

Adolescent Striving and Methylation Aging

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April 27, 2018

Finding

- Adolescents from highly disadvantaged backgrounds who strive to succeed in school experience more rapid epigenetic aging across childhood and adolescence
- This pattern is observed among black and Hispanic adolescents but not among whites

Motivation



- Evidence that higher levels of self-control, striving, and socioeconomic success among disadvantaged blacks and Hispanics are associated with worse physical health
 - ▶ John-Henryism (James 1983)
 - ▶ Skin-deep resilience (Brody et al. 2013; Miller et al. 2015)
 - ▶ Unequal benefits (Gaydos et al. 2018)

Research questions

- 1 What is the relationship between early life disadvantage, childhood striving, and the pace of epigenetic aging?
- 2 Does this relationship vary by race/ethnicity?



- Probability sample of 4,898 births in 75 hospitals across 20 US cities
- Oversample of non-marital births
- Baseline survey at birth
- Follow-up at years 1, 3, 5, 9, and 15

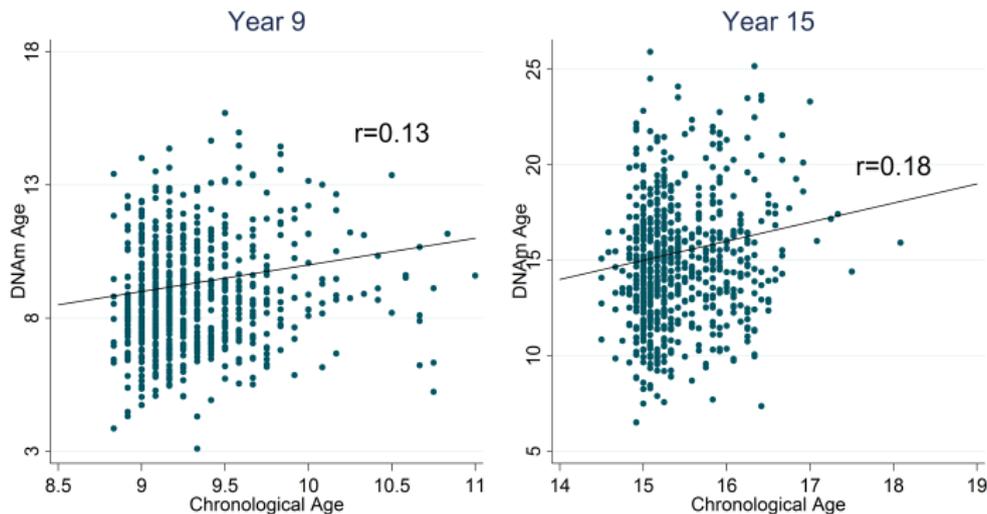
Data - DNA methylation

- Saliva collected at years 9 and 15 using Oragene DNA self-collection kit
- Preliminary sample of $n \sim 700$ respondents using Illumina Infinium HumanMethylation 450K BeadChip
- Stay tuned: will add more samples using EPIC chip, $n > 2,000$

Measures - DNA methylation (DNAm) age

- Horvath method for calculating epigenetic age:
 - ▶ Analyzed 21k CpG sites across 51 different tissue and cell types from over 7k samples
 - ▶ Regressed chronological age on the CpG sites using a penalized regression model
 - ▶ Identified 353 CpG sites as “clock” CpG sites
 - ▶ Robust across tissue types
- Construct DNAm age using the weighted average of methylation levels at these CpGs

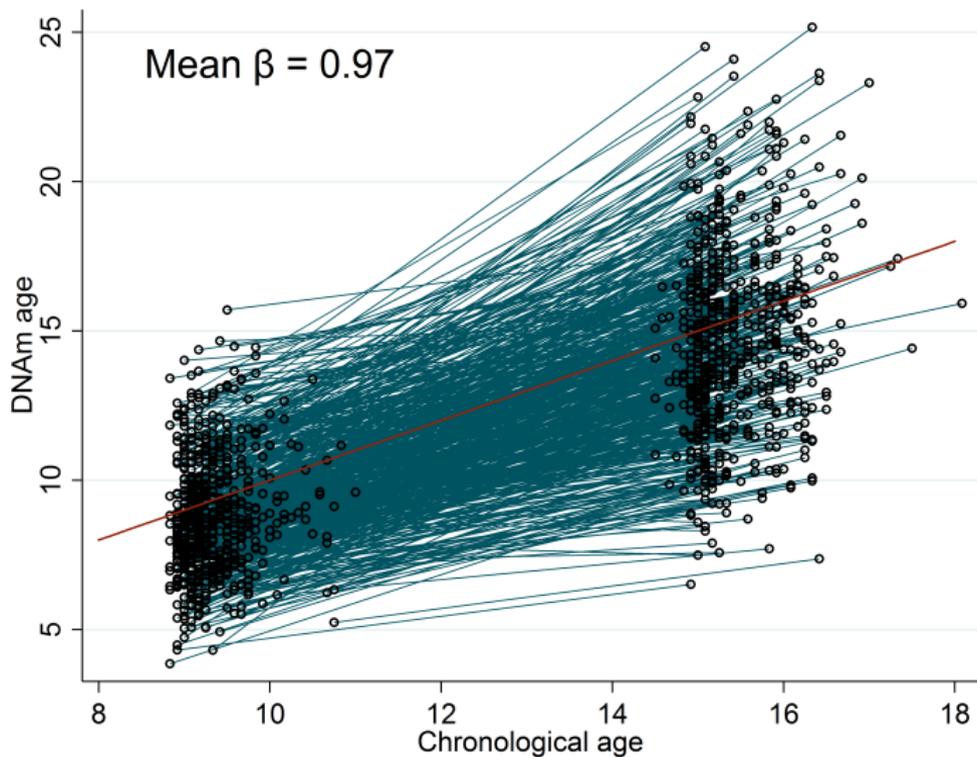
Measures - DNAm age and chronological age



