1. **Background**

- Brain-predicted age difference (brainPAD) is a marker of brain health that quantifies the divergence between an individual’s chronological and biological age of their brain, as predicted from neuroimaging data.¹
- BrainPAD has been associated with multiple behavioural and health features, particularly in older individuals.
- This study examined relationships between brainPAD and a range of biological, cognitive, and environmental factors in healthy young adults from the Human Connectome Project.

2. **Methods**

1. BrainPAD was computed for 1113 Human Connectome Project (HCP) ² subjects using linear support vector regression (SVR) with 153 structural MRI features (total intracranial volume + 68 cortical thickness & surface areas + 16 subcortical volumes).

   ![SVR age prediction](image)

2. A subset of 348 subjects with brainPAD scores > ±1 SD from the mean were selected to examine relationships between brain maturation rates & non-imaging measures (NIMs).

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Mean Age (Years)</th>
<th>Mean brainPAD (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated maturation</td>
<td>n = 183</td>
<td>28.57 (SD = 3.34)</td>
</tr>
<tr>
<td>Delayed maturation</td>
<td>n = 165</td>
<td>28.88 (SD = 3.95)</td>
</tr>
<tr>
<td>Full HCP sample</td>
<td>n = 1113</td>
<td>28.80 (SD = 3.70)</td>
</tr>
</tbody>
</table>

3. Predictors of brain maturation rate were identified using Bayesian logistic regression models³, with NIMs modelled in domain blocks. Because this data set includes families, stratified bootstrapping was used to perform regressions in unrelated individuals only.

4. **Conclusions**

- Bayesian regression provides a distribution of coefficients for each predictor.
- Distributions were characterized in terms of:
  1) Median coefficient
  2) Probability of direction (PD; % of distribution that is positive or negative)

   ![Median PD](image)

- Z-scores for age- and sex-normed cortical thickness were negatively correlated with brainPAD.
- In the subset of subjects with highly accelerated or delayed maturation, females were more likely to be accelerated, while males were more likely to be delayed. Therefore, subsequent regressions were performed separately in males & females.

- Divergence between chronological and biological brain age in early adulthood may reflect deviations in normal developmental changes in cortical thickness.
- Factors linked to brain maturation may differentially affect males and females.
- Biological brain age in females may be further impacted by hormonal influences.

**References**