

# Unpacking the Genetics of Birth Weight: Evidence from a Genotyped Panel of Mothers and Children

**SAM TREJO**



# **IS BIOLOGY DESTINY? BIRTH WEIGHT AND LIFE CHANCES**

**DALTON CONLEY**  
*New York University*

**NEIL G. BENNETT**  
*Baruch School of Public Affairs*

**IS BIOLOGY DESTINY?  
BIRTH WEIGHT AND LIFE CHANCES**

**DALTON CONLEY**  
*New York University*

**NEIL G. BENNETT**  
*Baruch School of Public Affairs*

**LOW BIRTH WEIGHT, SOCIAL FACTORS, AND  
DEVELOPMENTAL OUTCOMES AMONG CHILDREN IN  
THE UNITED STATES\***

JASON D. BOARDMAN, DANIEL A. POWERS, YOLANDA C. PADILLA, AND  
ROBERT A. HUMMER

**IS BIOLOGY DESTINY?  
BIRTH WEIGHT AND LIFE CHANCES**

**DALTON CONLEY**  
*New York University*

**NEIL G. BENNETT**  
*Baruch School of Public Affairs*

**LOW BIRTH WEIGHT, SOCIAL FACTORS, AND  
DEVELOPMENTAL OUTCOMES AMONG CHILDREN IN  
THE UNITED STATES\***

JASON D. BOARDMAN, DANIEL A. POWERS, YOLANDA C. PADILLA, AND  
ROBERT A. HUMMER

**RETURNS TO BIRTHWEIGHT**

Jere R. Behrman and Mark R. Rosenzweig\*

**IS BIOLOGY DESTINY?  
BIRTH WEIGHT AND LIFE CHANCES**

**DALTON CONLEY**  
*New York University*

**NEIL G. BENNETT**  
*Baruch School of Public Affairs*

**LOW BIRTH WEIGHT, SOCIAL FACTORS, AND  
DEVELOPMENTAL OUTCOMES AMONG CHILDREN IN  
THE UNITED STATES\***

JASON D. BOARDMAN, DANIEL A. POWERS, YOLANDA C. PADILLA, AND  
ROBERT A. HUMMER

**RETURNS TO BIRTHWEIGHT**

Jere R. Behrman and Mark R. Rosenzweig\*

**THE COSTS OF LOW BIRTH WEIGHT\***

DOUGLAS ALMOND  
KENNETH Y. CHAY  
DAVID S. LEE

**IS BIOLOGY DESTINY?  
BIRTH WEIGHT AND LIFE CHANCES**

**DALTON CONLEY**  
*New York University*

**NEIL G. BENNETT**  
*Baruch School of Public Affairs*

**LOW BIRTH WEIGHT, SOCIAL FACTORS, AND  
DEVELOPMENTAL OUTCOMES AMONG CHILDREN IN  
THE UNITED STATES\***

**RETURNS TO BIRTHWEIGHT**

**Jere R. Behrman and Mark R. Rosenzweig\***

**FROM THE CRADLE TO THE LABOR MARKET? THE  
EFFECT OF BIRTH WEIGHT ON ADULT OUTCOMES\***

**SANDRA E. BLACK  
PAUL J. DEVEREUX  
KJELL G. SALVANES**

**JASON D. BOARDMAN, DANIEL A. POWERS, YOLANDA C. PADILLA, AND  
ROBERT A. HUMMER**

**THE COSTS OF LOW BIRTH WEIGHT\***

**DOUGLAS ALMOND  
KENNETH Y. CHAY  
DAVID S. LEE**

## IS BIOLOGY DESTINY? BIRTH WEIGHT AND LIFE CHANCES

DALTON CONLEY  
*New York University*

NEIL G. BENNETT  
*Baruch School of Public Affairs*

## LOW BIRTH WEIGHT, SOCIAL FACTORS, AND DEVELOPMENTAL OUTCOMES AMONG CHILDREN IN THE UNITED STATES\*

JASON D. BOARDMAN, DANIEL A. POWERS, YOLANDA C. PADILLA, AND  
