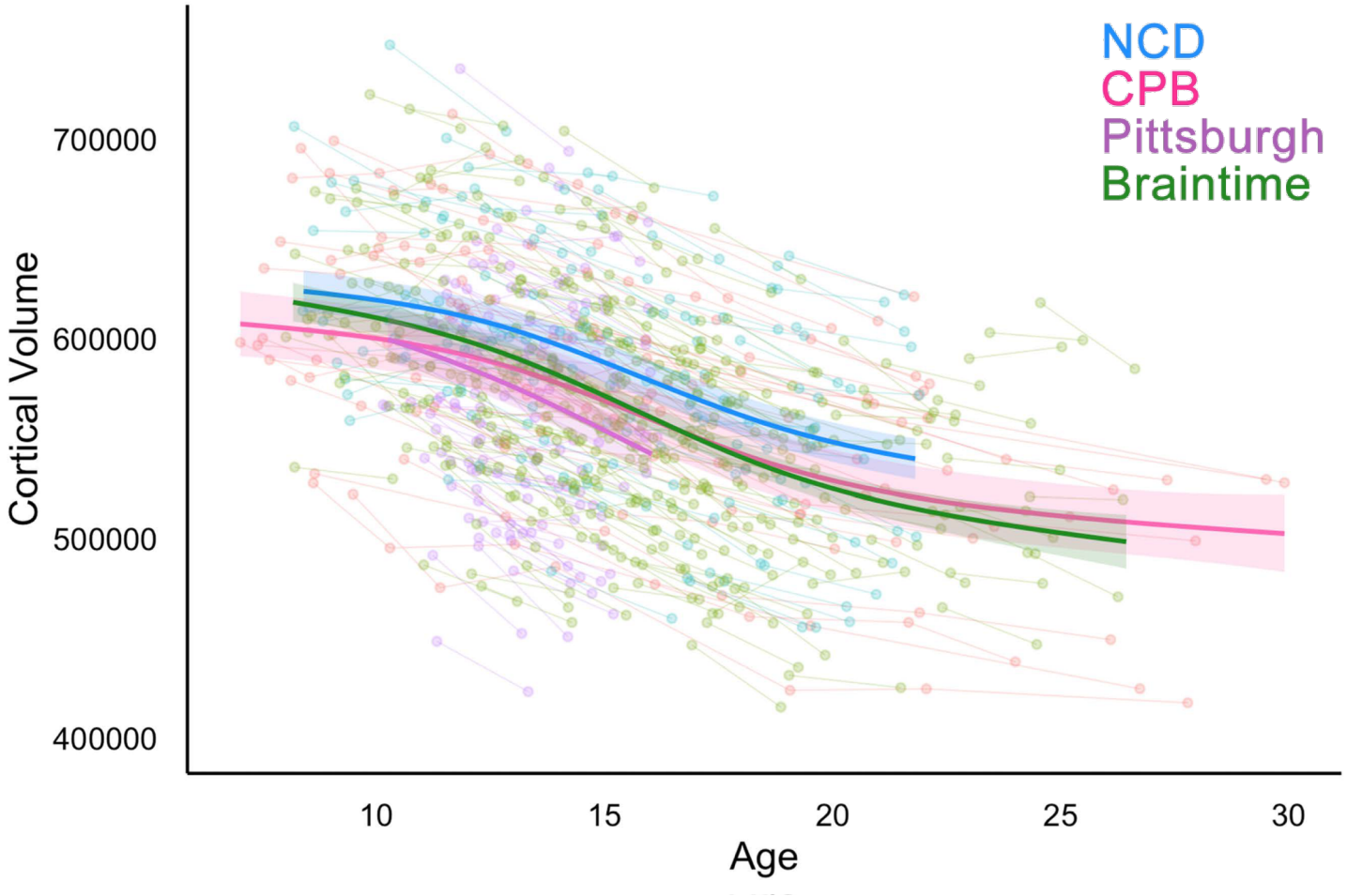
- Mixed-effects models in R
- Best fitting model selected by AIC
- Code available on Open Science Framework

