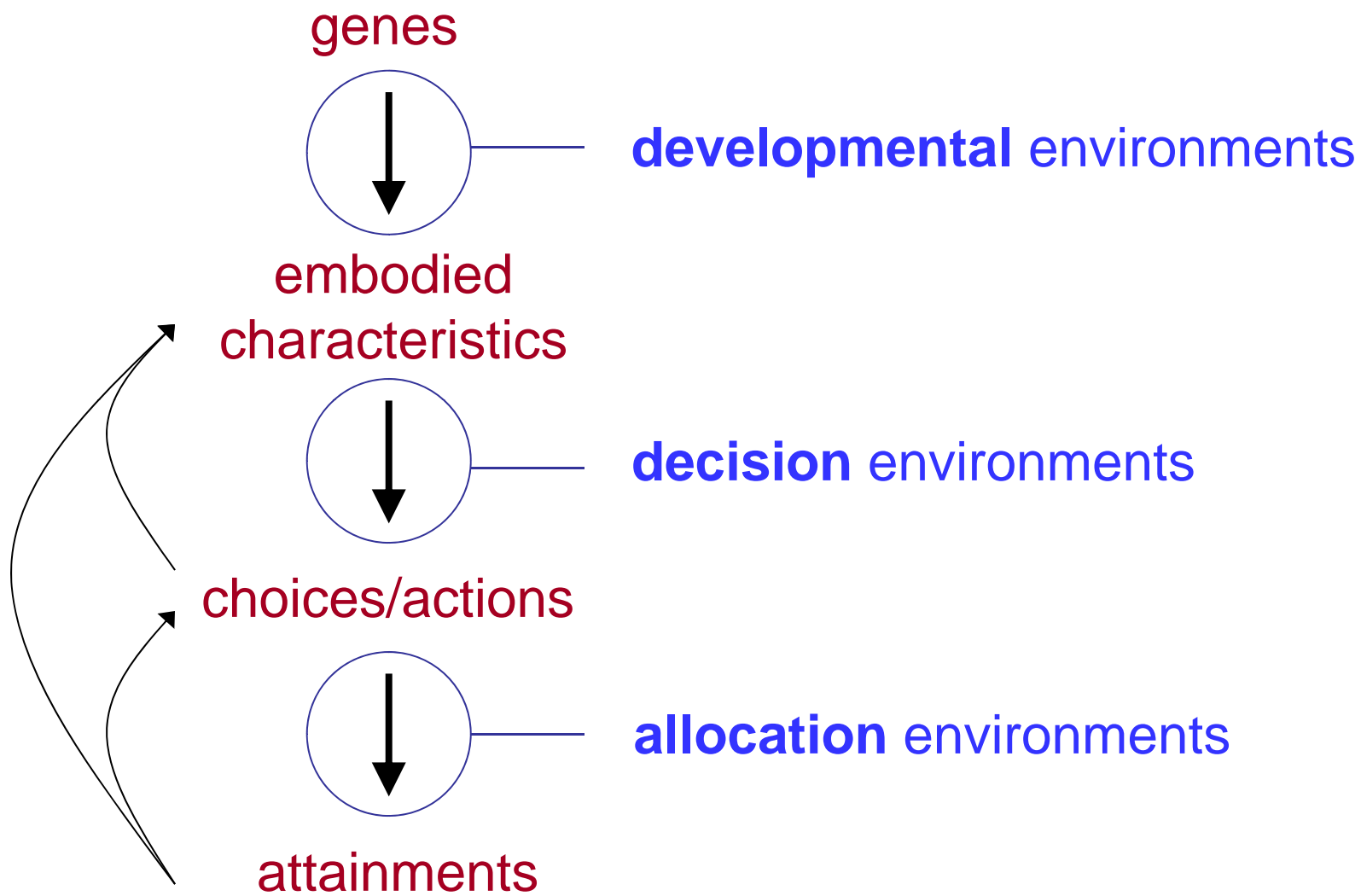


Moderation of  
Gene-Phenotype Associations  
May Be Socially Instructive Even  
When Psychologically Ambiguous

Jeremy Freese  
Northwestern University



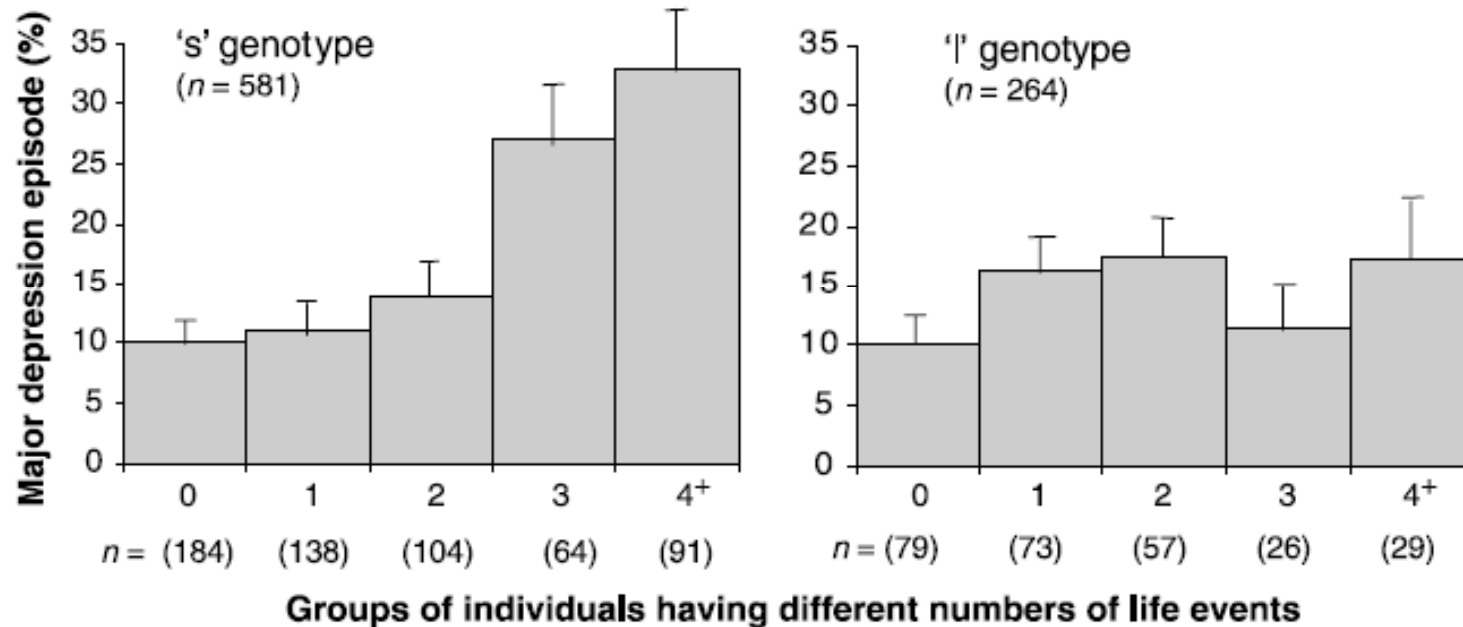
# Genotypic data: what's in it for social science?