ROBERT A. HUMMER

## RETURNS TO BIRTHWEIGHT

Jere R. Behrman and Mark R. Rosenzweig\*

FROM THE CRADLE TO THE LABOR MARKET? THE  
EFFECT OF BIRTH WEIGHT ON ADULT OUTCOMES\*

SANDRA E. BLACK  
PAUL J. DEVEREUX  
KJELL G. SALVANES

THE COSTS OF LOW BIRTH WEIGHT\*

DOUGLAS ALMOND  
KENNETH Y. CHAY  
DAVID S. LEE

---

**Short-, Medium-, and Long-Term  
Consequences of Poor Infant Health**  
An Analysis Using Siblings and Twins

---

Philip Oreopoulos  
Mark Stabile  
Randy Walld  
Leslie L. Roos

## IS BIOLOGY DESTINY? BIRTH WEIGHT AND LIFE CHANCES

DALTON CONLEY  
*New York University*

NEIL G. BENNETT  
*Baruch School of Public Affairs*

## LOW BIRTH WEIGHT, SOCIAL FACTORS, AND DEVELOPMENTAL OUTCOMES AMONG CHILDREN IN THE UNITED STATES\*

JASON D. BOARDMAN, DANIEL A. POWERS, YOLANDA C. PADILLA, AND  
ROBERT A. HUMMER

## RETURNS TO BIRTHWEIGHT

Jere R. Behrman and Mark R. Rosenzweig\*

FROM THE CRADLE TO THE LABOR MARKET? THE  
EFFECT OF BIRTH WEIGHT ON ADULT OUTCOMES\*

SANDRA E. BLACK  
PAUL J. DEVEREUX  
KJELL G. SALVANES

THE COSTS OF LOW BIRTH WEIGHT\*

DOUGLAS ALMOND  
KENNETH Y. CHAY  
DAVID S. LEE

---

**Short-, Medium-, and Long-Term  
Consequences of Poor Infant Health**  
An Analysis Using Siblings and Twins

Separated at Girth:  
US Twin Estimates of the Effects of Birth Weight†

By HEATHER ROYER\*

---

Philip Oreopoulos  
Mark Stabile  
Randy Walld  
Leslie L. Roos



## IS BIOLOGY DESTINY? BIRTH WEIGHT AND LIFE CHANCES

DALTON CONLEY  
*New York University*

NEIL G. BENNETT  
*Baruch School of Public Affairs*

## LOW BIRTH WEIGHT, SOCIAL FACTORS, AND DEVELOPMENTAL OUTCOMES AMONG CHILDREN IN THE UNITED STATES\*

JASON D. BOARDMAN, DANIEL A. POWERS, YOLANDA C. PADILLA, AND  
ROBERT A. HUMMER

## RETURNS TO BIRTHWEIGHT

Jere R. Behrman and Mark R. Rosenzweig\*

FROM THE CRADLE TO THE LABOR MARKET? THE  
EFFECT OF BIRTH WEIGHT ON ADULT OUTCOMES\*

SANDRA E. BLACK  
PAUL J. DEVEREUX  
KJELL G. SALVANES

THE COSTS OF LOW BIRTH WEIGHT\*

DOUGLAS ALMOND  
KENNETH Y. CHAY  
DAVID S. LEE

---

**Short-, Medium-, and Long-Term  
Consequences of Poor Infant Health**  
An Analysis Using Siblings and Twins

Separated at Girth:  
US Twin Estimates of the Effects of Birth Weight<sup>†</sup>

By HEATHER ROYER\*

---

Philip Oreopoulos  
Mark Stabile<sup>†</sup>  
Randy Walld  
Leslie L. Roos

The effect of birthweight on childhood  
cognitive development in a middle-income  
country