http://surfer.nmr.mgh.harvard.edu/

Cortical Grey Matter Volume

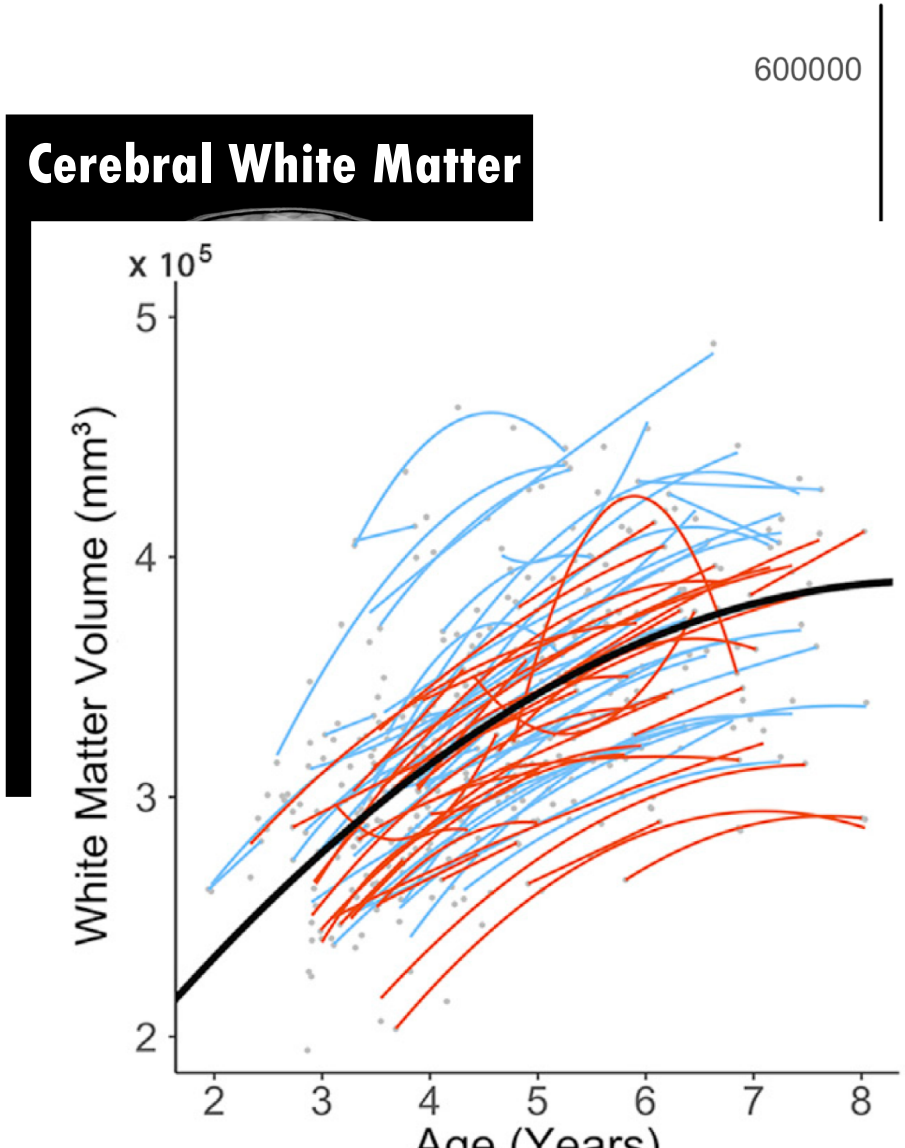


391 participants
852 scans
51% female

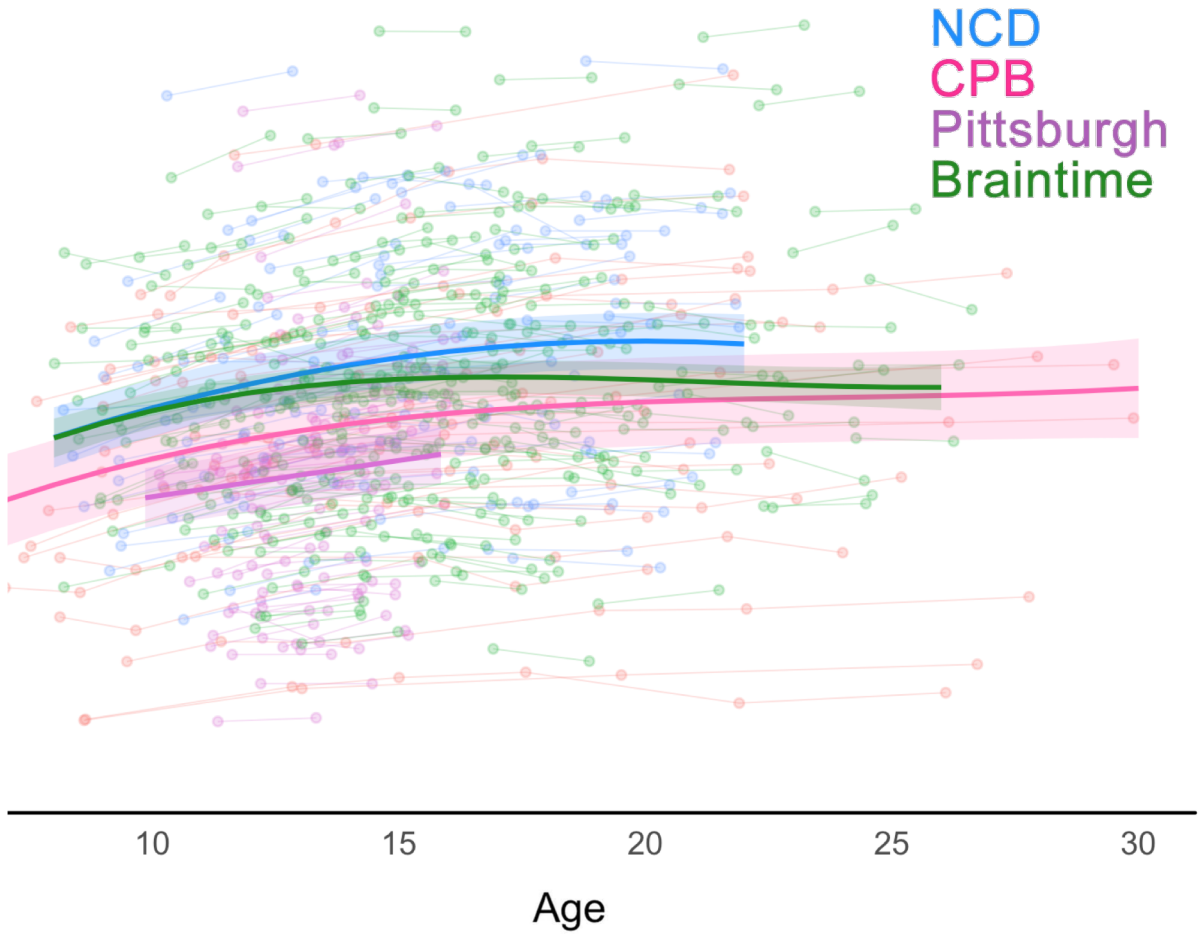


Mills et al., 2016; Tamnes et al., 2017

Cerebral White Matter Volume

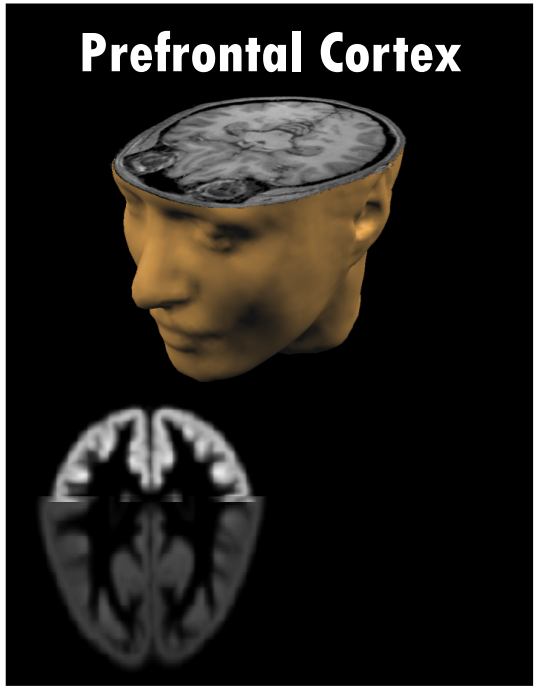


Reynolds et al., 2019



Mills et al., 2016; Tamnes et al., 2017

Statistical analysis: Raw vs. corrected measures



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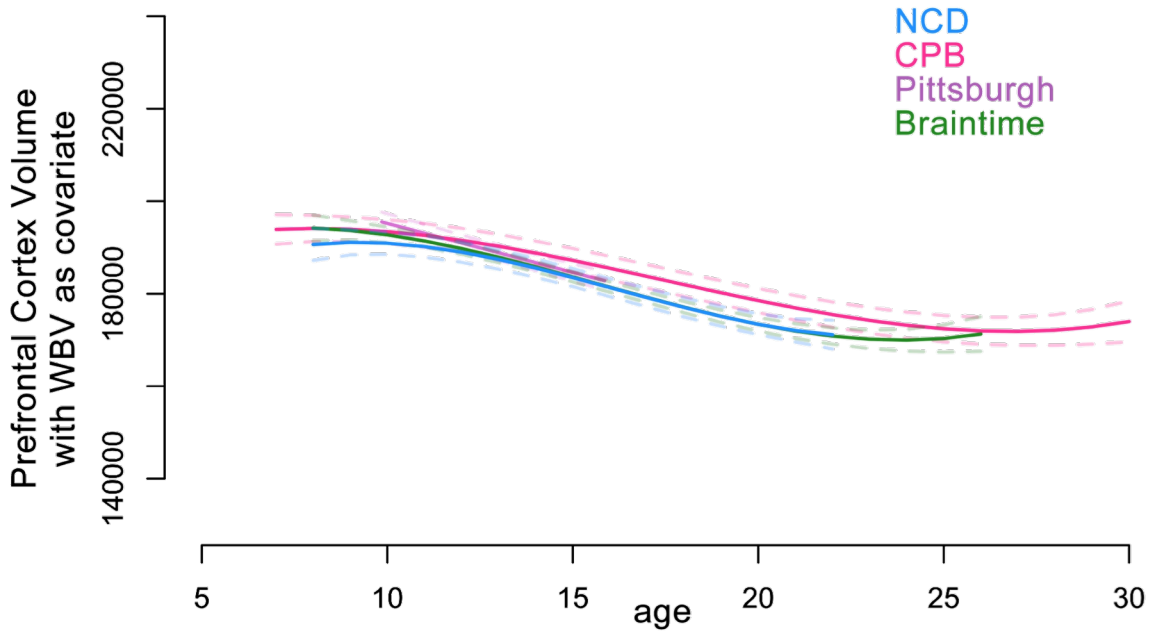
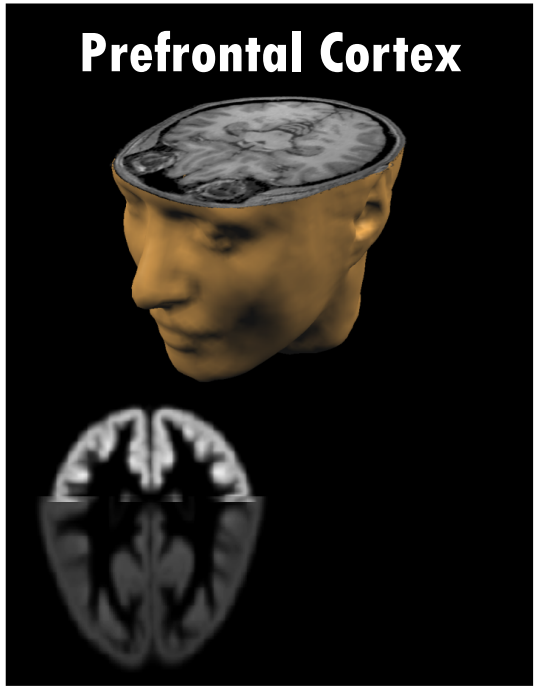


Mills et al., 2016

Statistical analysis: Raw vs. corrected measures



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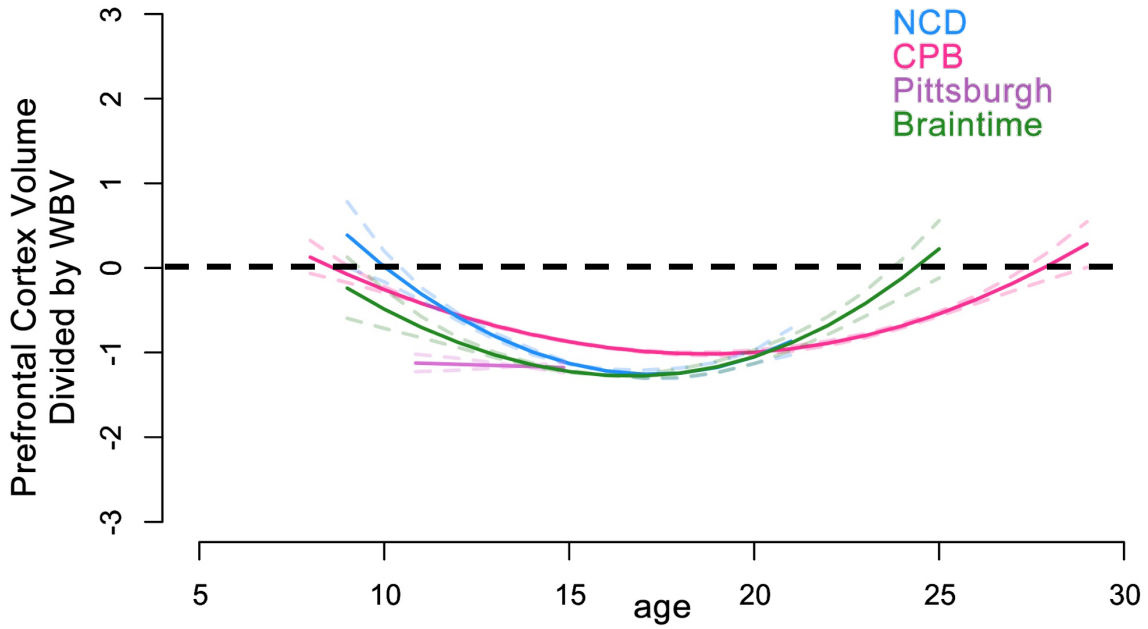
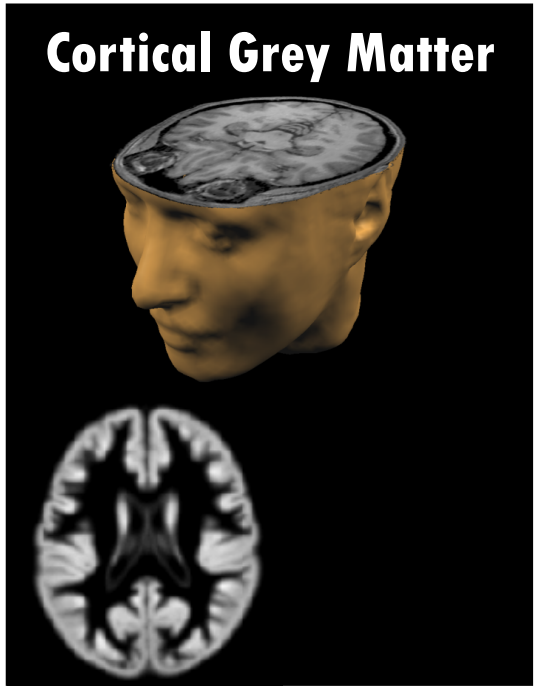


- Controlling for whole brain volume reduces magnitude of cortical volumetric development