1. New leverage for estimating effects of environmental causes
2. Reveal importance of and serve as proxies for individual traits
3. Leverage to understanding how trait development varies over environments
4. Reveal information about nature of attainment processes in societies

# Influence of Life Stress on Depression: Moderation by a Polymorphism in the 5-HTT Gene

Avshalom Caspi,<sup>1,2</sup> Karen Sugden,<sup>1</sup> Terrie E. Moffitt,<sup>1,2\*</sup>  
Alan Taylor,<sup>1</sup> Ian W. Craig,<sup>1</sup> HonaLee Harrington,<sup>2</sup>  
Joseph McClay,<sup>1</sup> Jonathan Mill,<sup>1</sup> Judy Martin,<sup>3</sup>  
Antony Braithwaite,<sup>4</sup> Richie Poulton<sup>3</sup>

*Science, 2003*



**Environmental Contingencies and Genetic Propensities: Social Capital, Educational Continuation, and Dopamine Receptor Gene *DRD2*<sup>1</sup>**

*American Journal of Sociology, 2008*

**Partisanship, Voting, and the Dopamine D2 Receptor Gene**

*Journal of Politics, 2009*

Research Article

**Moderating effects of *DRD2* on depression**

*Stress and Health, 2009*

The interaction of *DRD2* and violent victimization on depression:  
An analysis by gender and race

*Journal of Affective Disorders, 2009*

**A Dopamine Gene  
(DRD2) Distinguishes  
Between Offenders Who  
Have and Have Not Been  
Violently Victimized**

International Journal of  
Offender Therapy and  
Comparative Criminology  
XX(X) 1-17  
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DOI: 10.1177/0306624X10361583  
<http://ijo.sagepub.com>  


*International Journal of Offender Therapy and Comparative Criminology, 2010*

Research

**Open A**

**A gene × gene interaction between DRD2 and DRD4 is associated  
with conduct disorder and antisocial behavior in males**

*Behavioral and Brain Functions, 2007*

**A Gene X Environment Interaction Between DRD2  
and Religiosity in the Prediction of Adolescent  
Delinquent Involvement in a Sample of Males**

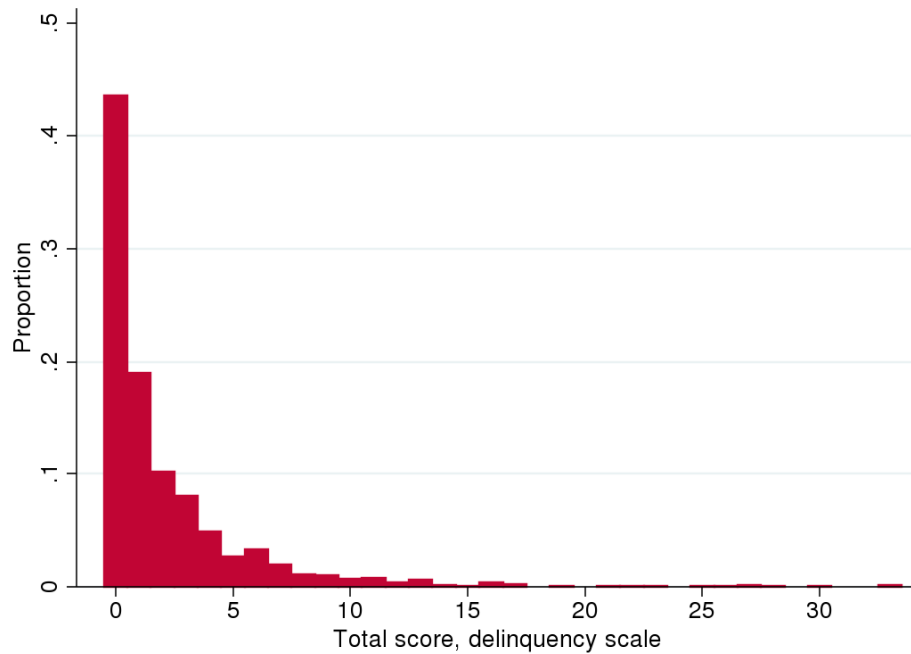
*Biodemography and Social Biology, 2009*