Florencia Torche<sup>1\*</sup> and Ghislaine Echevarría<sup>2</sup>

## IS BIOLOGY DESTINY? BIRTH WEIGHT AND LIFE CHANCES

DALTON CONLEY  
*New York University*

NEIL G. BENNETT  
*Baruch School of Public Affairs*

## LOW BIRTH WEIGHT, SOCIAL FACTORS, AND DEVELOPMENTAL OUTCOMES AMONG CHILDREN IN THE UNITED STATES\*

JASON D. BOARDMAN, DANIEL A. POWERS, YOLANDA C. PADILLA, AND  
ROBERT A. HUMMER

## RETURNS TO BIRTHWEIGHT

Jere R. Behrman and Mark R. Rosenzweig\*

FROM THE CRADLE TO THE LABOR MARKET? THE  
EFFECT OF BIRTH WEIGHT ON ADULT OUTCOMES\*

SANDRA E. BLACK  
PAUL J. DEVEREUX  
KJELL G. SALVANES

THE COSTS OF LOW BIRTH WEIGHT\*

DOUGLAS ALMOND  
KENNETH Y. CHAY  
DAVID S. LEE

---

**Short-, Medium-, and Long-Term  
Consequences of Poor Infant Health**  
An Analysis Using Siblings and Twins

---

Separated at Girth:

US Twin Estimates of the Effects of Birth Weight†

The Effects of Poor Neonatal Health  
on Children's Cognitive Development† *By* HEATHER ROYER\*

*By* DAVID FIGLIO, JONATHAN GURVAN,  
KRZYSZTOF KARBOWNIK, AND JEFFREY ROTH\*

---

Philip Oreopoulos  
†Mark Stabile  
Randy Walld  
Leslie L. Roos

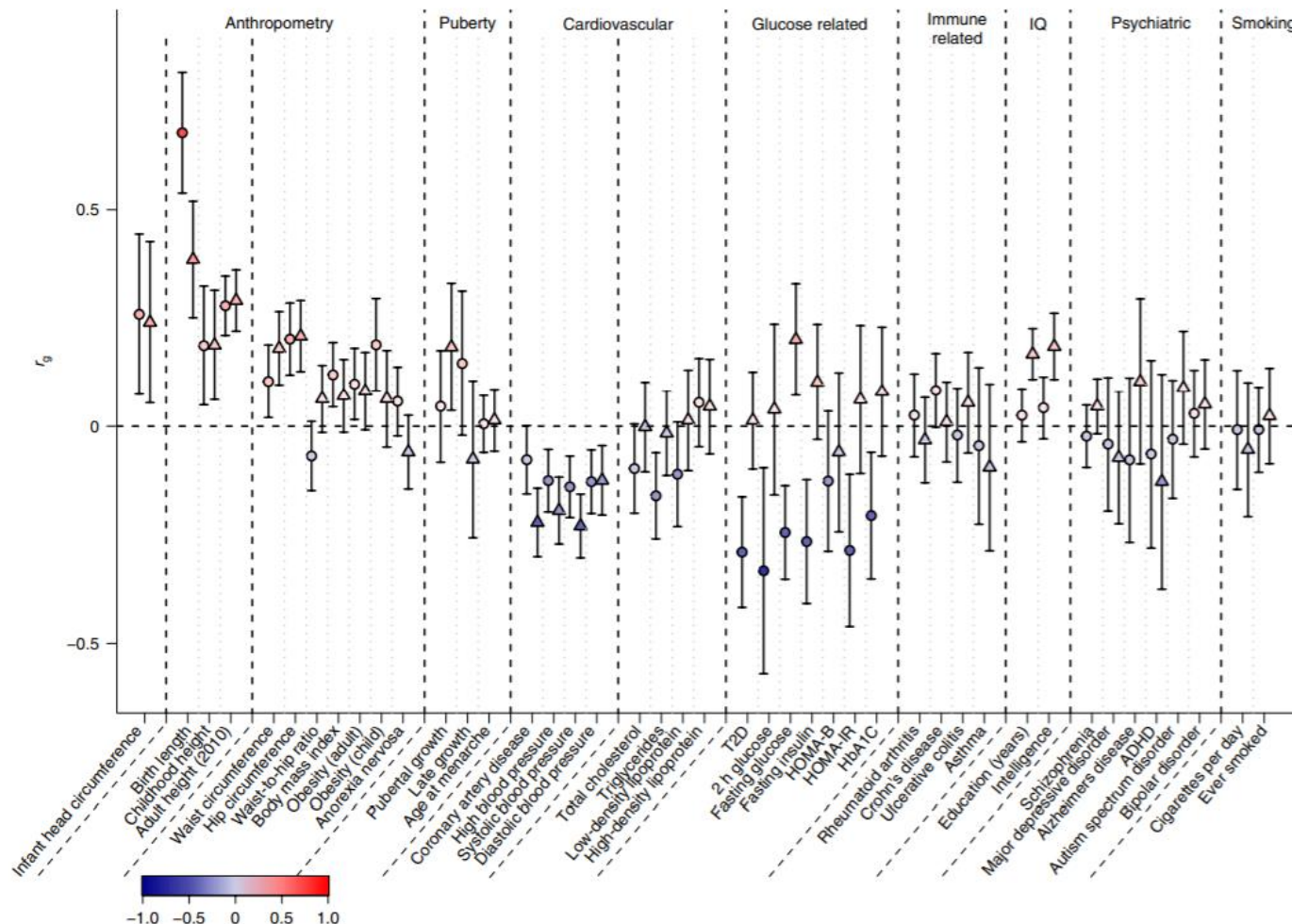
The effect of birthweight on childhood  
cognitive development in a middle-income  
country

