



# Heterogeneity of Treatment Effects: Evidence from Head Start Impact Study

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# Introduction

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- The National Head Start Impact Study (NHSIS)
- Low-income families
- Age 3 cohort & Age 4 cohort
- --> Stage-environment fit

# Research questions

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- How **quantity** and **quality** of center care impact child development?
- How does the impact **vary by age**?

Quantity

# Quantity

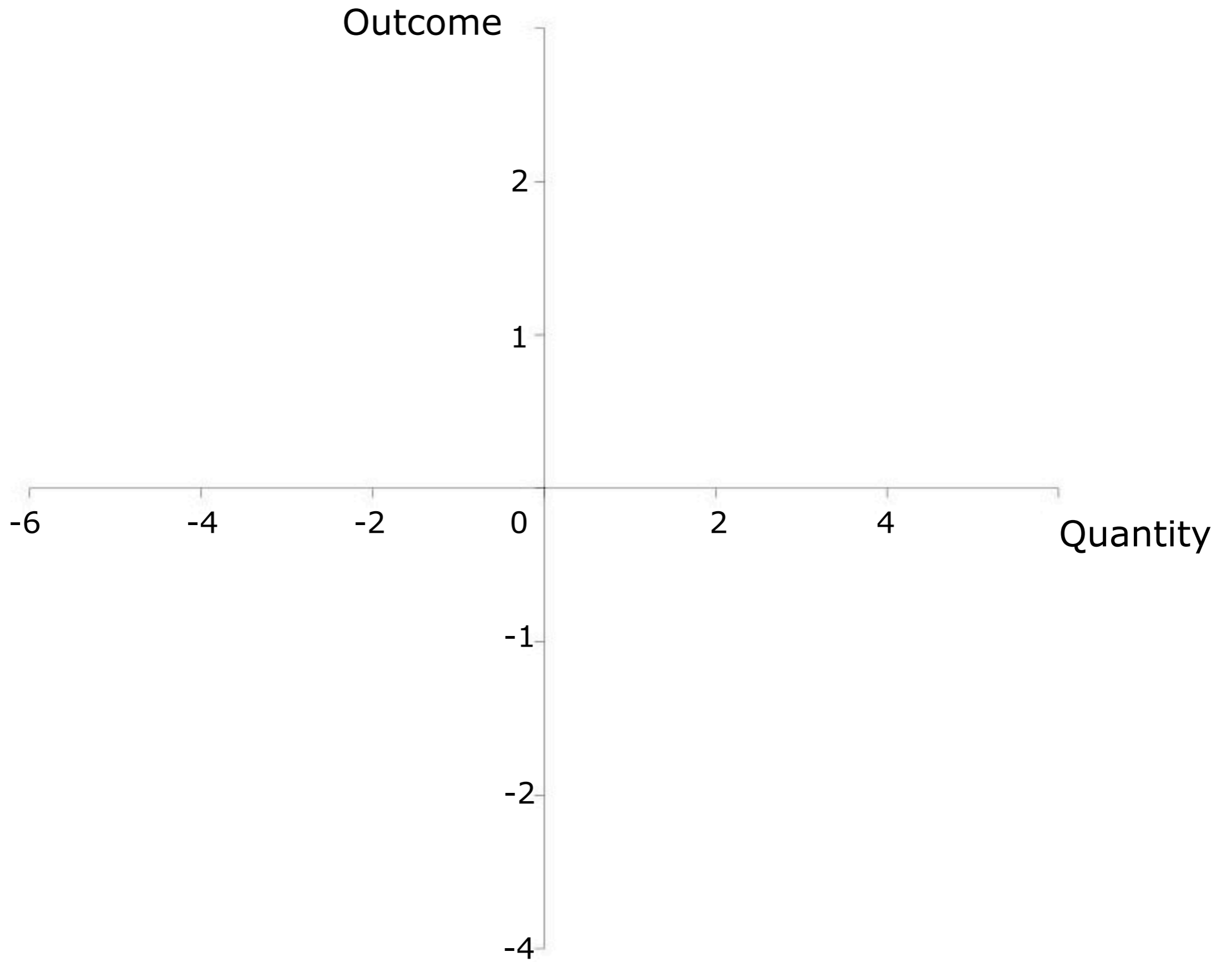
- NICHD (2003): quantity of nonmaternal care
  - more behavioral problems
- Loeb et al. (2005): quantity of center care
  - more academic benefits
  - more behavioral problems
- Causal inference?