Mills et al., 2016

Regional differences in cortical development



388 participants
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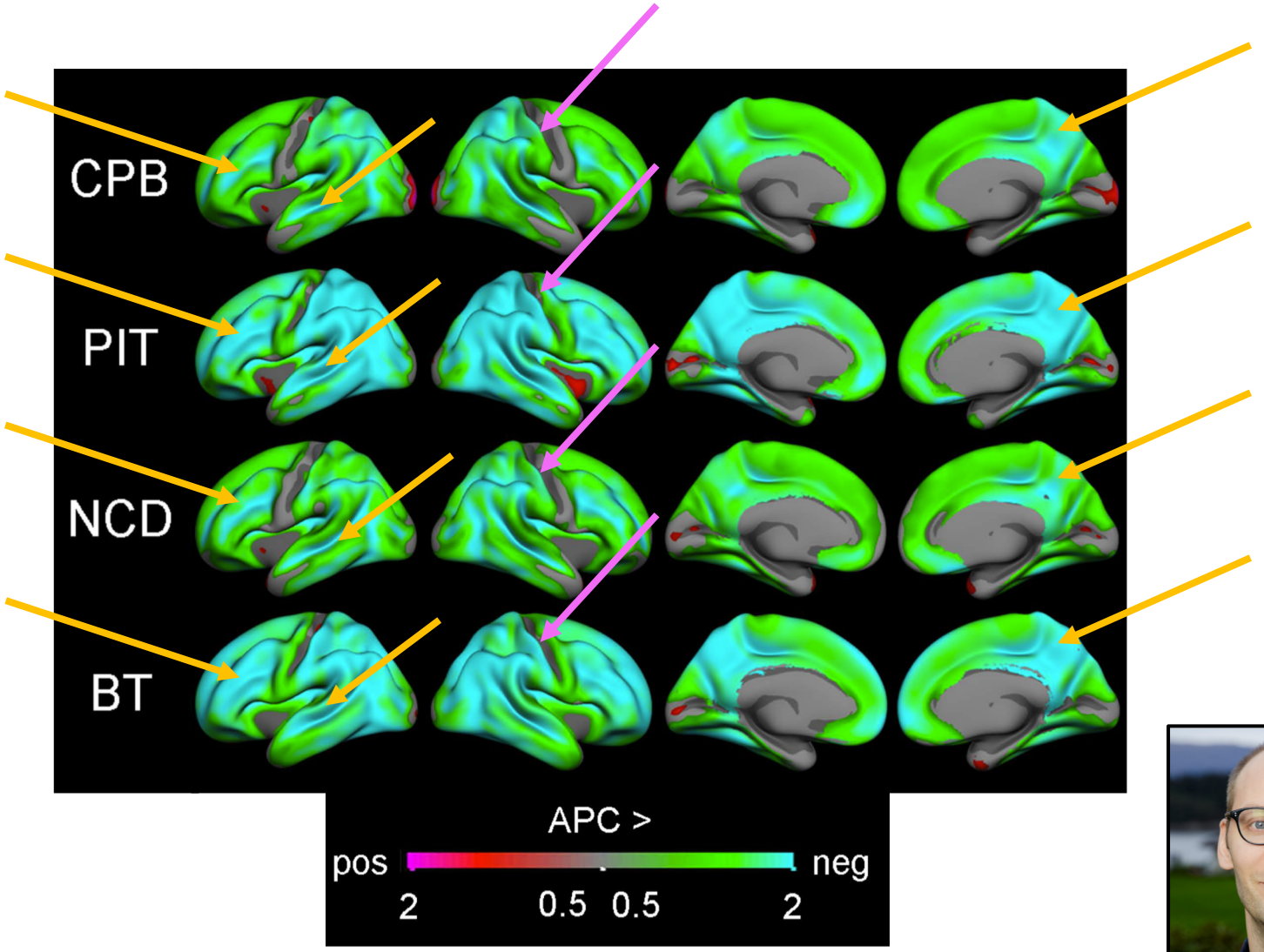
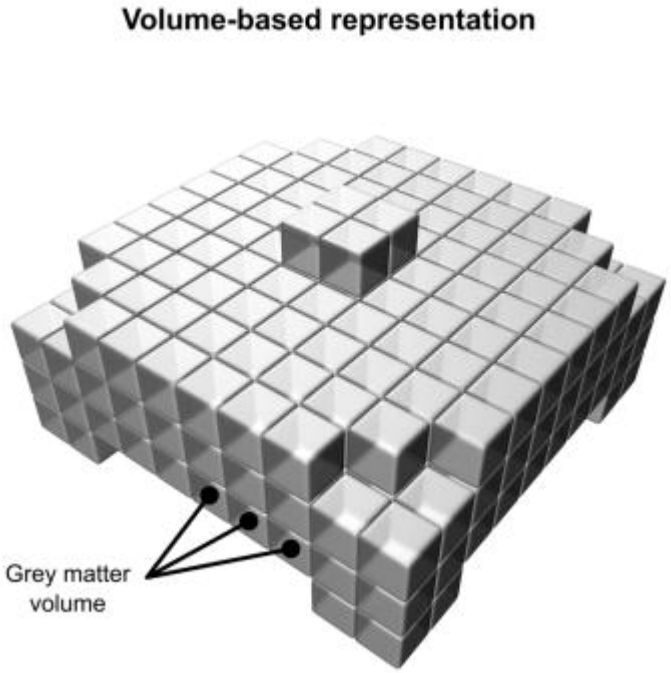
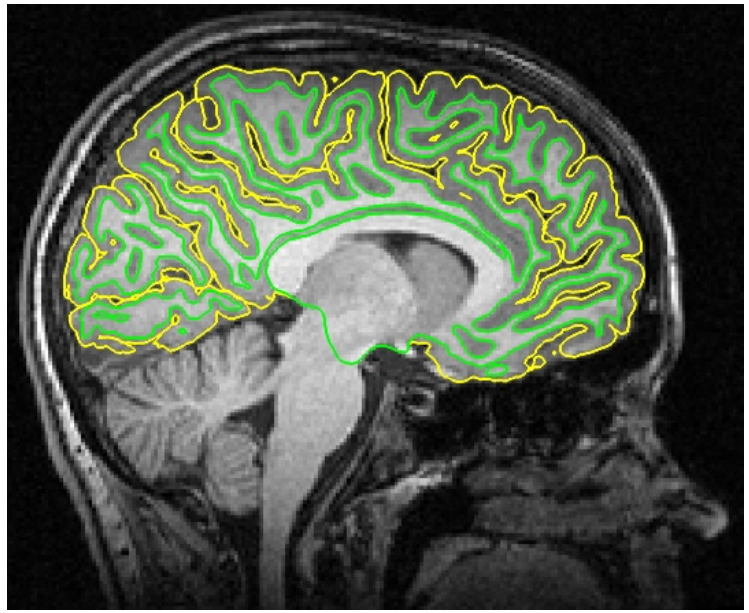
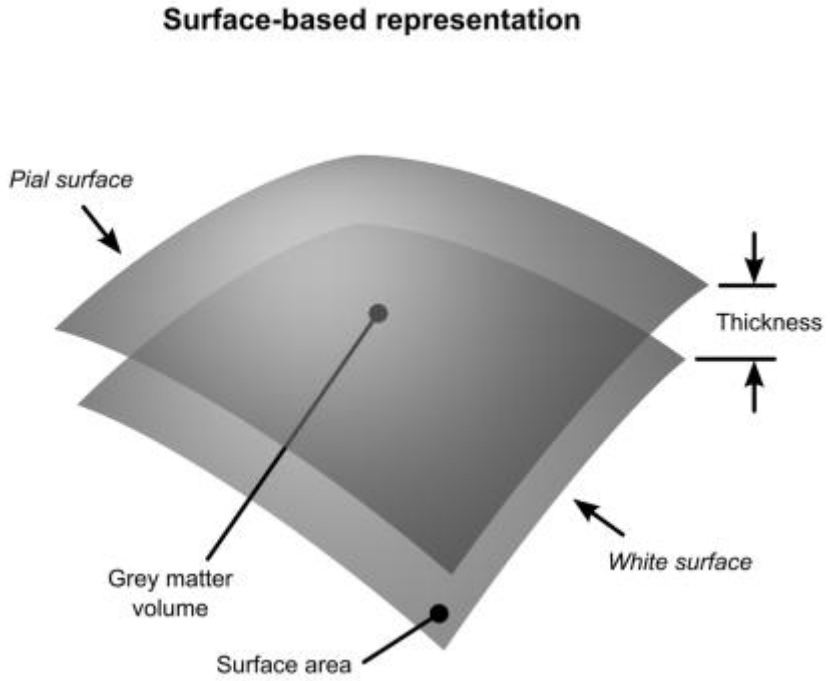