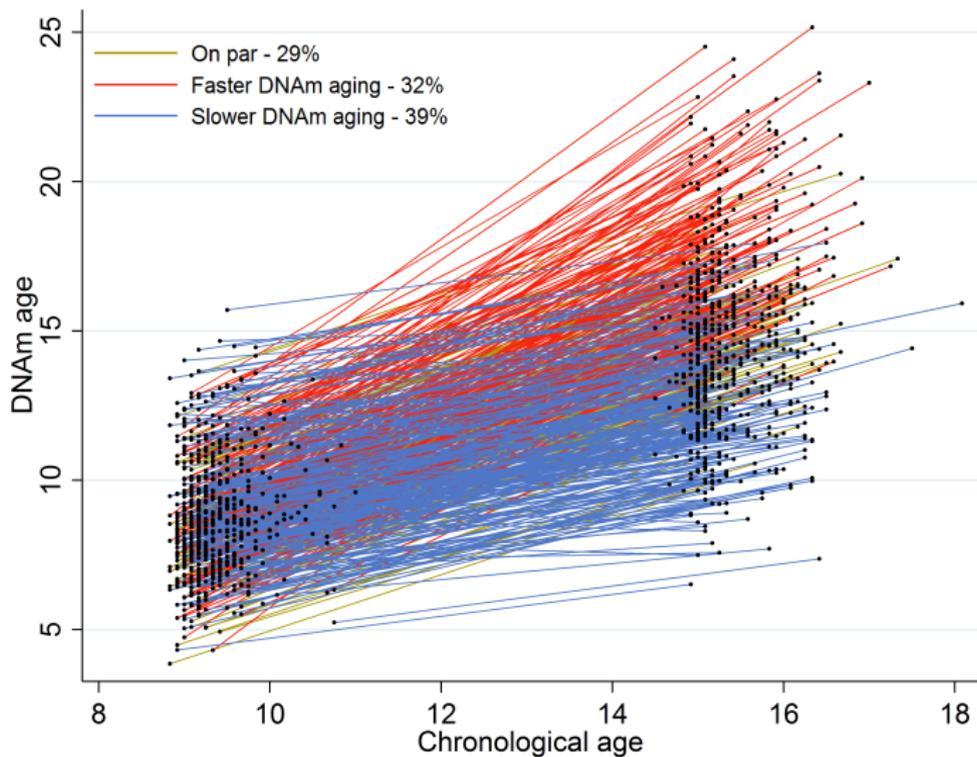
- Modest correlation between DNAm age and chronological age
- Little variation in chronological age in cross-section
- Exploit greater variation over time by looking at pace of epigenetic aging:

$$\text{Pace} = (\text{DNAm age 15} - \text{DNAm age 9}) / (\text{Date15} - \text{Date9})$$

Measures - pace of methylation aging



Measures - pace of methylation aging



Measures - socioeconomic disadvantage at birth

- Baseline interview
- 4 indicators at family level: household income below poverty line, receipt of public assistance, mother's education < HS, single parent household
- 7 indicators at neighborhood level: welfare receipt, unemployment, poverty, educational attainment, female headed, segregation, vacancies
- Summed across indicators
- Mean = 4.5, SD = 3.0, $\alpha = 0.79$