# NHSIS

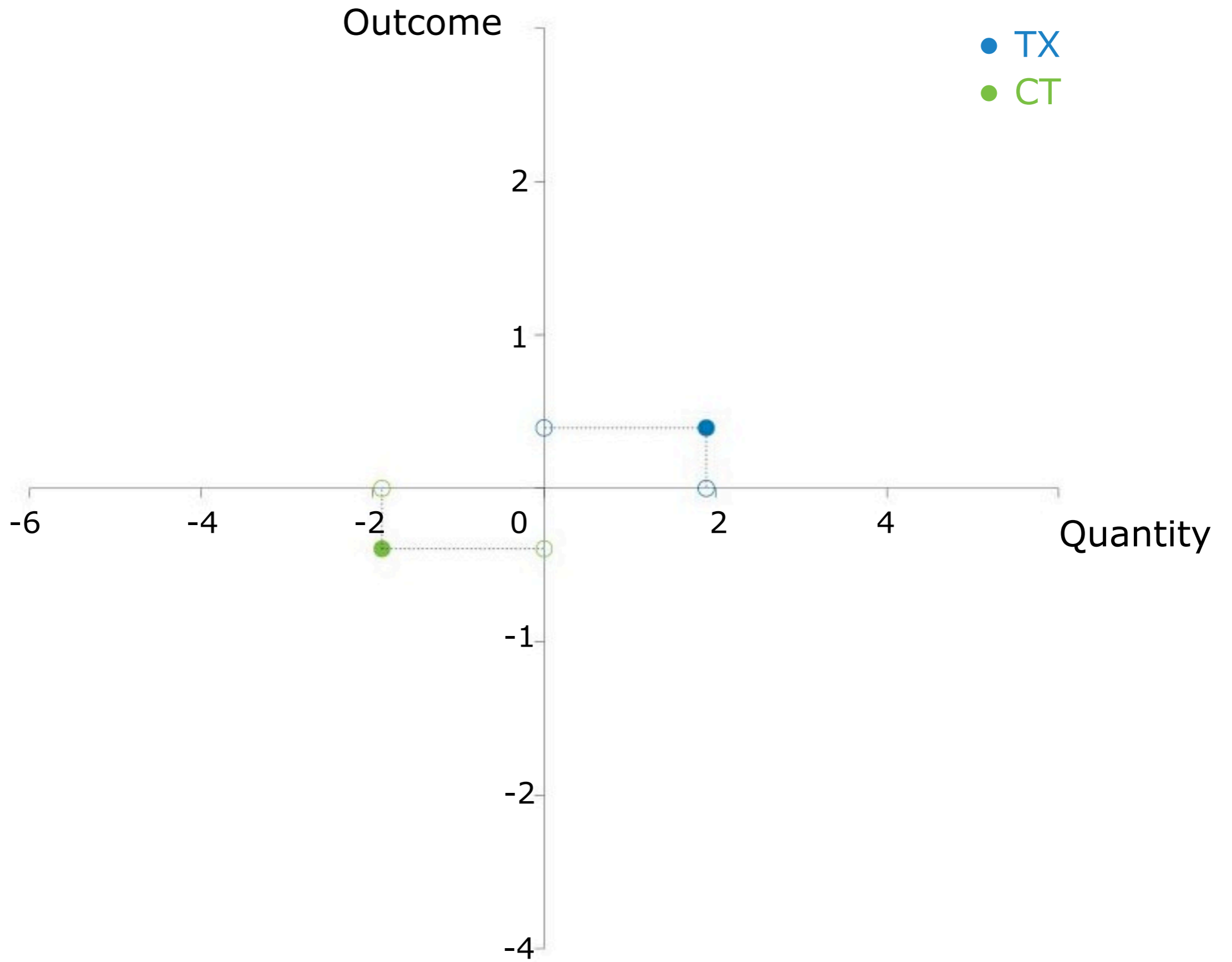
- 4442 Children
- Random assignment within 383 centers