Tamnes et al., 2017

Grey matter volume is the product of cortical thickness and surface area

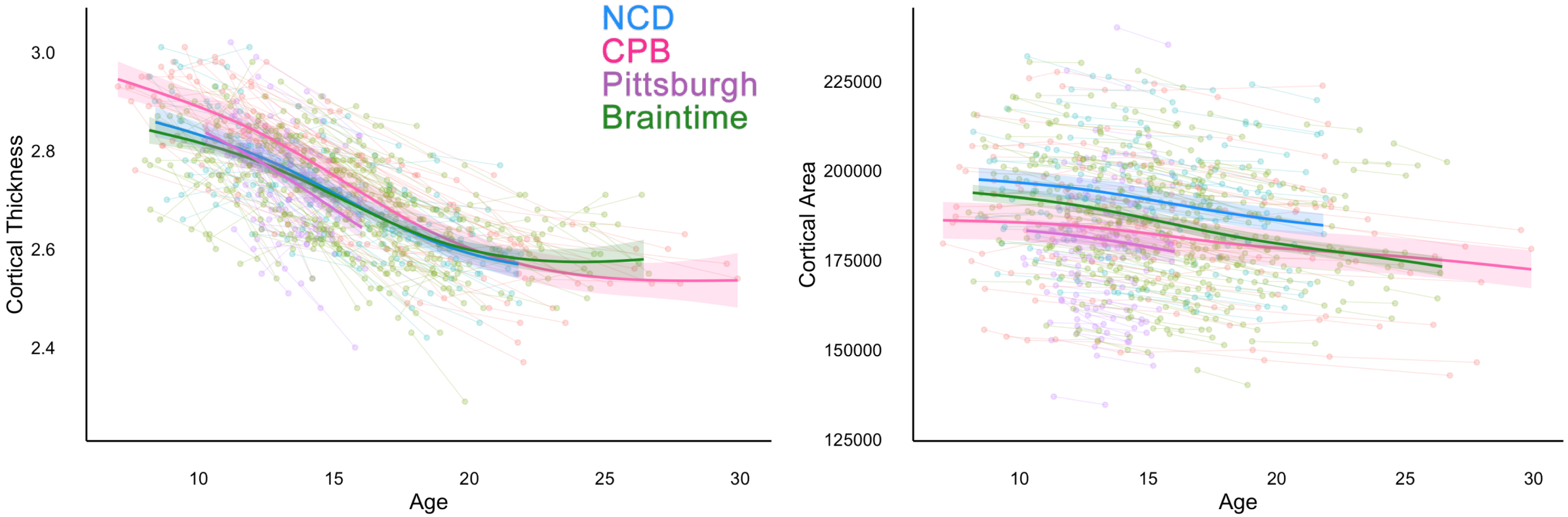






Winkler et al., 2010

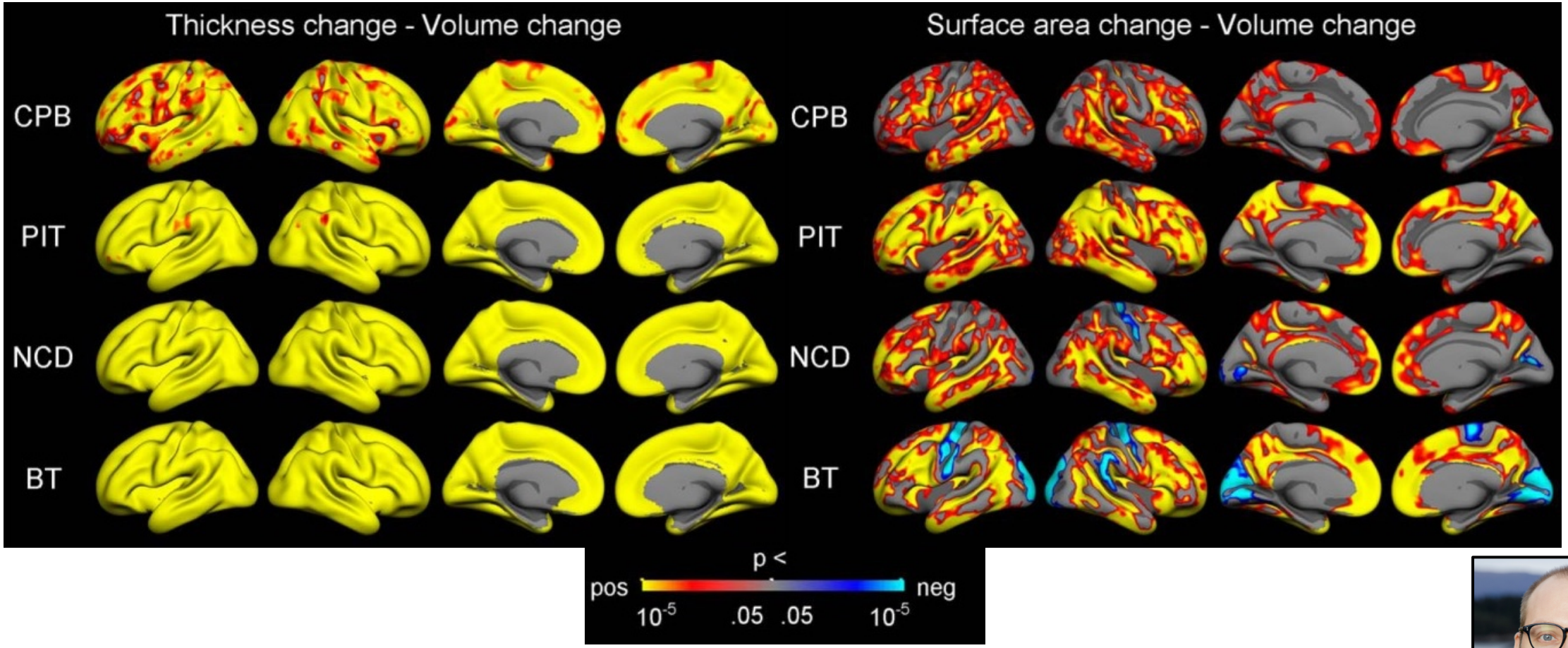
Cortical Thickness vs. Surface Area



- There is less inter-individual variability in cortical thickness than in surface area

Tamnes et al., 2017

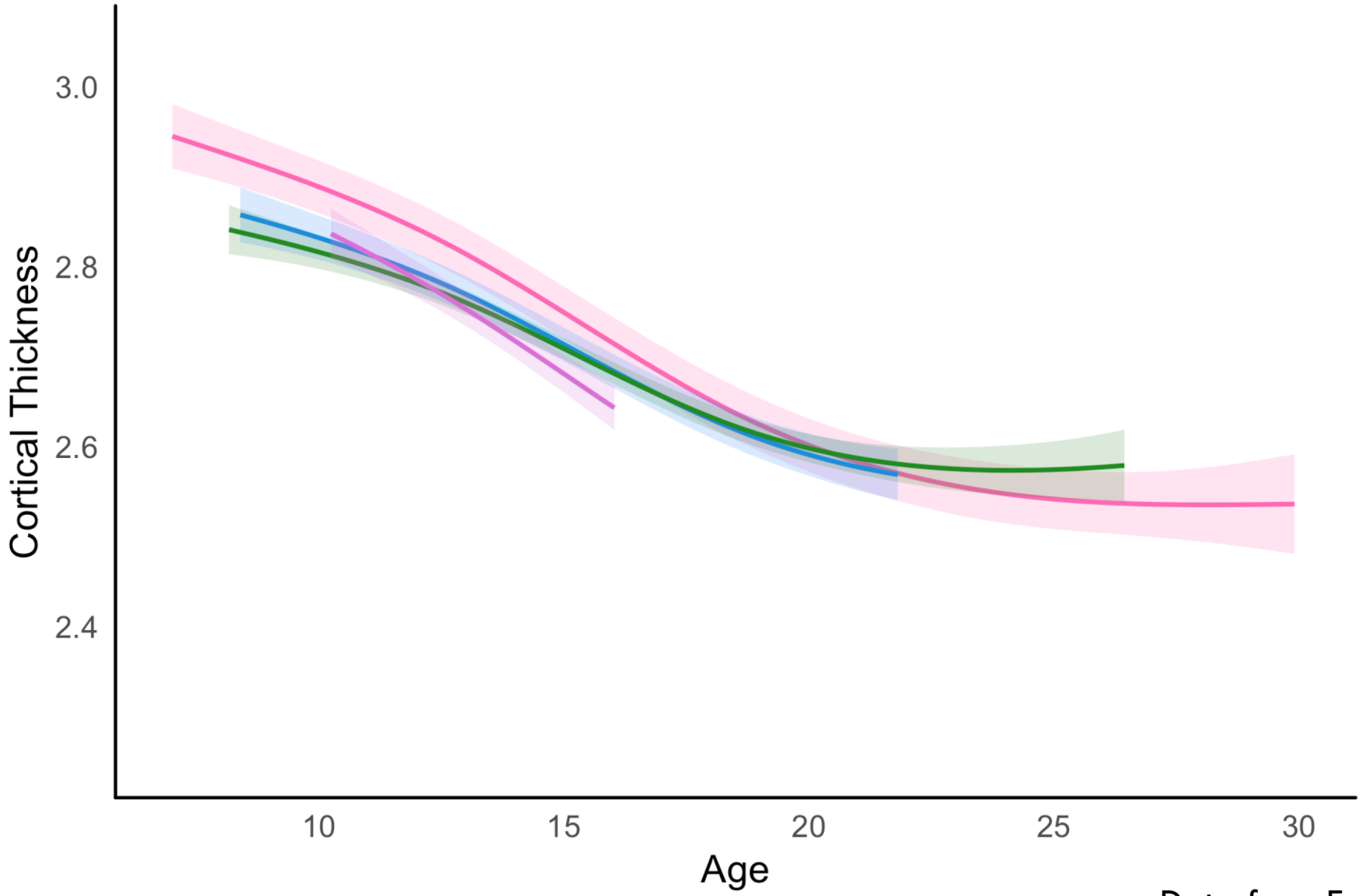
Cortical Thickness vs. Surface Area



- Cortical thinning is the dominant contributor to cortical volume reductions during adolescence

Tamnes et al., 2017

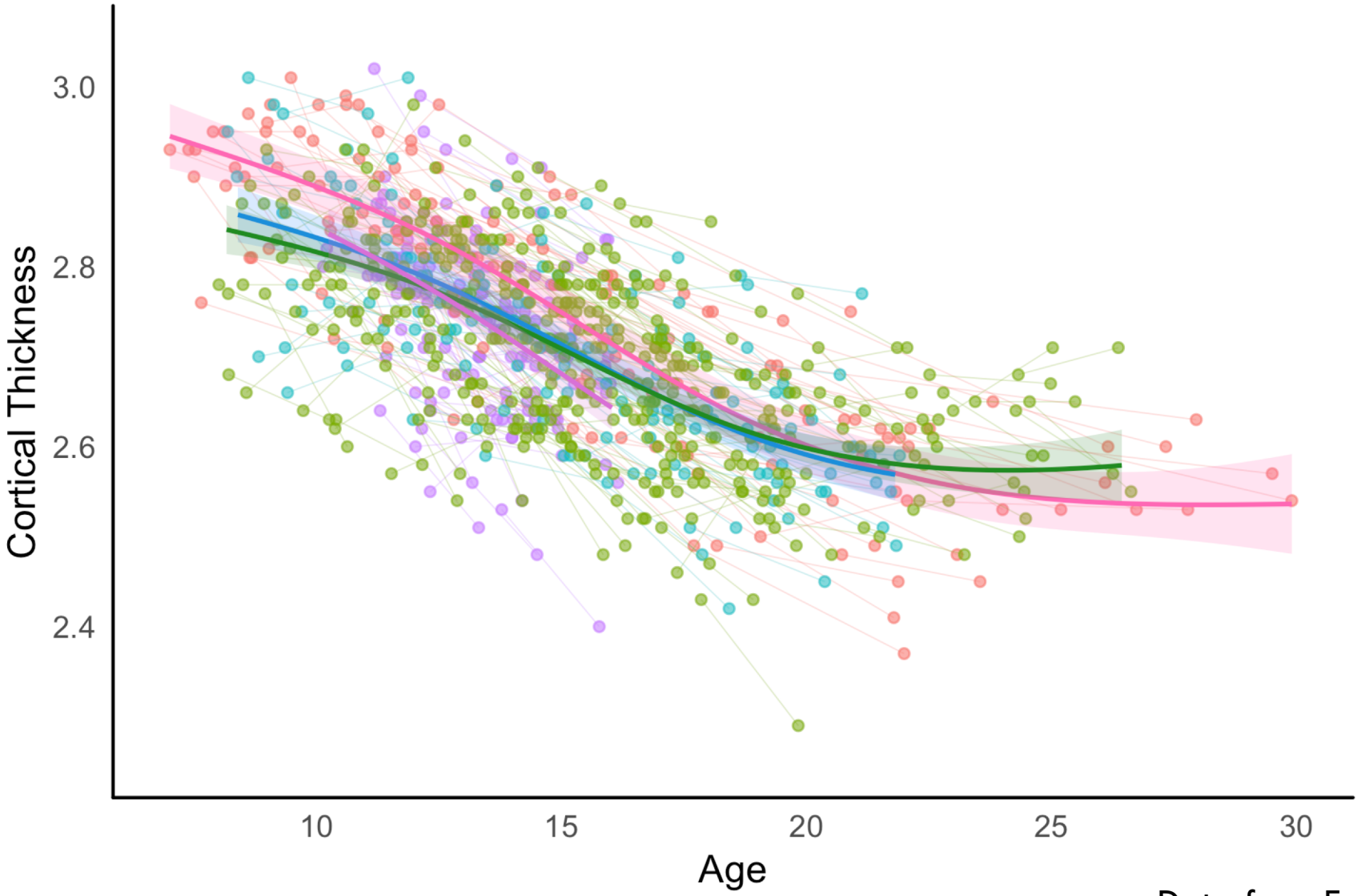
Cortical thickness decreases across adolescence