Florencia Torche<sup>1\*</sup> and Ghislaine Echevarría<sup>2</sup>

# The Genetics of Birth Weight

- **Warrington et al. 2019** conduct parallel GWAS with N>500K
- Maternal and fetal PGS explain ~2% and 4% of variance, respectively

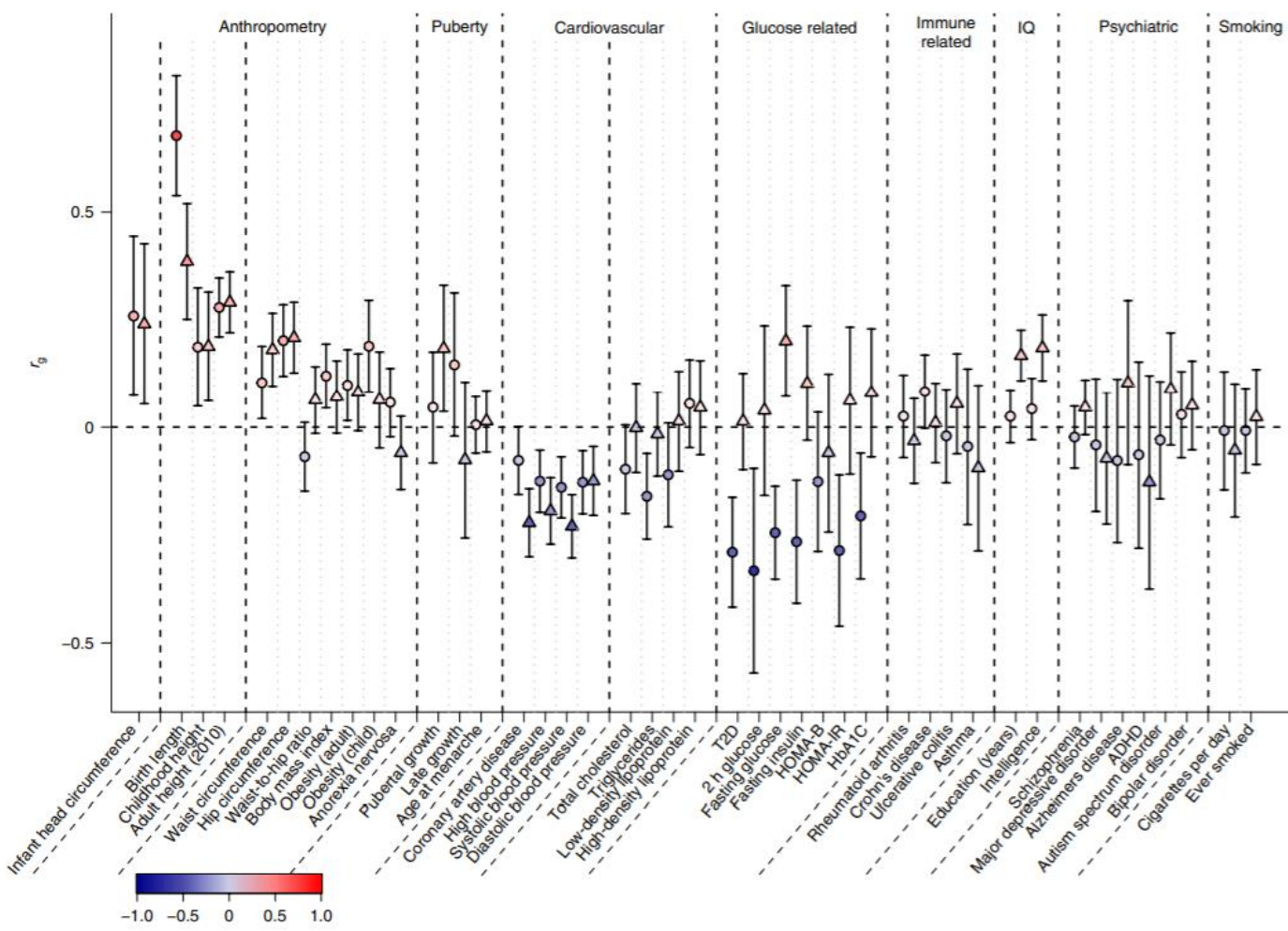
## ARTICLES NATURE GENETICS



# The Genetics of Birth Weight

- **Warrington et al. 2019** conduct parallel GWAS with N>500K
- Maternal and fetal PGS explain ~2% and 4% of variance, respectively

## ARTICLES NATURE GENETICS



Birth Weight	
	X
3.071** (0.317)	3.256* (1.360)
0.0353	0.816
4524	647

# Research Questions

- Genetic factors remain a *black box* in models of birth weight and human development
- Relegated to the error term or differenced out using an identification strategy (i.e. twin fixed-effect)

# Research Questions

- Genetic factors remain a *black box* in models of birth weight and human development
  - Relegated to the error term or differenced out using an identification strategy (i.e. twin fixed-effect)
1. Does a child's birth weight PGS predict other developmental outcomes? Net of observed birth weight?
  2. Do environmental factors moderate the relationship between a child's birth weight PGS and their birth weight?