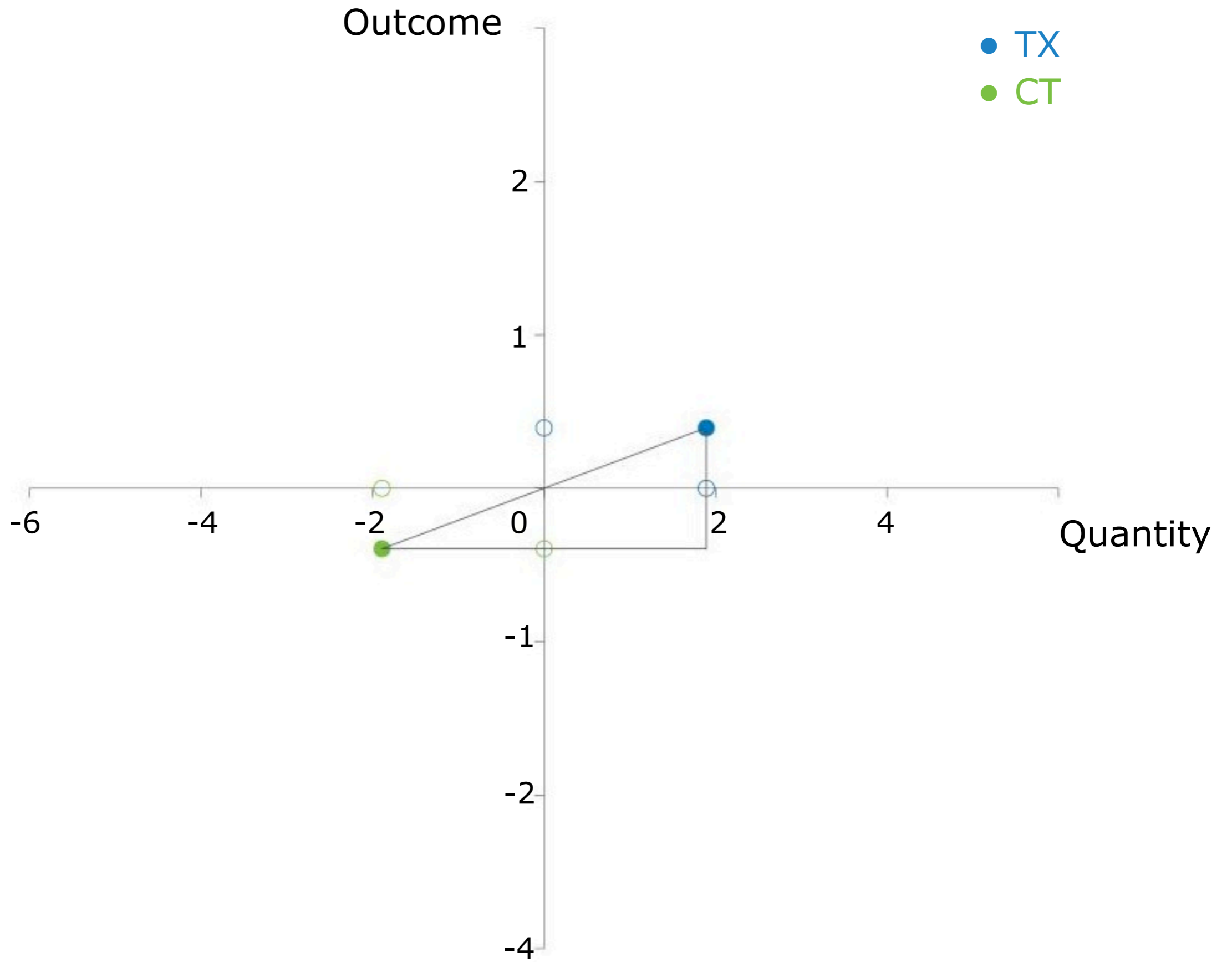
# NHSIS

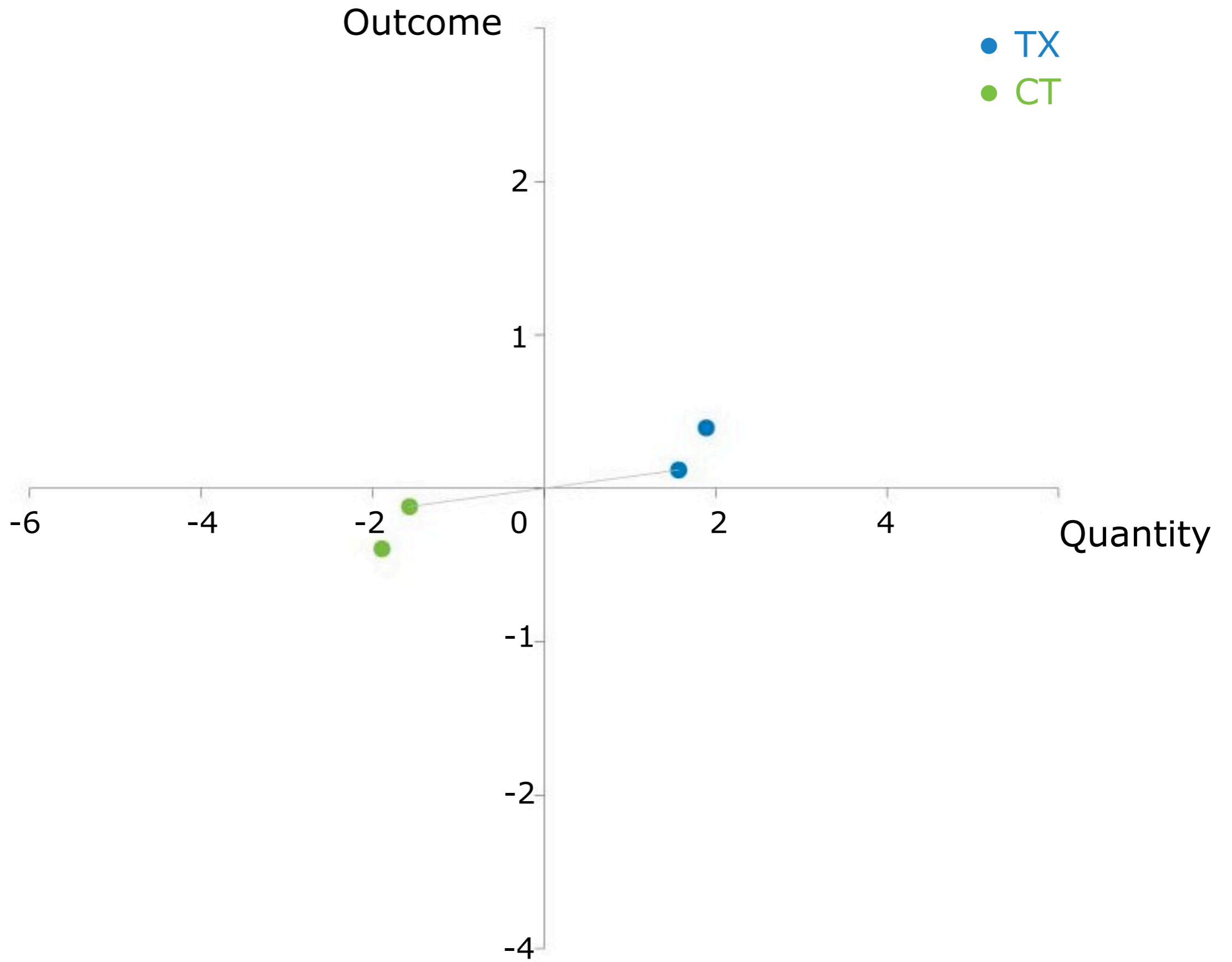
- 4442 Children
- Random assignment within 383 centers
- Hours/day at center care
  - Age 3: 4.6 (2.7) vs. 2.1 (3.2)
  - Age 4: 4.1 (2.5) vs. 2.1 (2.9)
- Instrumental variable approach

