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Growth Charting of Brain Connectivity Networks and the Identification of Attention Impairment in Youth

Published in JAMA Psychiatry, 2016 (Kessler, Sripada, & Angstadt)

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Outline

Motivation

Pediatric Growth Charts

- Long history for height, weight, etc

Intrinsic Connectivity Networks

- Attention & ADHD connection
- DMN vs TPN balance

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Background

Focus today: processing pipeline, modeling, and analysis

Sample

- Philadelphia Neurodevelopmental Cohort
- Resting state fMRI
- Penn Continuous Performance Task
- N = 519 (after QC & exclusions)

Task: PCPT

- Penn Continuous Performance Test
- 180 trials
- 1s to respond
- "Go" on digit/letter (varies by phase)
- Measure: Acc (as %age)

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Clinical Interview

MRI Measures

- T1-weighted image (structural contrast)
- Resting State fMRI

Standard fMRI Prepocessing

Slice-time Correction

- Each fMRI volume is acquired sequentially in slices
- Volume not acquired simultaneously
- Correct (through interpolation) s.t. all slices w/in volume temporally aligned

Motion Correction

Normalization

Smoothing

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Preprocessing & Connectome Generation

Preprocessing

- Linearly detrended
- COMPCor
- Bandpass Filtering
- Motion Scrubbing

Connectome Generation

- Isomorphic grid
- 12mm spacing
-
- 1068 Regions of Interest (ROIs)

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Data Cleansing

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Preprocessing & Connectome Generation

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Independent Components Analysis

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Network Growth Charting Analyses

Network Growth Charting to Predict Task Accuracy

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Shifting DMN-TPN Architecture Among Maturing Components

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Shallow vs Lagged Dysmaturation and Task Accuracy

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Biomarker of Attention Dysfunction from Network Growth Charting

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Biomarker of ADHD from Network Growth Charting

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Unraveling miswired connectomes

ICN interplay

Dysmaturation Predicts Dysfunction

Differential Dysmaturation

Conclusions

Brain network growth charting predicts attention functioning.