Tamnes et al., 2017

Data from Four Labs Collaboration

Inter-individual variability in cortical thickness

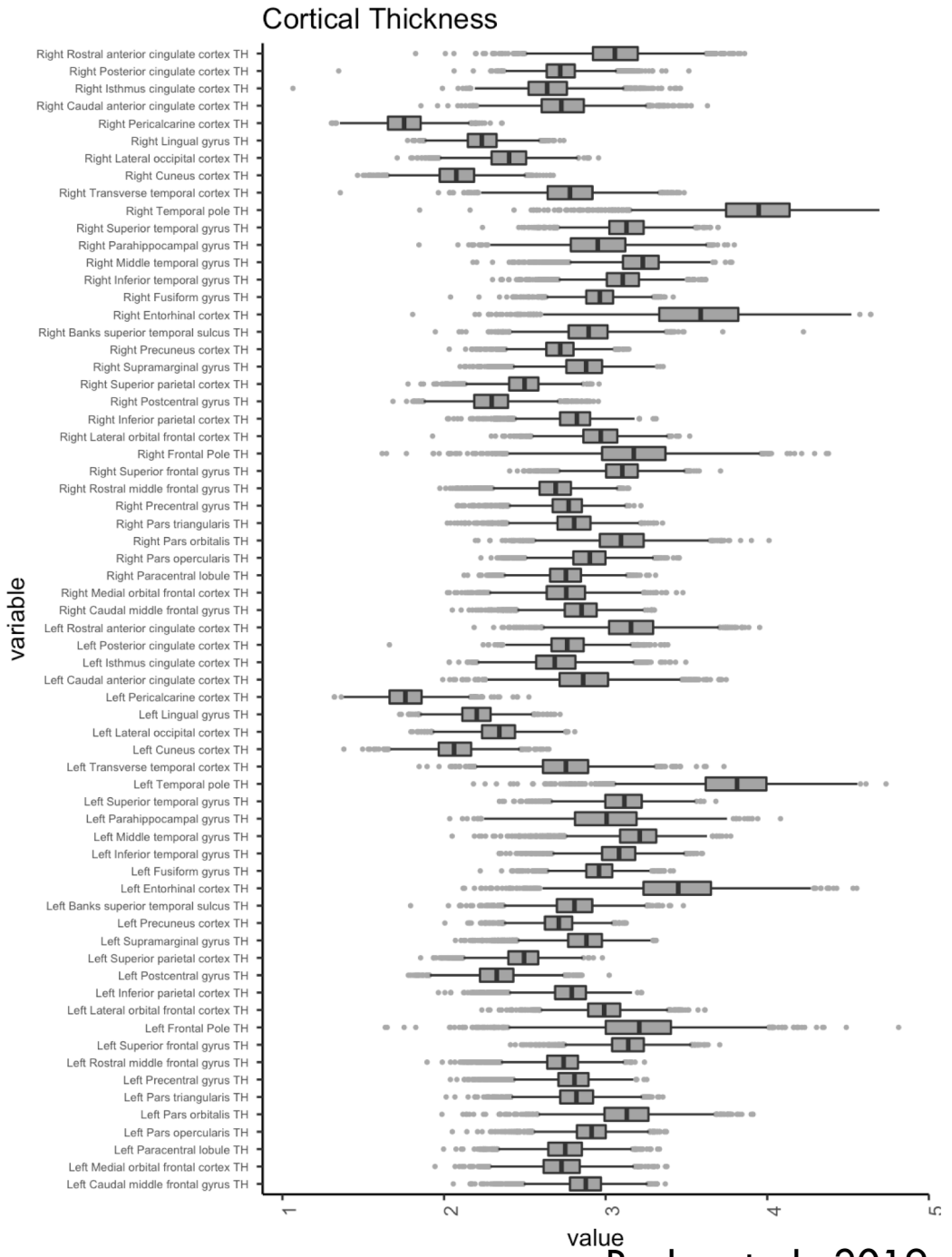


Tamnes et al., 2017

Data from Four Labs Collaboration

Drawing inferences about brain development from cross-sectional data

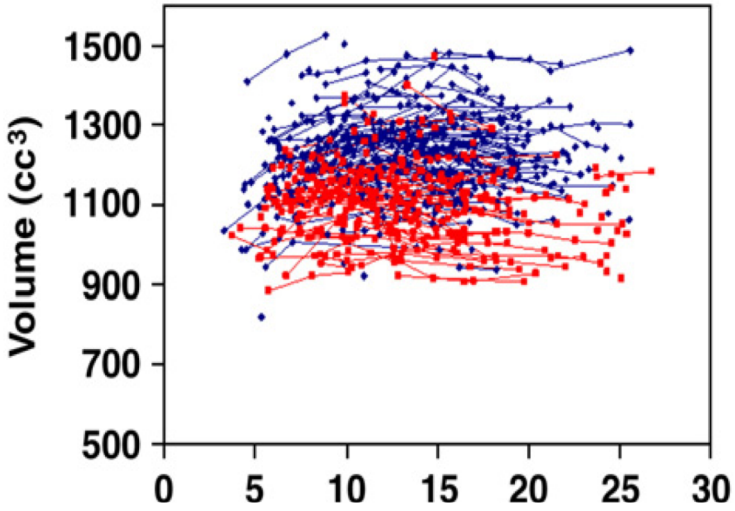
60 Minutes, December 2018



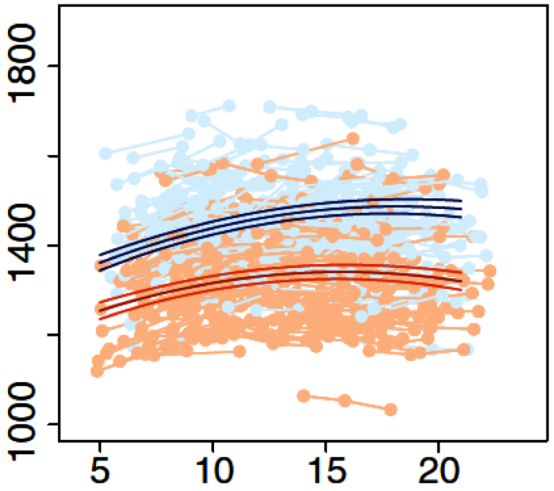
Paulus et al., 2019

Variability between individuals > Variability within individuals

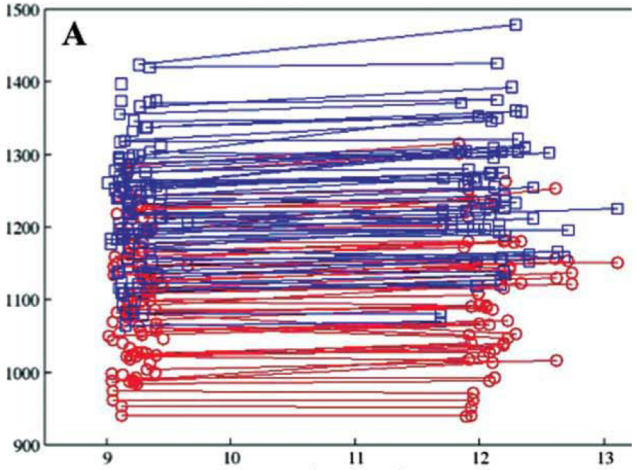
Total Cerebral Volume



Lenroot et al., 2007

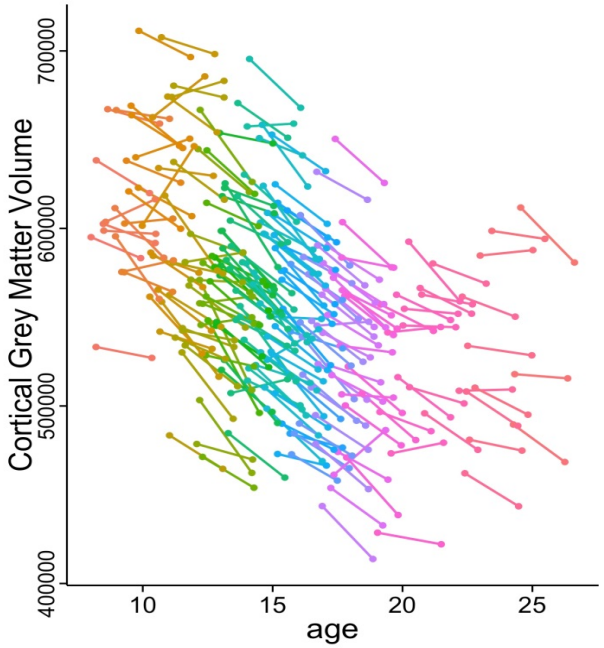


Aubert-Broche et al., 2013

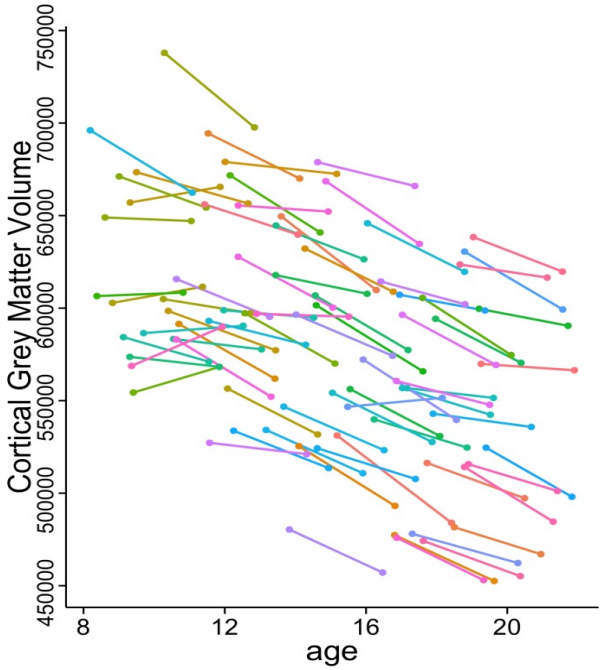


van Soelen et al., 2013

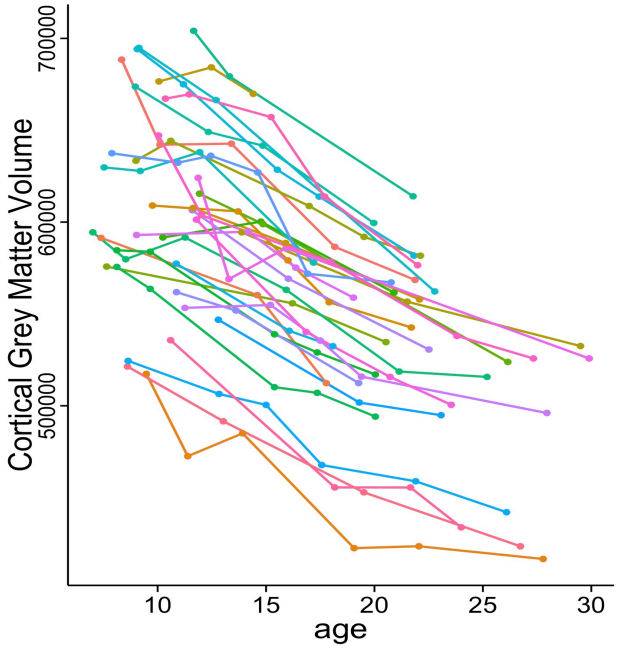
Individual Variability in Cortical Grey Matter



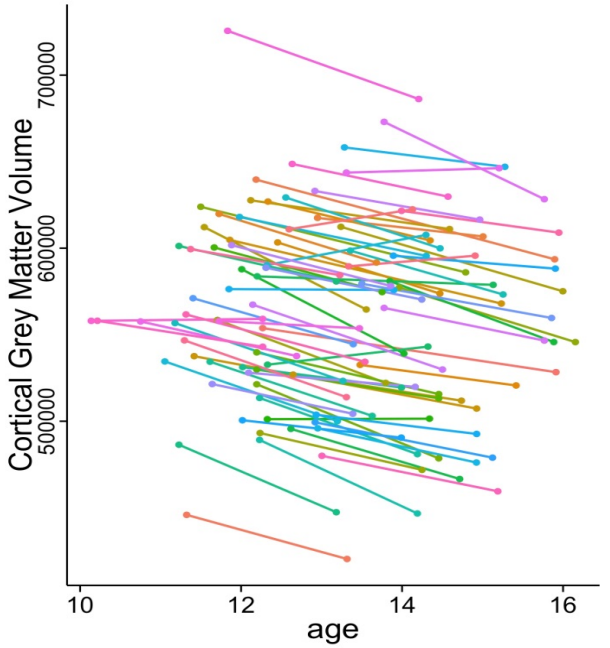
Braintime (Leiden)