# Data: Born in Bradford

Child Age

~28 weeks gestation

Birth

4-7 years

## Maternal Intake

Physical Health

Mental Health

Risk Behaviors

Nutrition

Economic Conditions

## Neonatal Records

Birth Weight

Gestational Age

## Biological Samples

Mother Genotype

Child Genotype

## Educational Records

Child Development

Academic Achievement

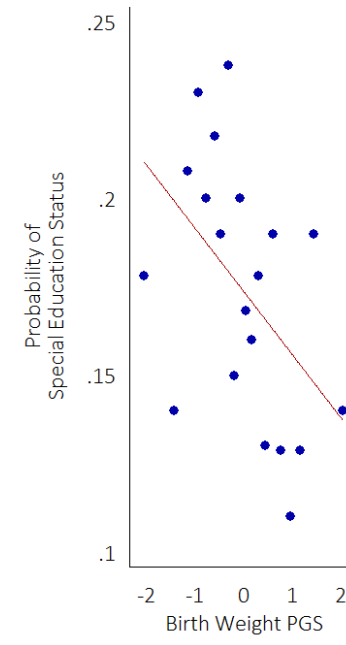
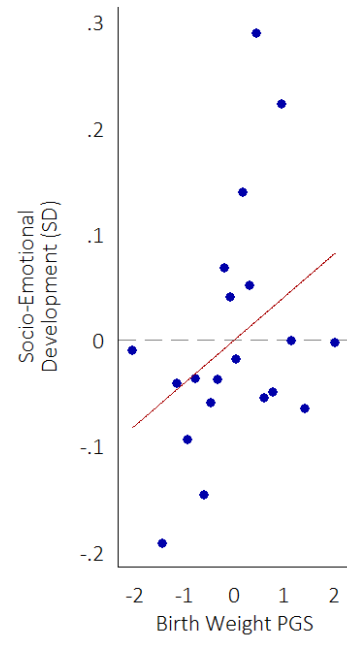
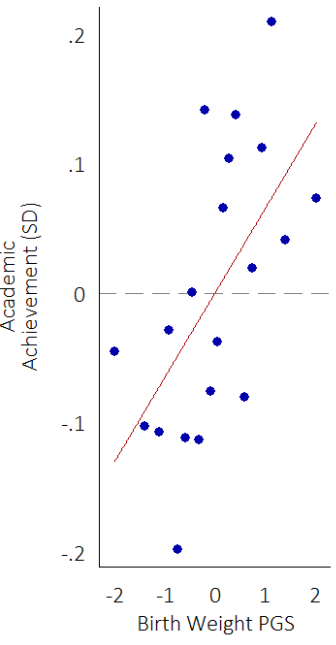
Special Needs

Physical Development



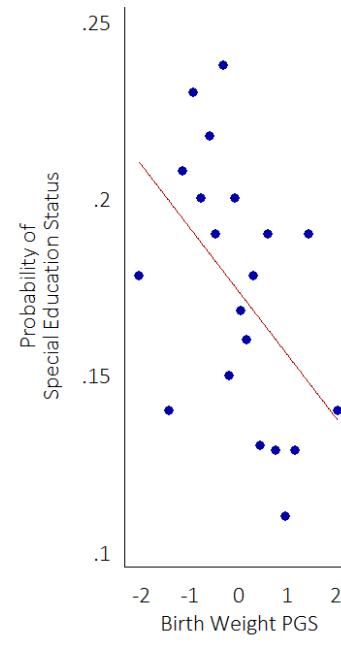
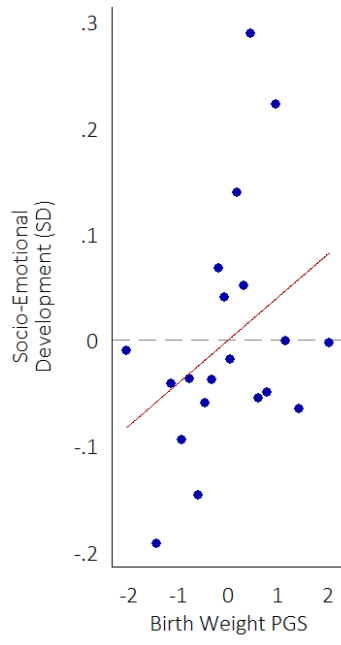
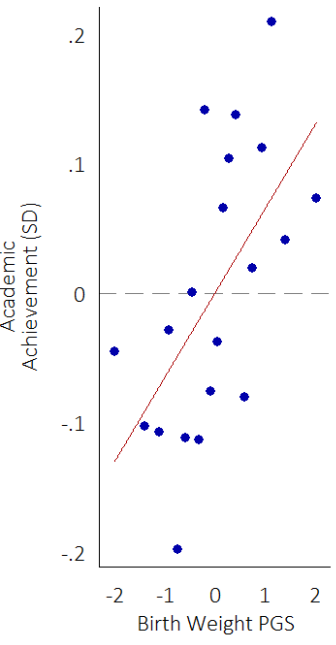
$N \approx 2,000$  (Soon to be 3,000!)