**ALL IN THE FAMILY**

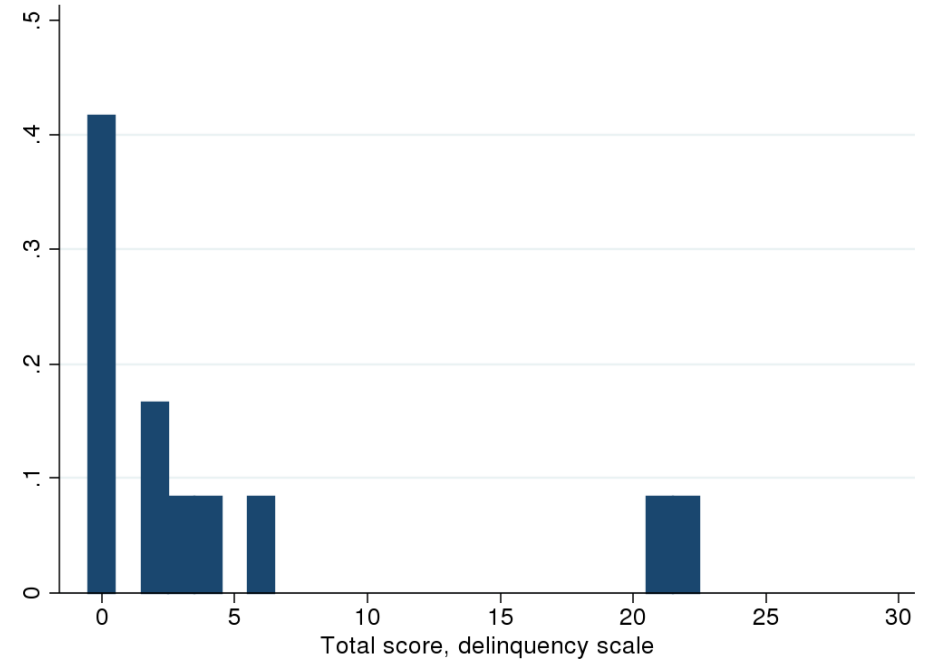
**Gene × Environment Interaction Between  
DRD2 and Criminal Father Is Associated  
With Five Antisocial Phenotypes**

*Criminal Justice and Behavior, 2009*

## MAOA and delinquency, Add Health males (Wave 1)

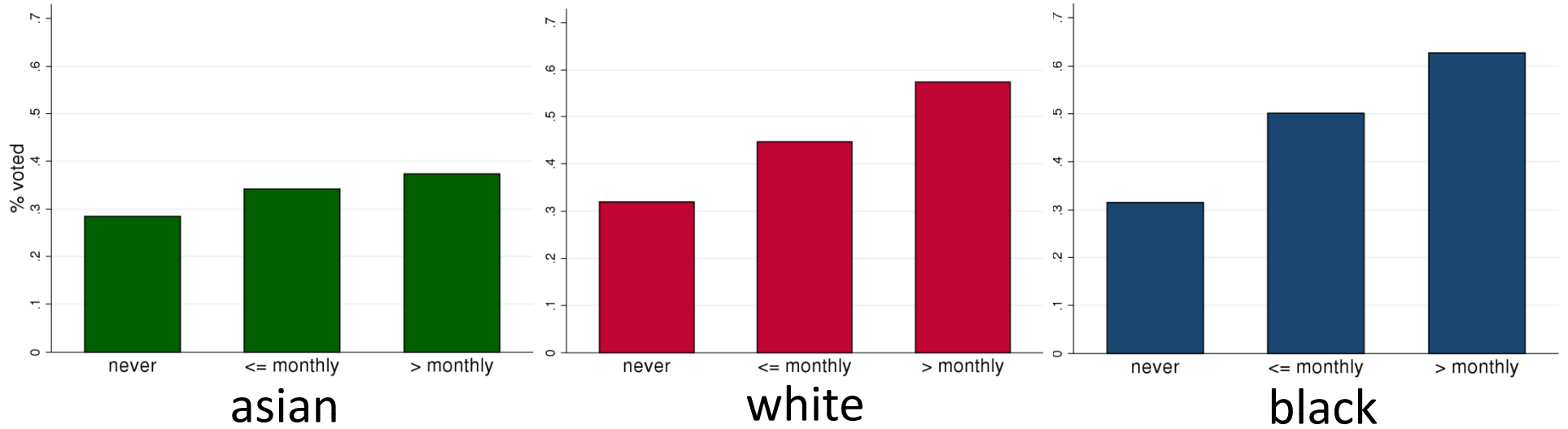


3R, 3.5R, 4R, 5R  
(N = 1200)

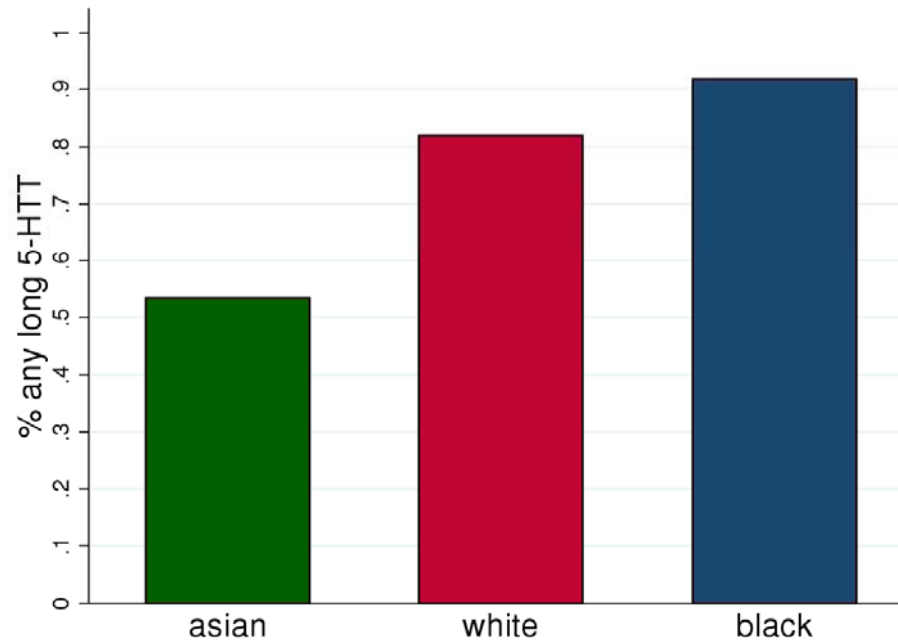


2R  
(N = 12)