Neurocognitive Development (Oslo)



Child Psychiatry Branch (NIMH)

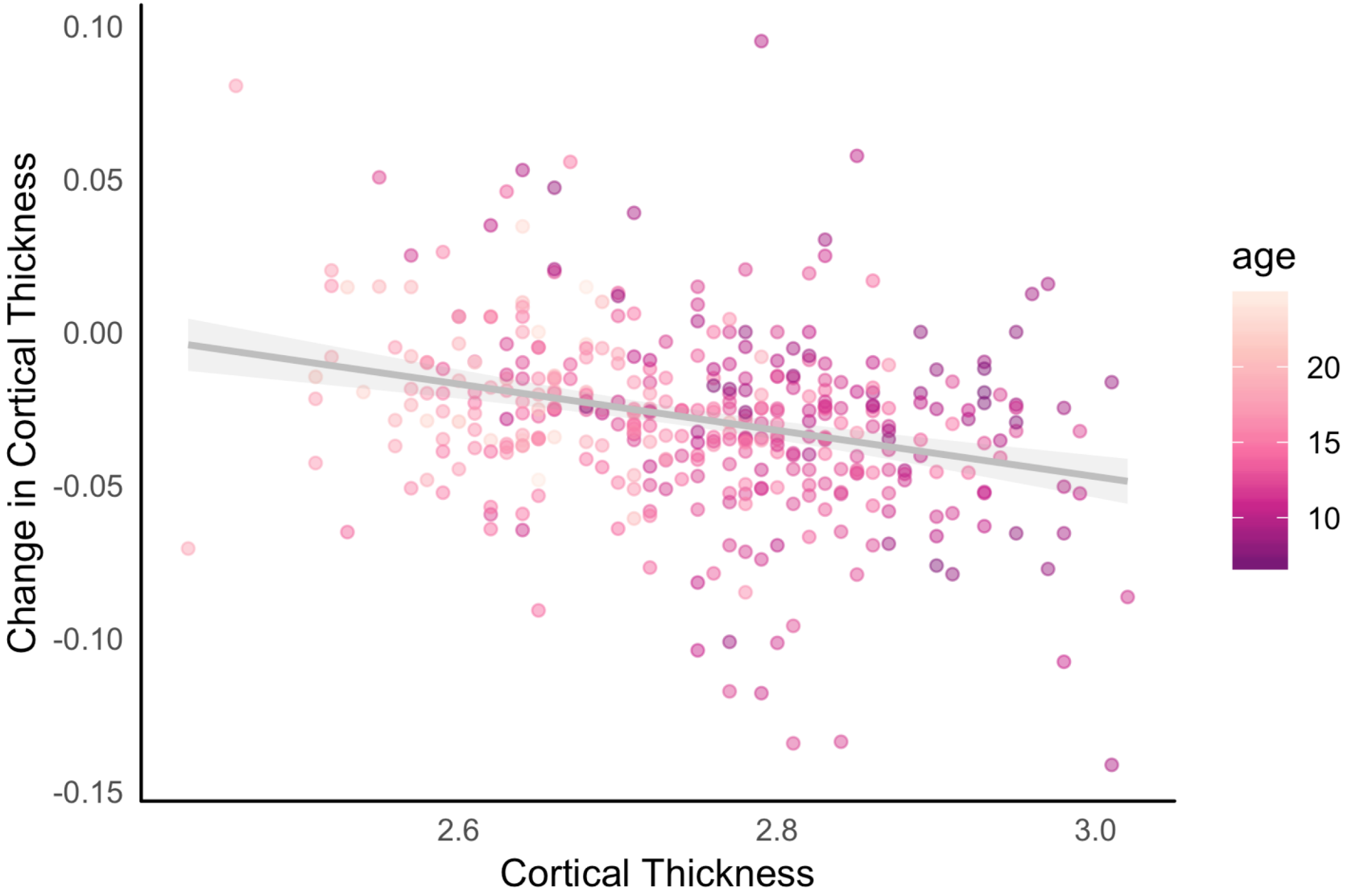


Pittsburgh

Mills et al., 2016

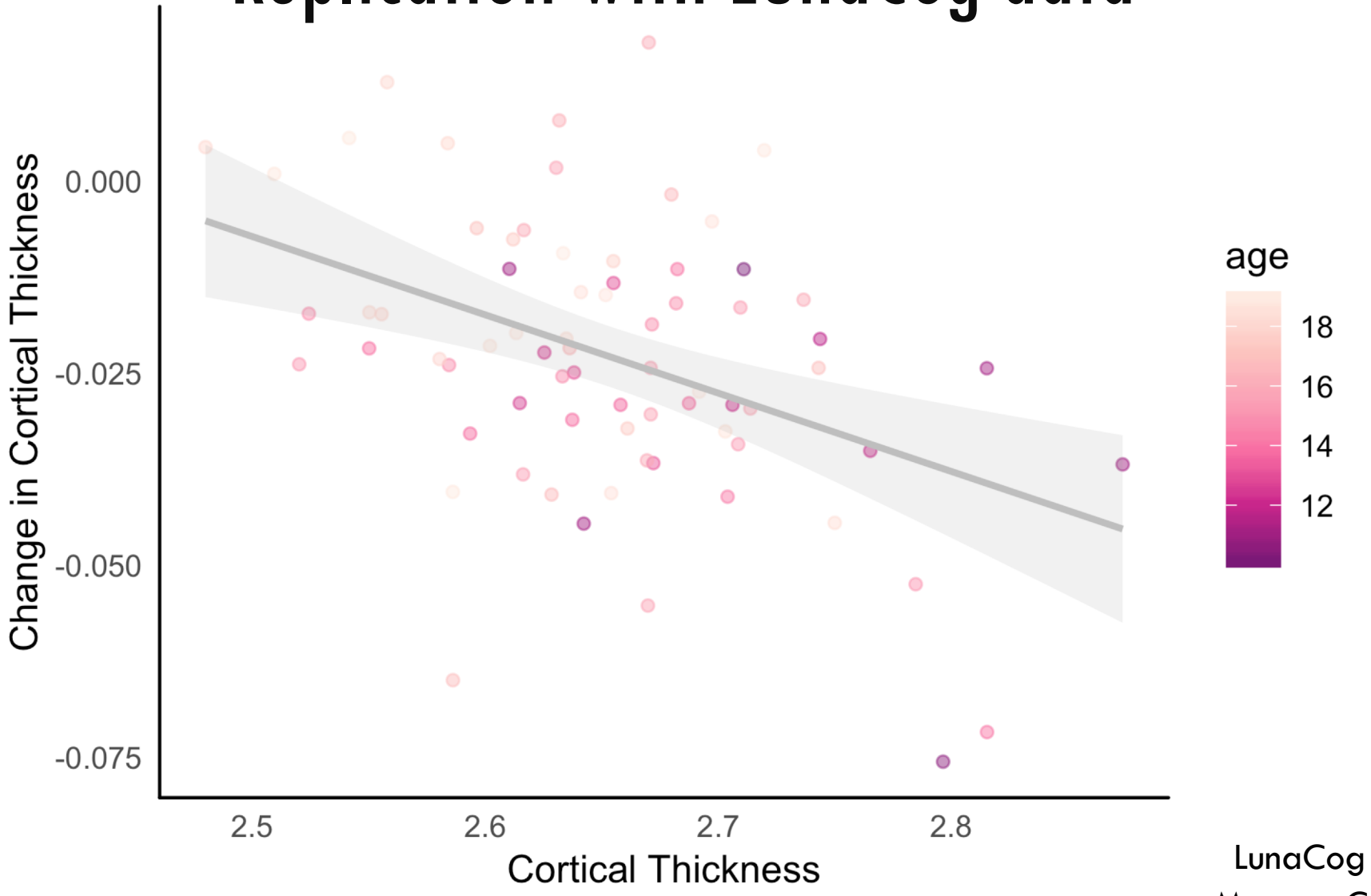
Data from Four Labs Collaboration

Cortical thickness correlates with subsequent change



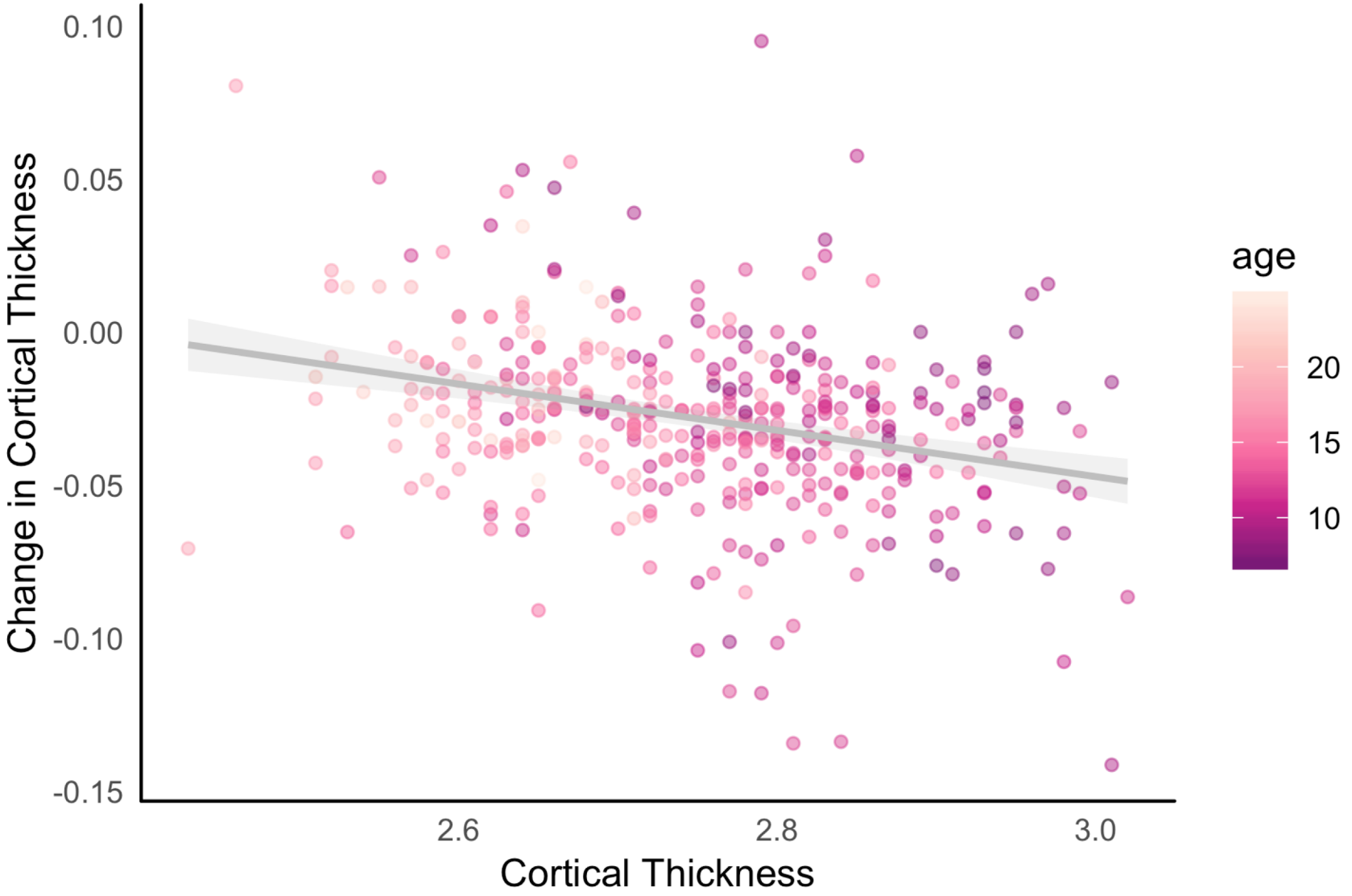
Data from Four Labs Collaboration

Cortical thickness correlates with subsequent change: Replication with LunaCog data