# Findings

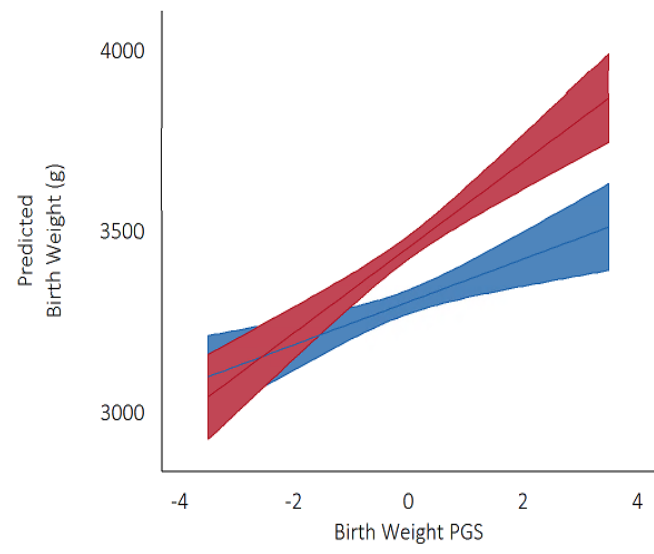




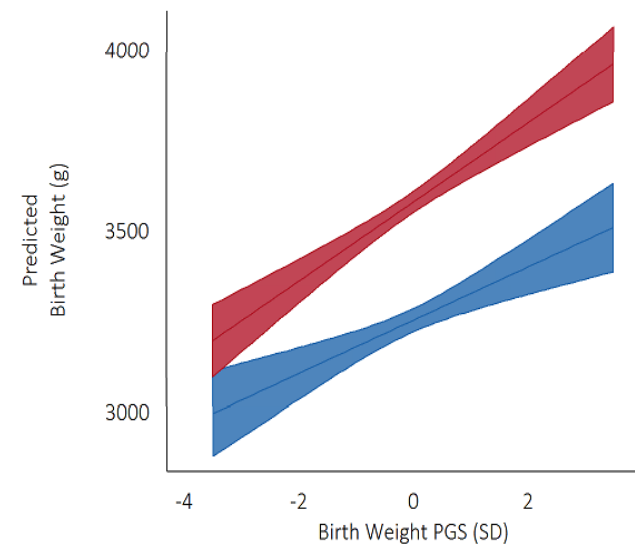
# Findings



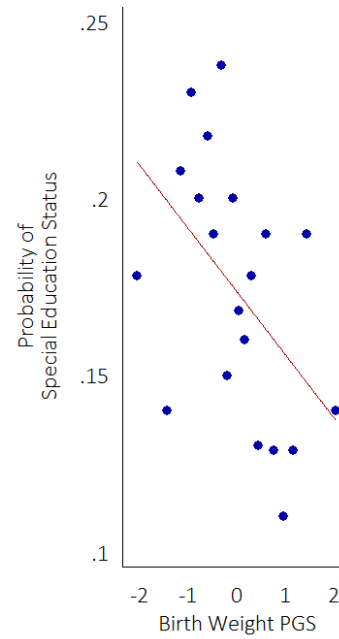
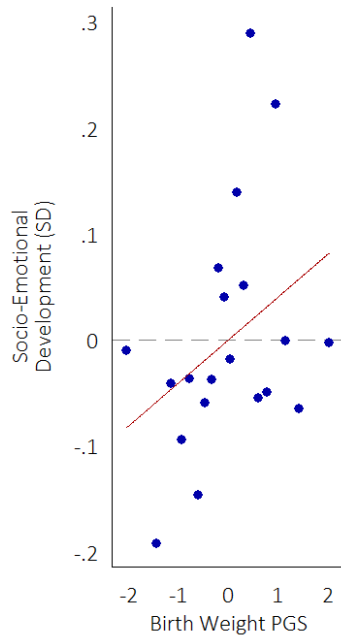
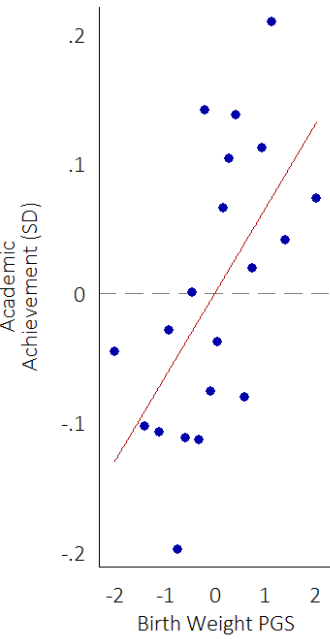
— Low BMI Mother  
— High BMI Mother