Measures - striving across childhood and adolescence

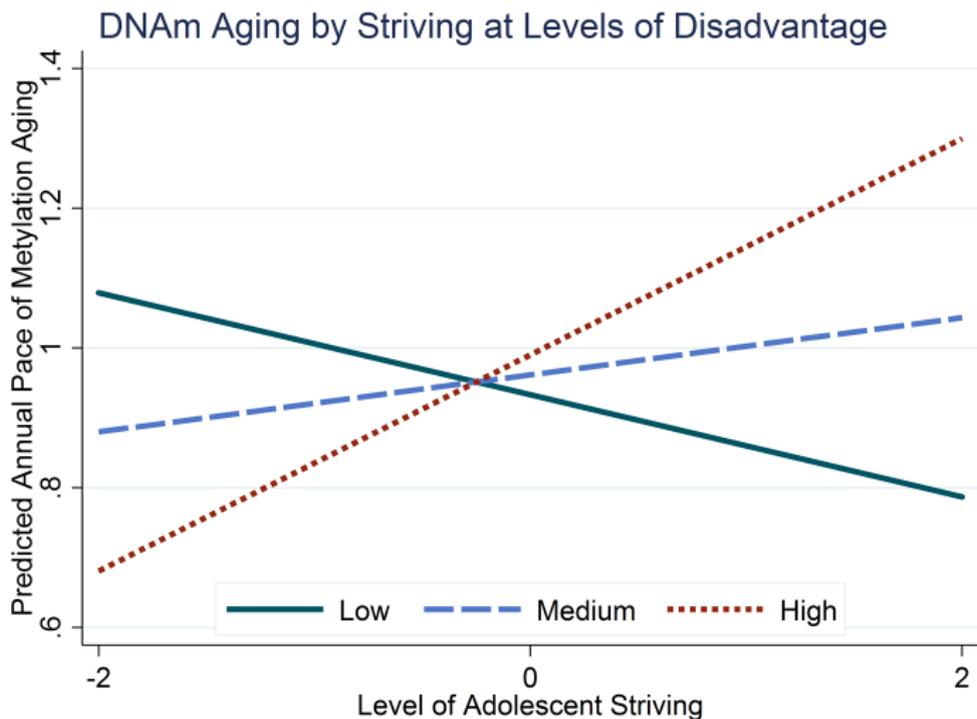


- Years 9 and 15 child surveys
- 12 measures of educational aspirations, school engagement, perseverance, and optimism
- Highest response to each question considered “striving”, summed across measures, averaged between years
- Mean = 5.2, SD = 2.2, $\alpha = 0.89$

Methods

- Linear regression model predicting annual pace of epigenetic aging
- Interaction between disadvantage and striving
- Models control for sex, race/ethnicity, and pubertal development

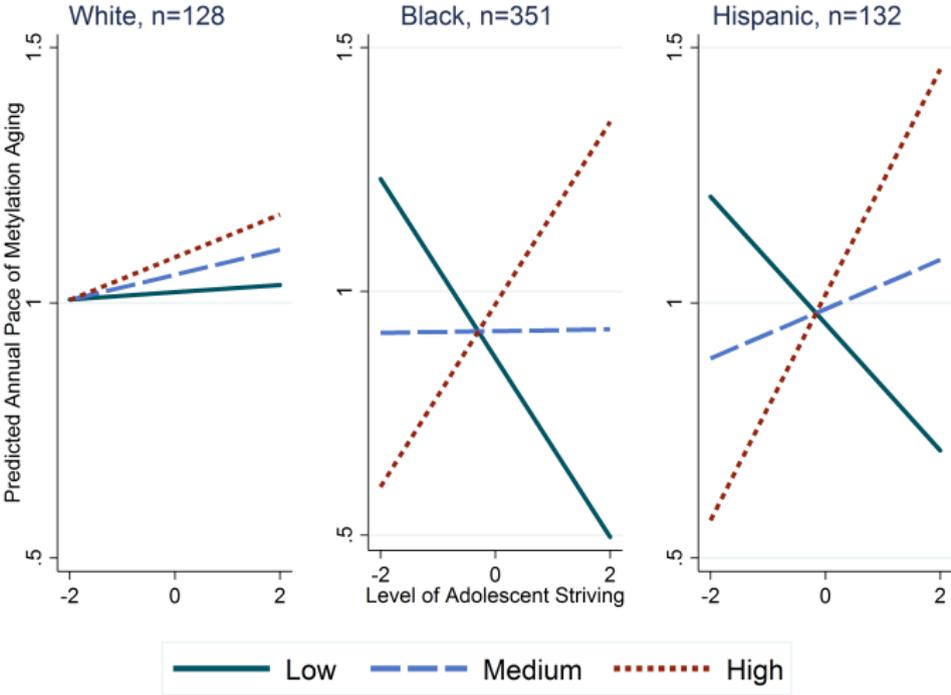
Results



Model controls for gender and race. p-value for interaction term <.05.

Results

Race/Ethnic Stratified Analyses



Conclusion

- Pace of DNAm aging is accelerated for disadvantaged adolescents who strive academically
- Suggestive evidence that this may be restricted to black and Hispanic adolescents
- Physical health risk associated with striving among disadvantaged minorities may appear earlier in the life course than previously documented

Acknowledgments

Fragile Families is funded by:

- Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD): R01 HD076592, R01HD36916, R01HD39135, and R01HD40421
- National Institute of Mental Health (NIMH): R01MH103761
- Consortium of private foundations

Thank you.

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