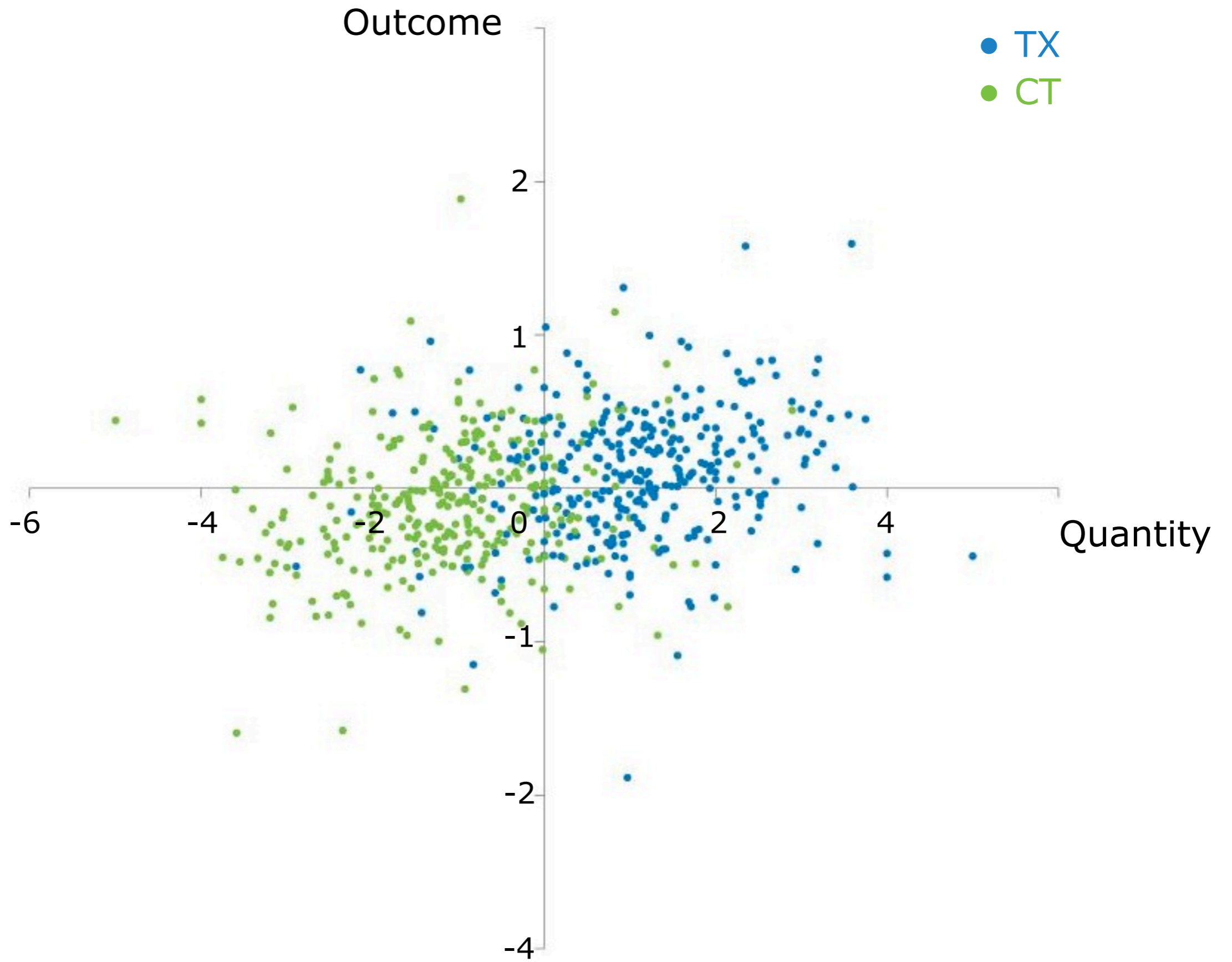


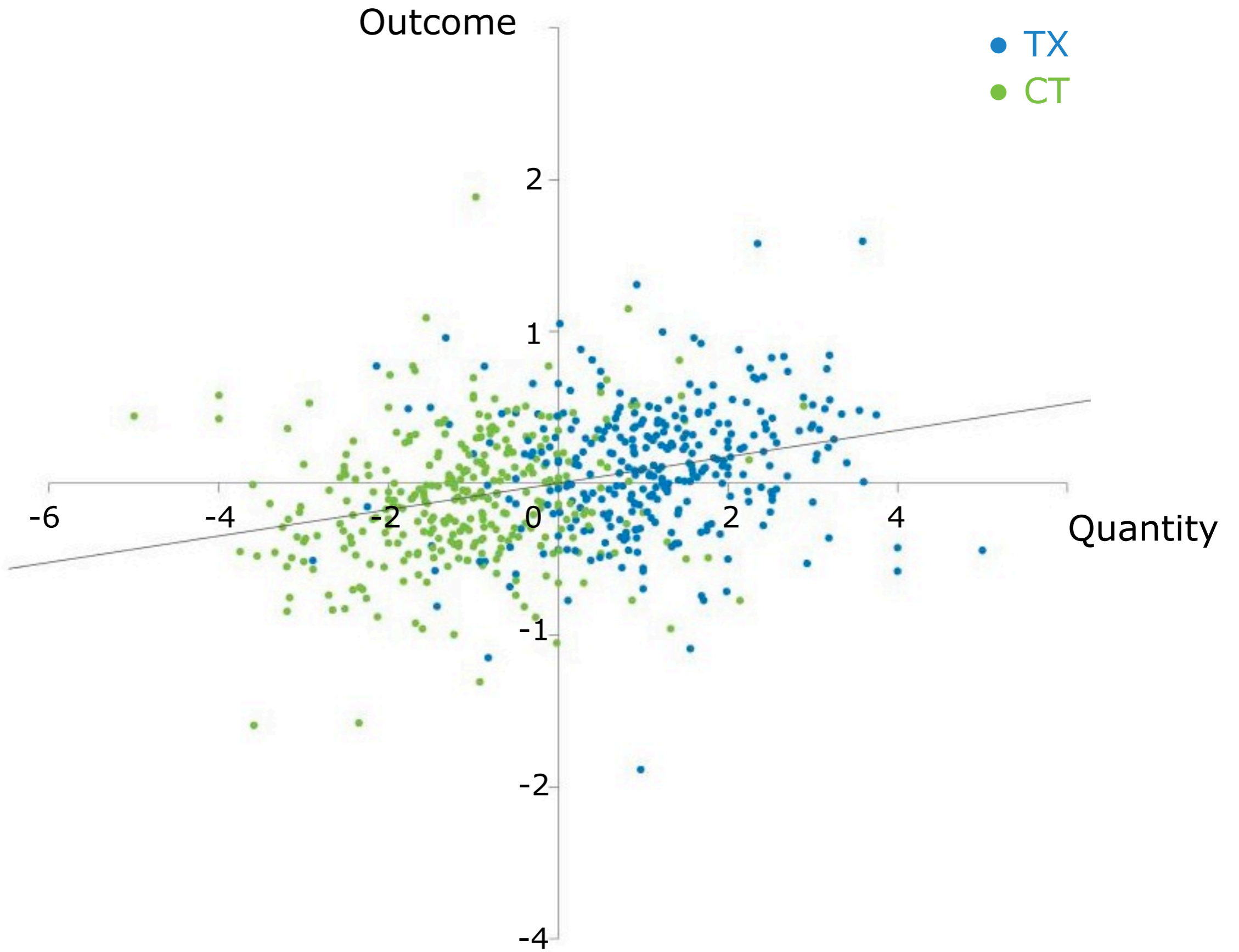












# Identification Strategy

- The Wald estimator

$$\rho = \frac{E[Y_i | TX] - E[Y_i | CT]}{E[Q_i | TX] - E[Q_i | CT]}$$

# Identification Strategy

- First Stage

$$\mathbf{Q} = \boxed{\mathbf{TX} \cdot \mathbf{Center}} \gamma_1 + \mathbf{Center} \gamma_2 + \mathbf{X} \gamma_3 + \boldsymbol{\varepsilon}$$

- Second Stage

$$\mathbf{Y} = \hat{\mathbf{Q}} \beta_1 + \mathbf{Center} \beta_2 + \mathbf{X} \beta_3 + \mathbf{e}$$

# Identification Strategy

- First Stage

$$F \in [4.98, 7.11]$$

$$Q = \mathbf{TX} \cdot \mathbf{Center} \gamma_1 + \mathbf{Center} \gamma_2 + \mathbf{X} \gamma_3 + \boldsymbol{\varepsilon}$$

- Second Stage

$$\mathbf{Y} = \hat{Q} \beta_1 + \mathbf{Center} \beta_2 + \mathbf{X} \beta_3 + \mathbf{e}$$



## Age 3 cohort:

### Estimated effects of **an additional hour/day** at center care

	PPVT	WJ Applied Problems	WJ Letter Words	Behavior problems
OLS	.014* (.007)	.025*** (.007)	.063*** (.007)	-.017* (.007)
IV	.033*** (.010) [.092]	.038*** (.011) [.106]	.081*** (.011) [.227]	-.027* (.011) [-.076]
N	2022	2008	2028	2043