## % voted by church attendance

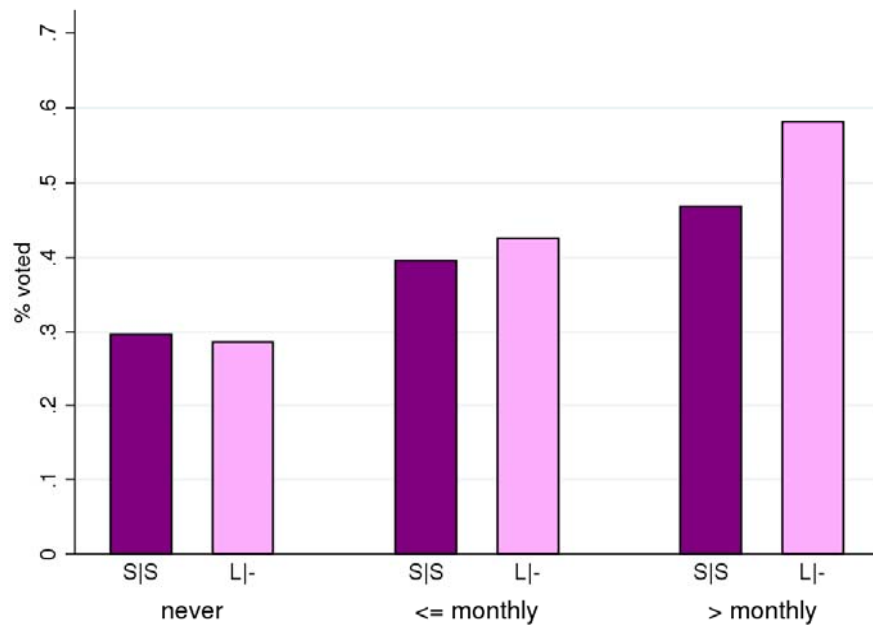


## % "long" 5-HTT by self-identified race

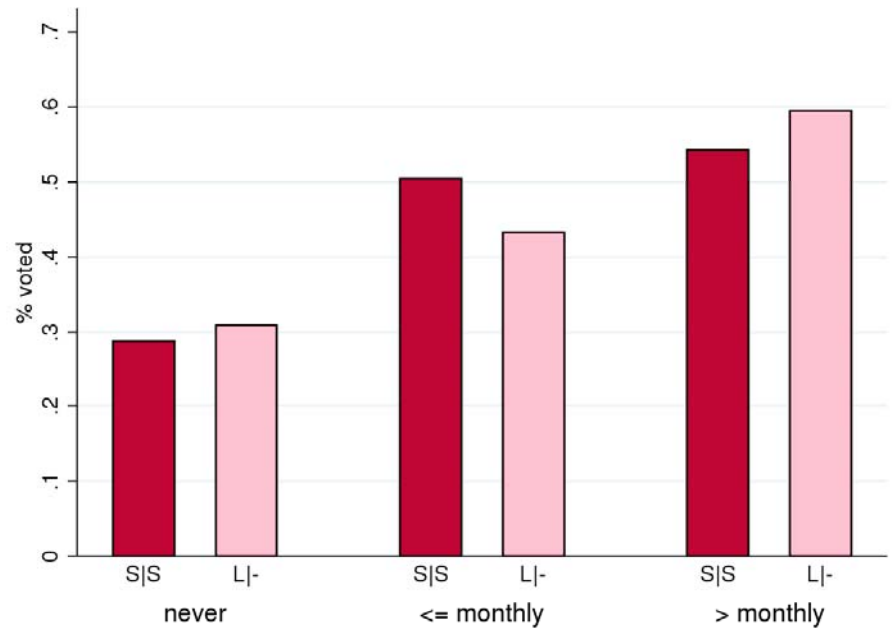




# % voted by church attendance and presence of “long” variant of 5-HTT



all



white

most environmental *moderators* of interest to  
social scientists are also commonly studied as *outcomes*

## Predictors of Early Grade Retention Among Children in the United States

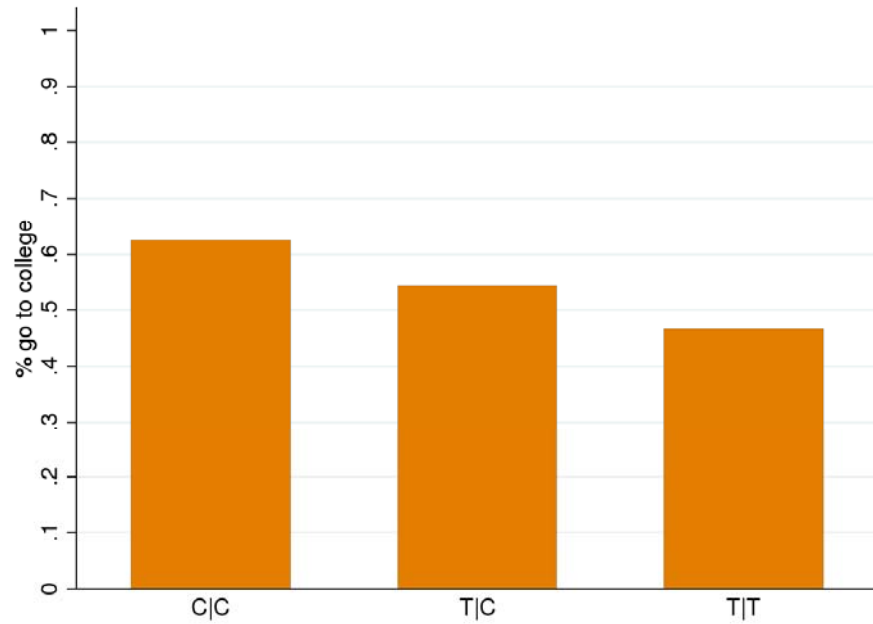
Robert S. Byrd, MD and Michael L. Weitzman, MD