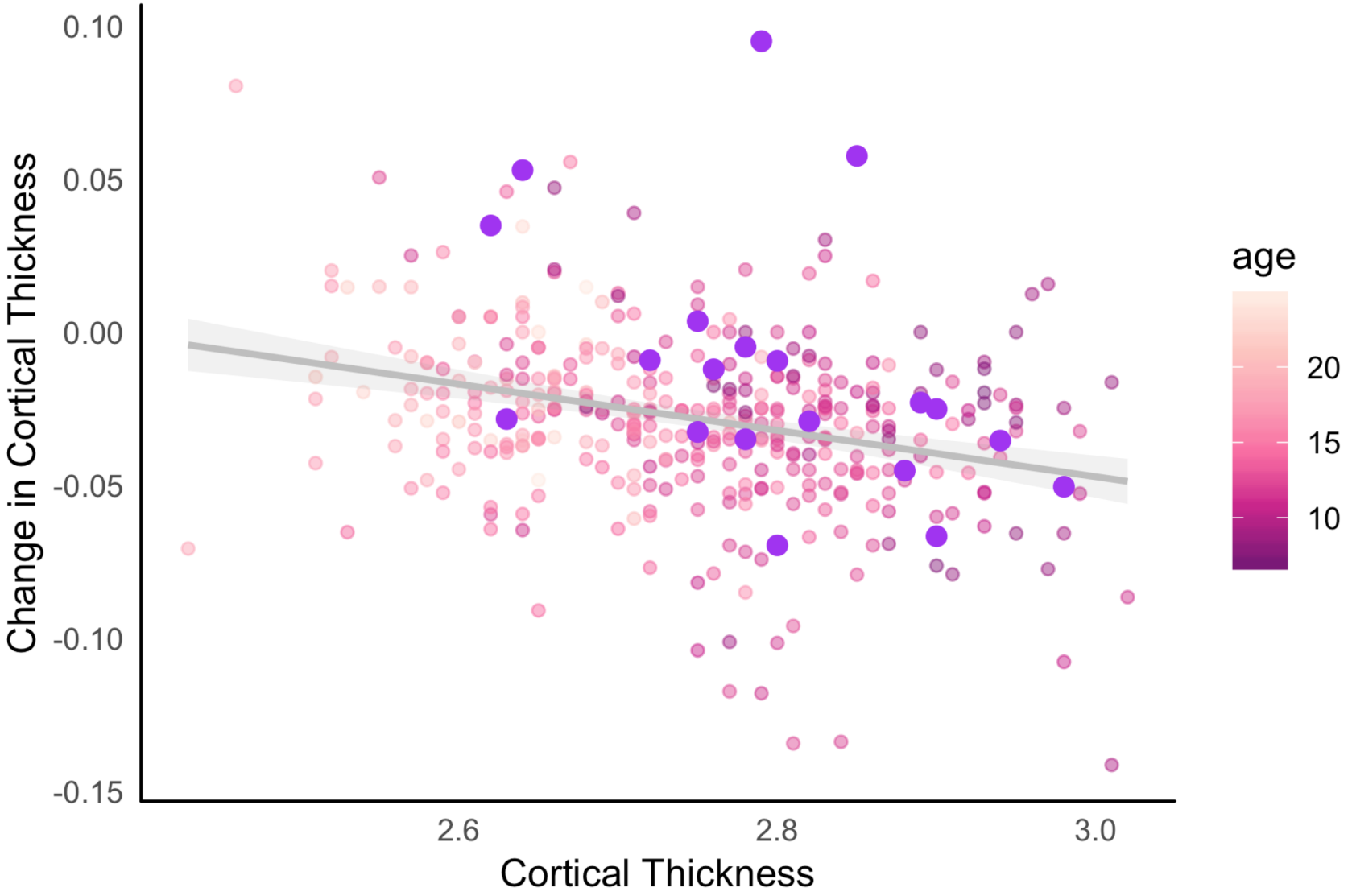
LunaCog data on Data Dryad
Montez, Calabro, & Luna 2017