— Short Gestation  
— Long Gestation



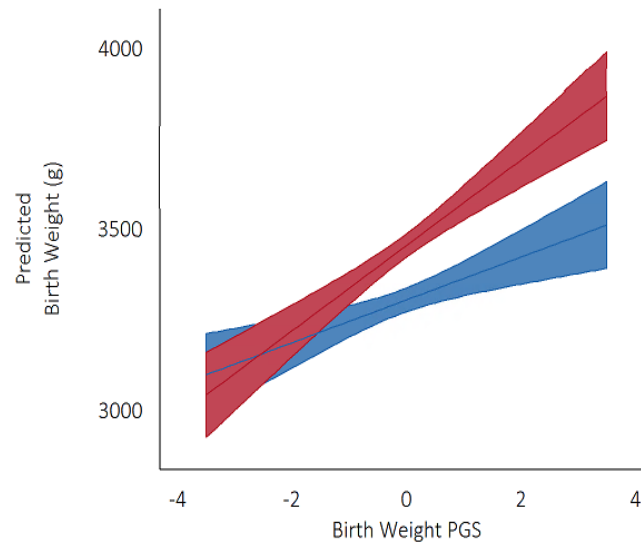
# Findings



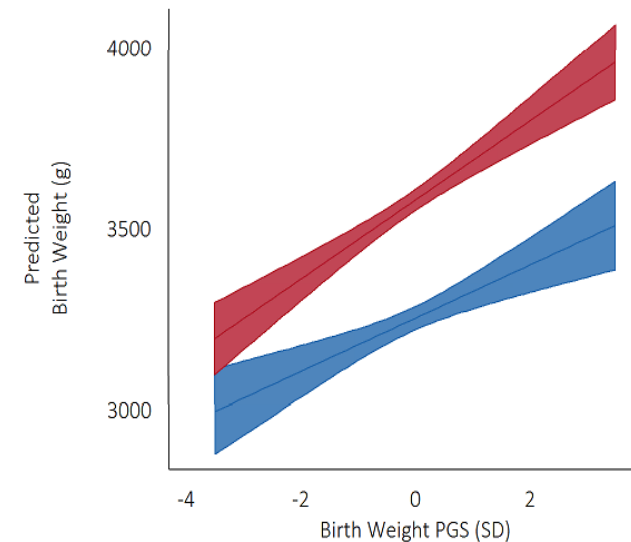
Twin differences in birth weight: The effects of genotype and prenatal environment on neonatal and post-neonatal mortality

Dalton Conley<sup>a</sup>, Kate W. Strully<sup>b,\*</sup>, Neil G. Bennett<sup>c</sup>

— Low BMI Mother  
— High BMI Mother



— Short Gestation  
— Long Gestation



# Preliminary Results and Future Directions

1. Child's birth weight PGS is associated with positive downstream developmental outcomes
2. Suggestive evidence of gene-environment interactions between a child's birth weight PGS and both maternal body mass index and gestational length.

# Preliminary Results and Future Directions

1. Child's birth weight PGS is associated with positive downstream developmental outcomes
2. Suggestive evidence of gene-environment interactions between a child's birth weight PGS and both maternal body mass index and gestational length.

## Future Directions

- Unpacking the maternal birth weight PGS
- What mechanisms mediate the relationship between maternal PGS and child birth weight?
  - Physical health, mental health, health behaviors, etc.

THANK YOU!

samtrejo@stanford.edu