## Associations of Childhood Religious Attendance, Family Structure, and Nonmarital Fertility Across Cohorts

CHRISTOPHER WILDEMAN *University of Michigan*

CHRISTINE PERCHESKI *Harvard University\**

*TaqIA ANKK1* and Biological Parents'  
Continuing Education Beyond High School  
Add Health (Whites, Wave 1)



Add Health respondents'  
fathers



Add Health respondents

**Interaction Between the Serotonin  
Transporter Gene (5-HTTLPR),  
Stressful Life Events, and Risk of Depression**

A Meta-analysis

*JAMA, 2009*

**Genetic Sensitivity to the Environment: The Case of the  
Serotonin Transporter Gene and Its Implications for  
Studying Complex Diseases and Traits**

*Am J Psychiatry, 2010*

**The Serotonin Transporter Promoter Variant  
(5-HTTLPR), Stress, and Depression  
Meta-analysis Revisited**

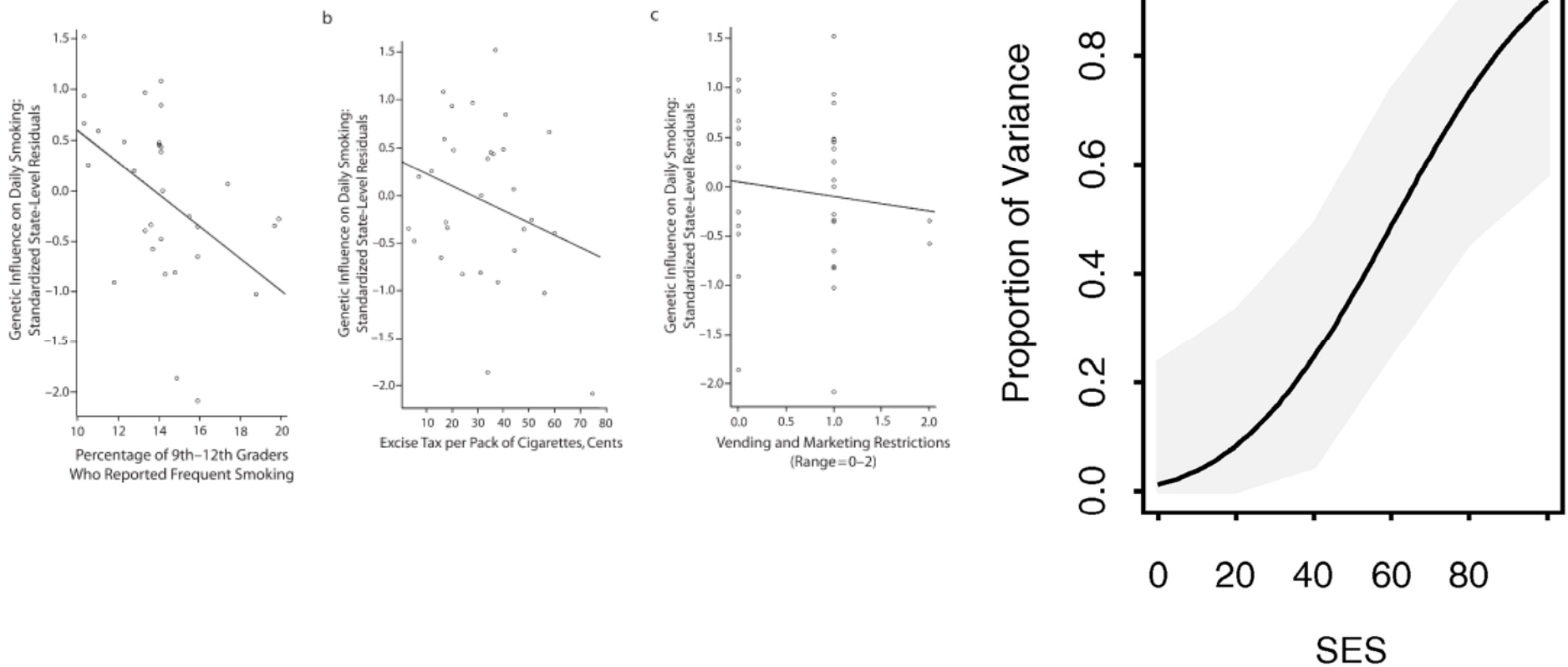
*Evidence of Genetic Moderation*

*Arch Gen Psychiatry, 2011*

**A Critical Review of the First 10 Years of Candidate  
Gene-by-Environment Interaction Research in Psychiatry**

*Am J Psychiatry, 2011*

# Examples of Heritability Estimates Differing over Within-Sample Gro

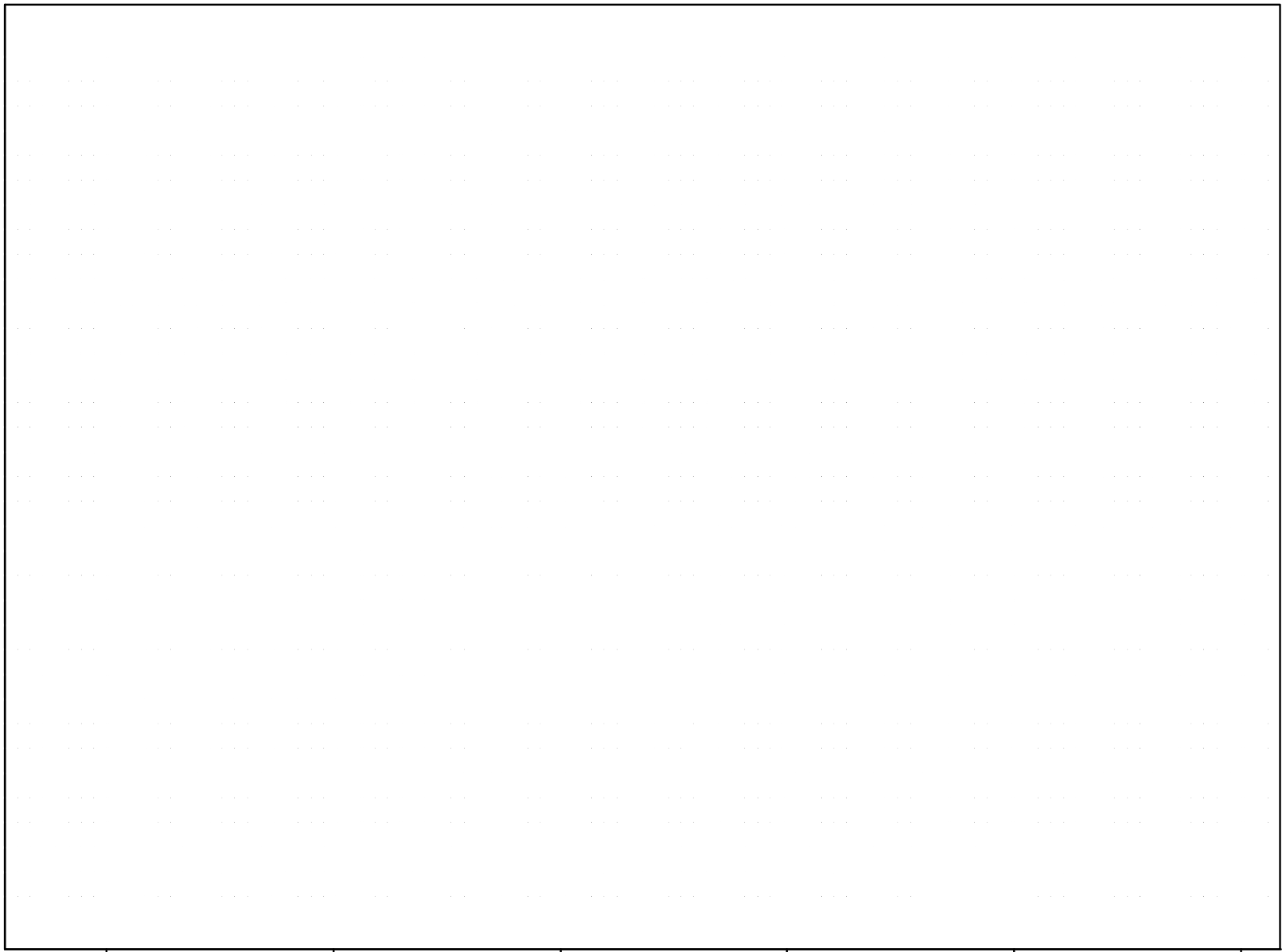


Boardman et al. 2009 State Level Moderation of Genetic Tendencies to Smoke. *Am J Pub Health*;  
Turkheimer et al. 2003, "Socioeconomic status modifies heritability of IQ in young children" *Psy Sci*

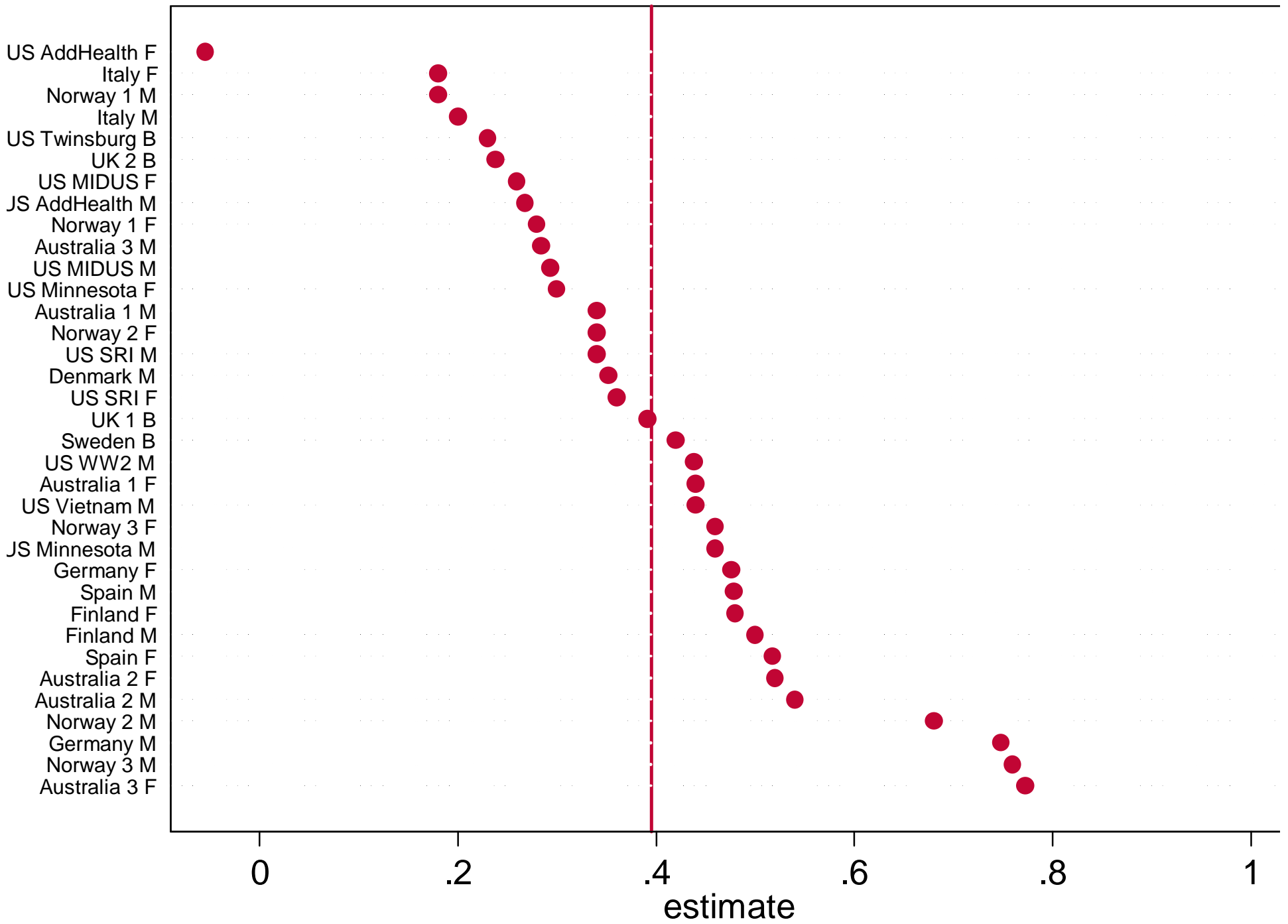
## why collect MZ and DZ correlations for educational attainment?