Cortical thickness correlates with subsequent change



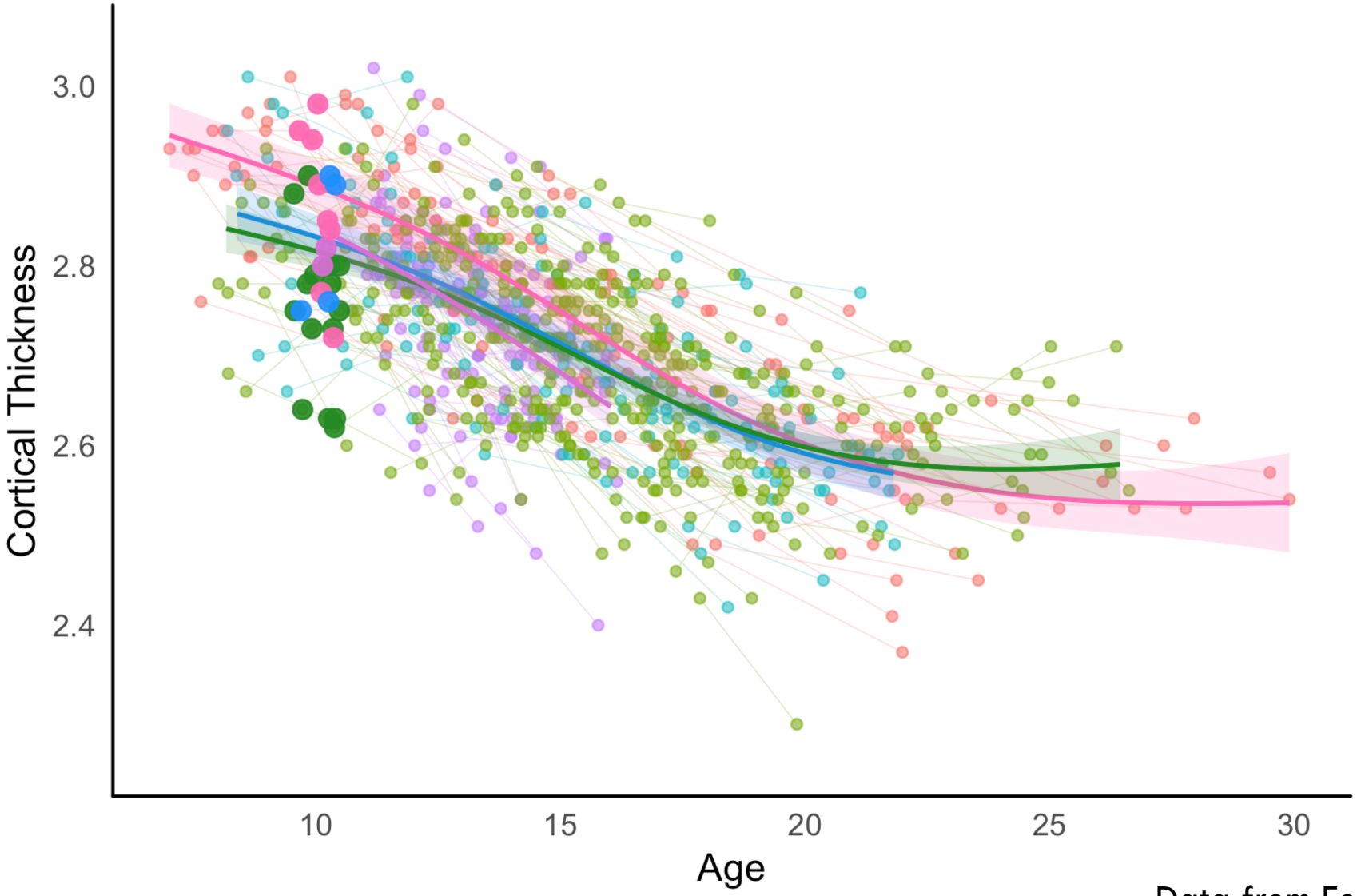
Data from Four Labs Collaboration

Cortical thickness correlates with subsequent change



Data from Four Labs Collaboration

Inter-individual variability in cortical thickness development



Tamnes et al., 2017

Data from Four Labs Collaboration

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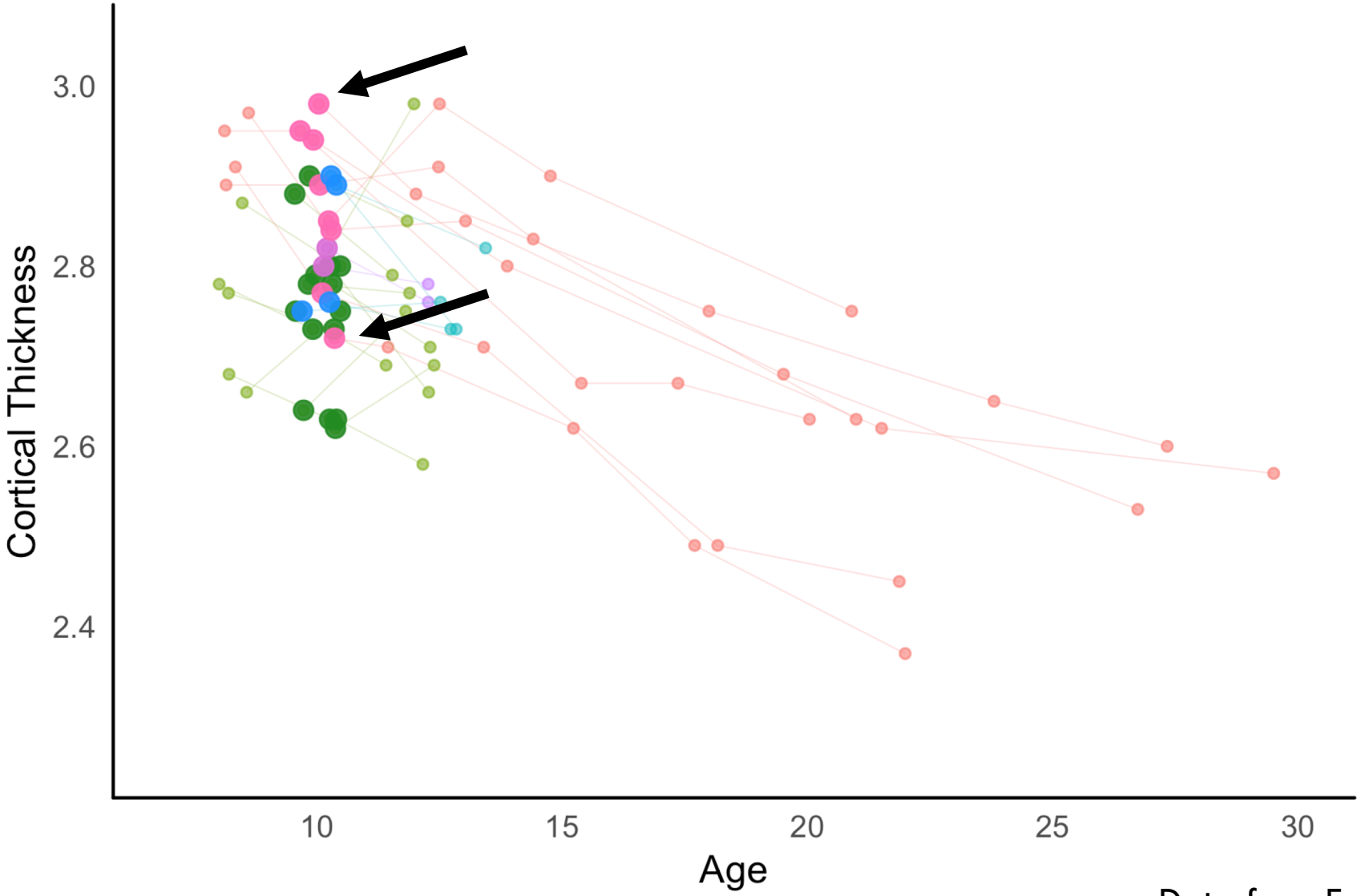

Data from Four Labs Collaboration

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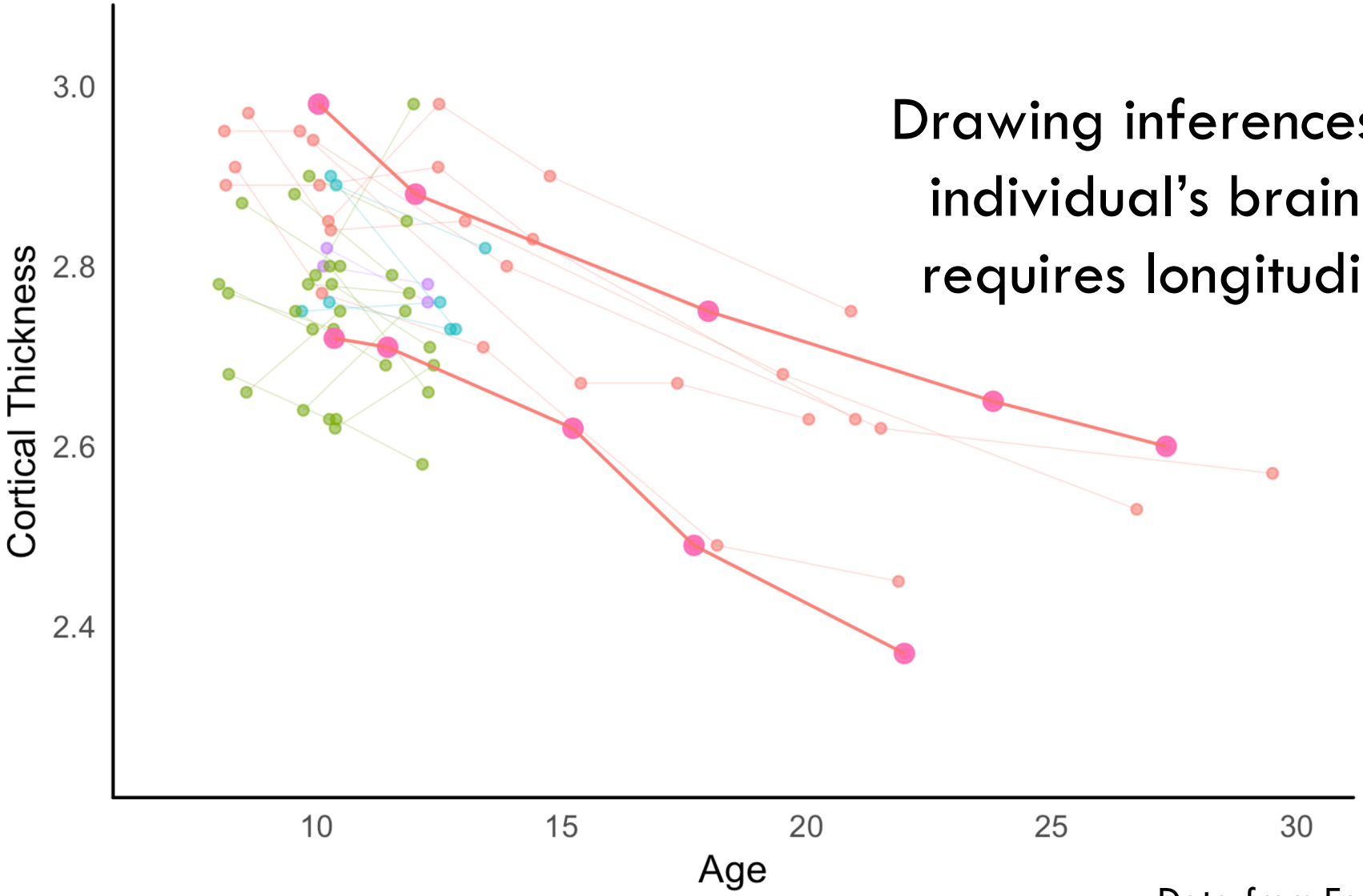


Drawing inferences about an individual's brain maturity requires longitudinal data!

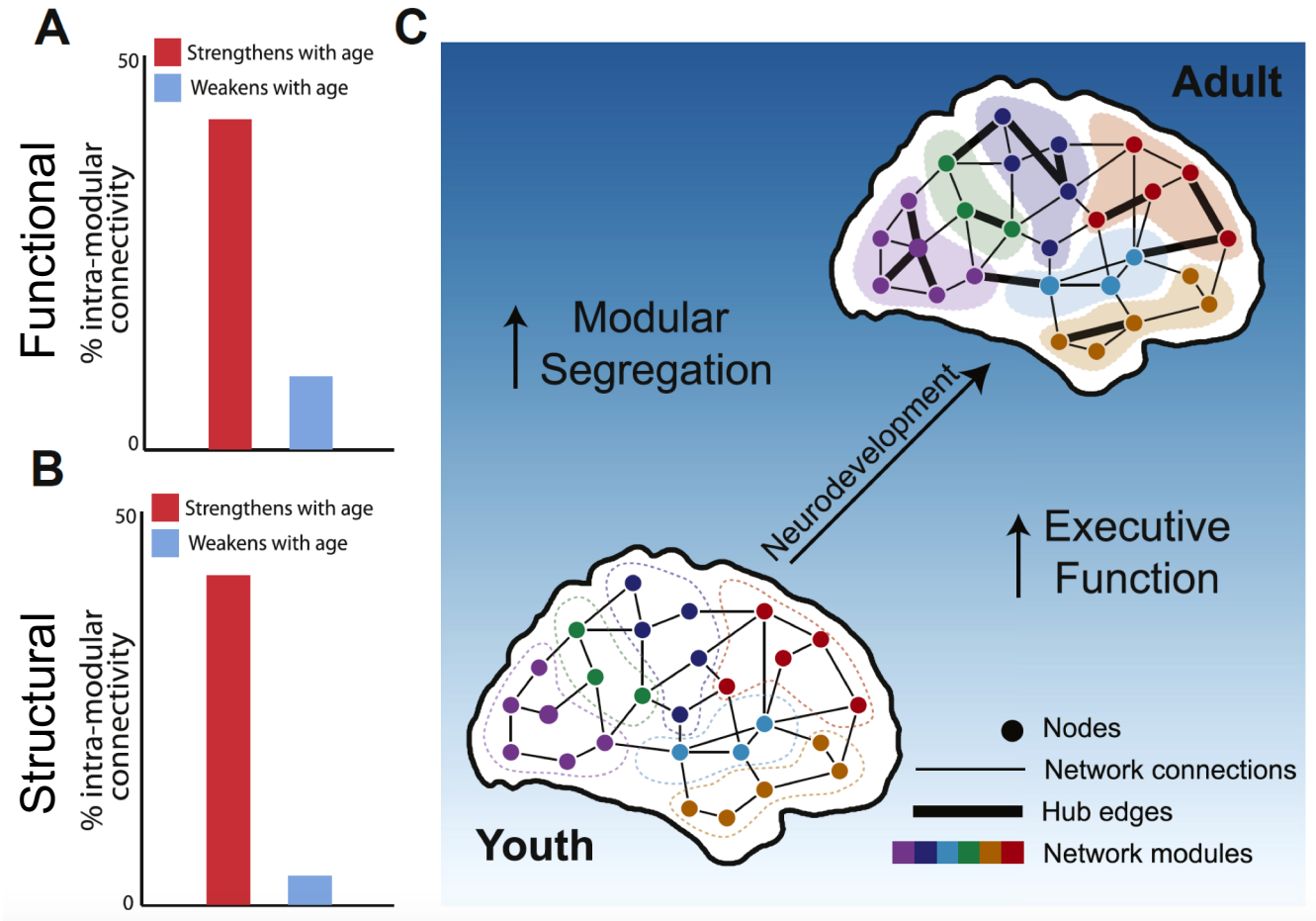
Data from Four Labs Collaboration

Longitudinal brain development fMRI

- Inter-individual variability can be greater in fMRI than sMRI
  - Variability in overall size (intercept)
  - Variability in direction and magnitude of change (slope)

General principles about connectivity

- Modular segregation in structural and functional connectivity



Bassett, Xia, and Satterthwaite, 2018

Keep in Mind

- Maybe longitudinal data are not needed if baseline data provide the relevant information (and change does not)
  - We can only know if we test – so please do!

Thank you!

Four labs replicable brain development collaboration

Megan Herting

Rosa Meuwese

Christian Tamnes

Anne-Lise Goddings

★ Eveline Crone Berna Güroğlu ★

★ Sarah-Jayne Blakemore ★

★ Armin Raznahan ★

★ Ron Dahl Elizabeth Sowell ★

★ ★ ★ ★ ★

+ Bea Luna & lab for sharing LunaCog dataset