- sibling correlations of attainments have history of being used as indicators of social mobility
- heritability has been suggested as indicator of meritocracy of society
- heritability of realized abilities and attainments has been posited to increase in more advantaged environments

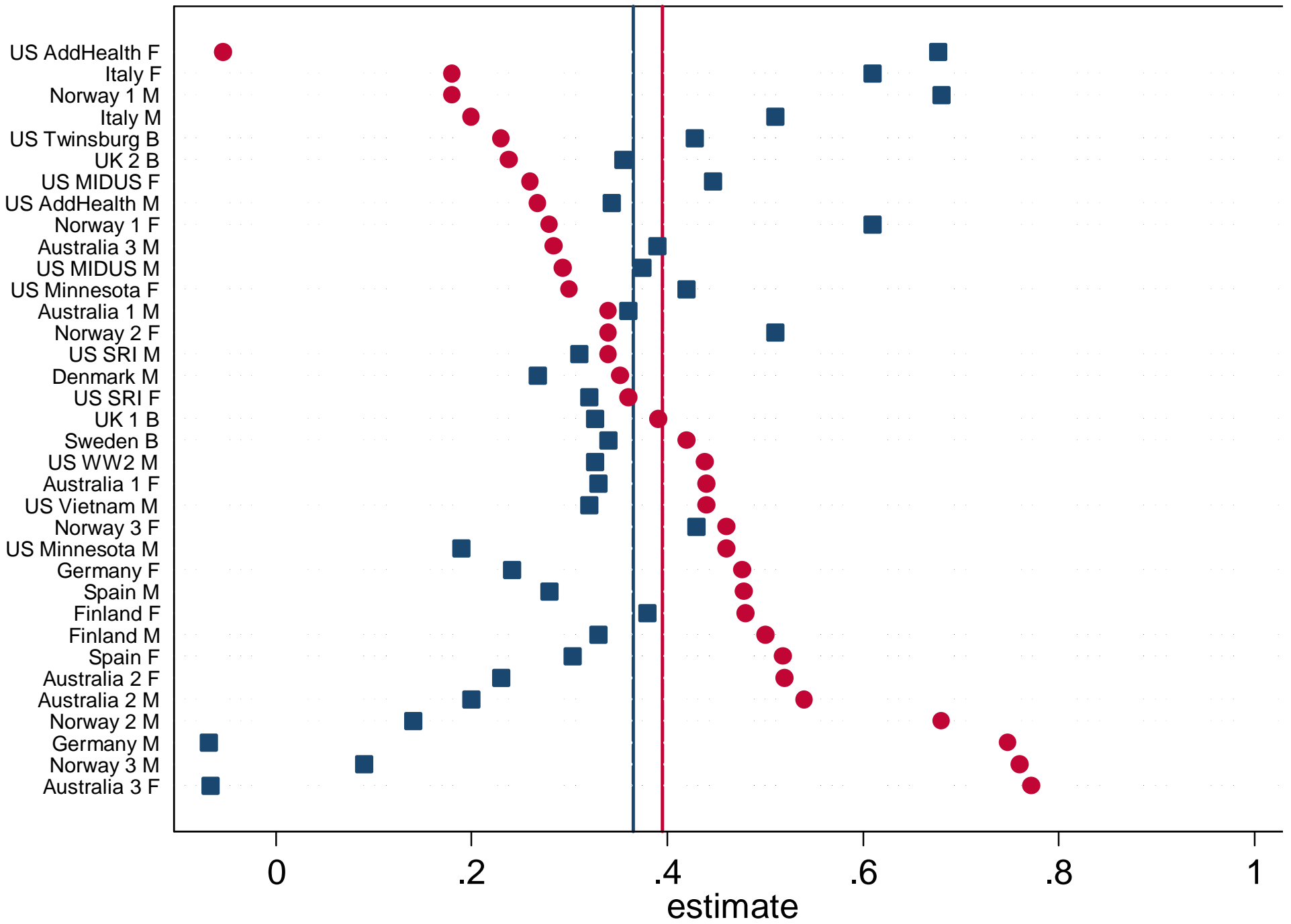
US AddHealth F  
Italy F  
Norway 1 M  
Italy M  
US Twinsburg B  
UK 2 B  
US MIDUS F  
US AddHealth M  
Norway 1 F  
Australia 3 M  
US MIDUS M  
US Minnesota F  
Australia 1 M  
Norway 2 F  
US SRI M  
Denmark M  
US SRI F  
UK 1 B  
Sweden B  
US WW2 M  
Australia 1 F  
US Vietnam M  
Norway 3 F  
US Minnesota M  
Germany F  
Spain M  
Finland F  
Finland M  
Spain F  
Australia 2 F  
Australia 2 M  
Norway 2 M  
Germany M  
Norway 3 M  
Australia 3 F

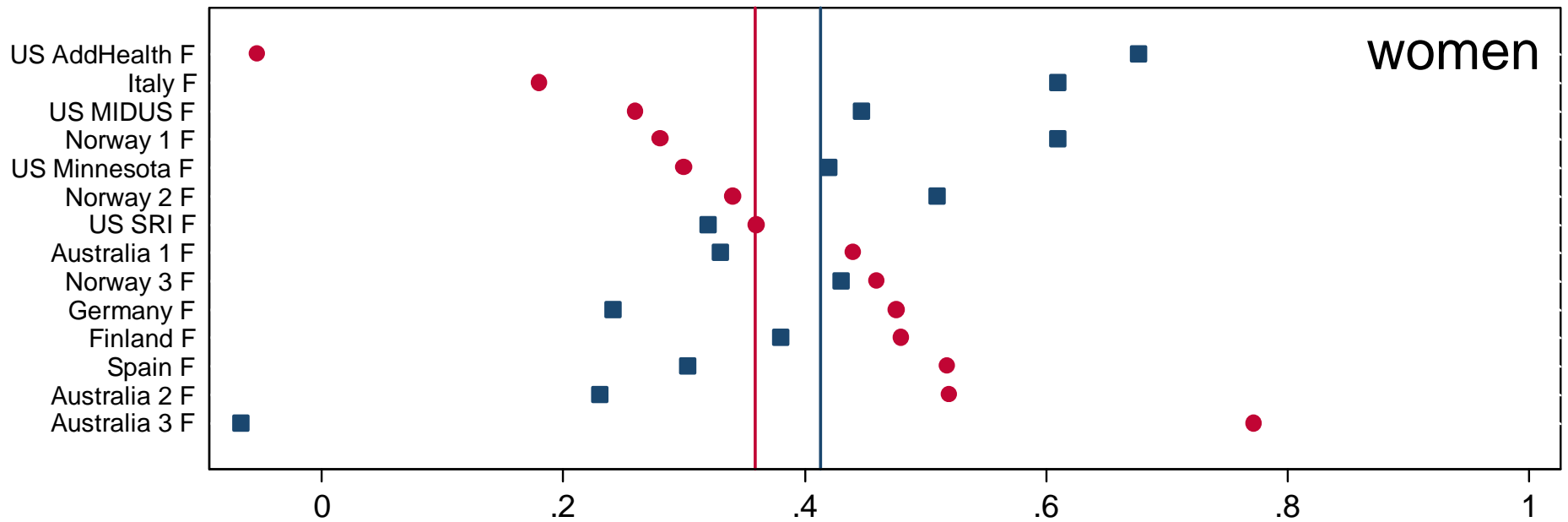
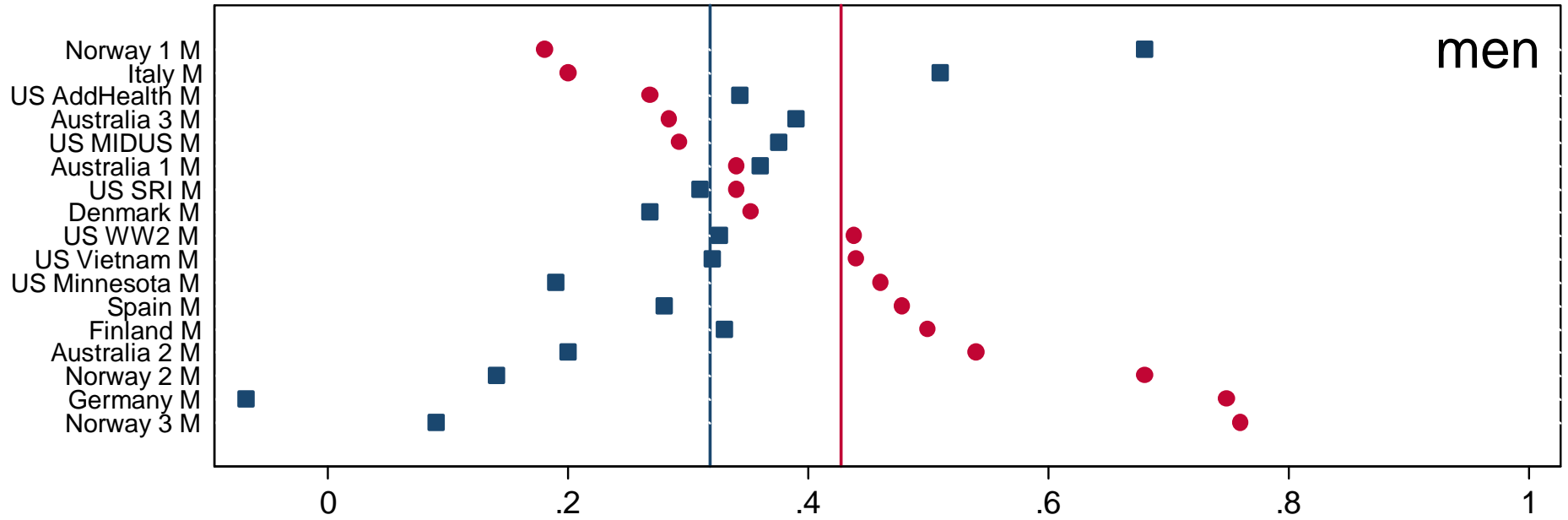


0 .2 .4 .6 .8 1  
estimate









## results from meta-analysis of educational attainment in twin samples

- “shared environment” component nearly as large as heritability
- heritability lower ( $\sim .07$ ) and shared environment higher ( $\sim .10$ ) in female subsamples
- heritability higher ( $\sim .09$ ) and shared environment lower ( $.10$ ) in younger cohorts
- more heterogeneity in estimates in Scandinavian vs. US samples

# upshot

- Diversity of samples in consortium possible detriment in finding loci
- Risk scores and cumulative measures provide way this diversity may address questions about *social* processes
- Moderation across samples or broad subgroups can be informative at this stage without being causally decisive