## Age 4 cohort:

### Estimated effects of **an additional hour/day** at center care

	PPVT	WJ Applied Problems	WJ Letter Words	Behavior problems
OLS	.026*** (.007)	.047*** (.010)	.053*** (.009)	-.020* (.009)
IV	.038*** (.010) [.101]	.078*** (.014) [.207]	.075*** (.013) [.199]	-.010 (.013) [-.027]
N	1583	1578	1585	1590

# Robustness check

- Anderson-Rubin statistic
- Stock-Wright LM S statistic
- LIML
- Subset of large centers
- Results are **consistent**

# Further work

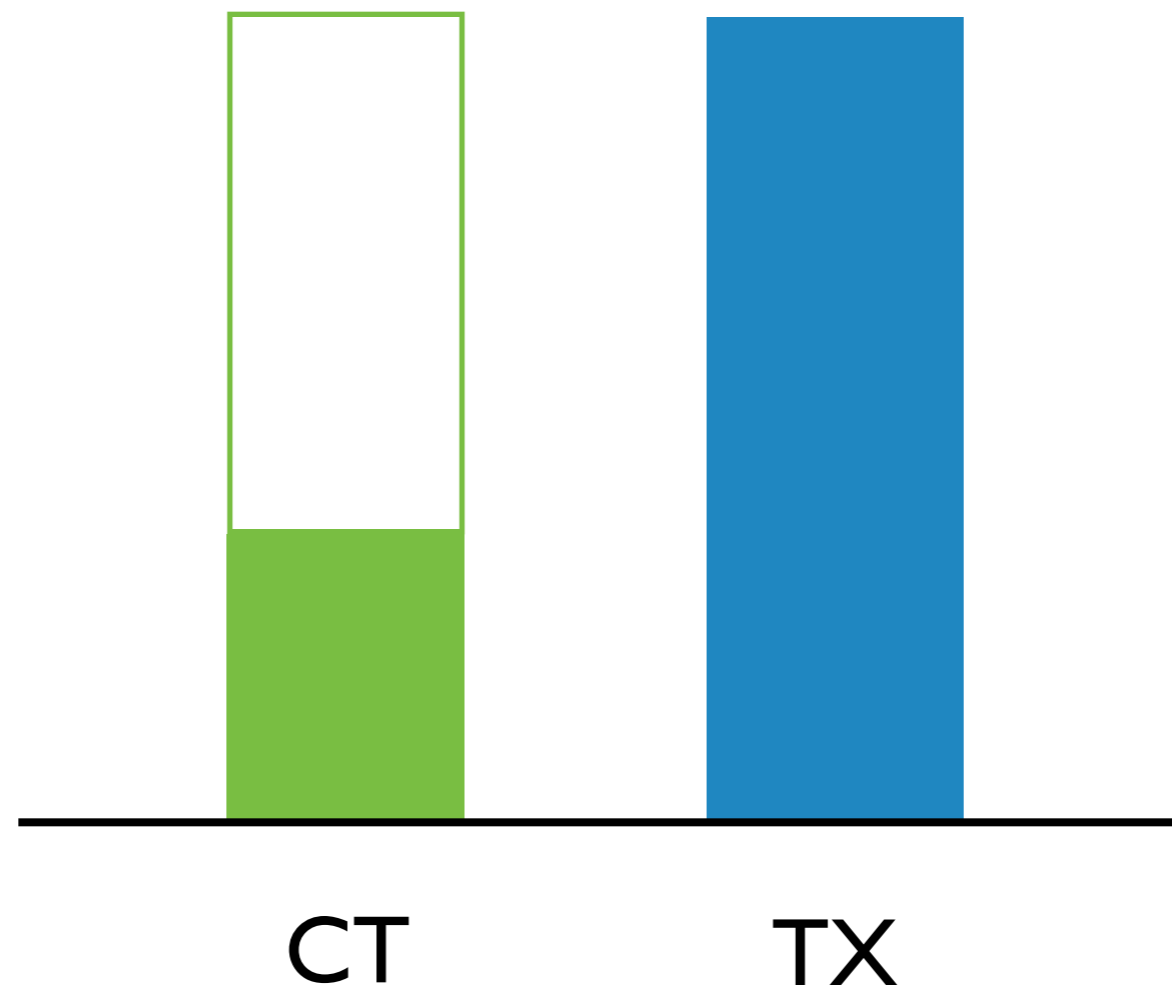
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- Multiple imputation
- Spline regression + IV

Quality

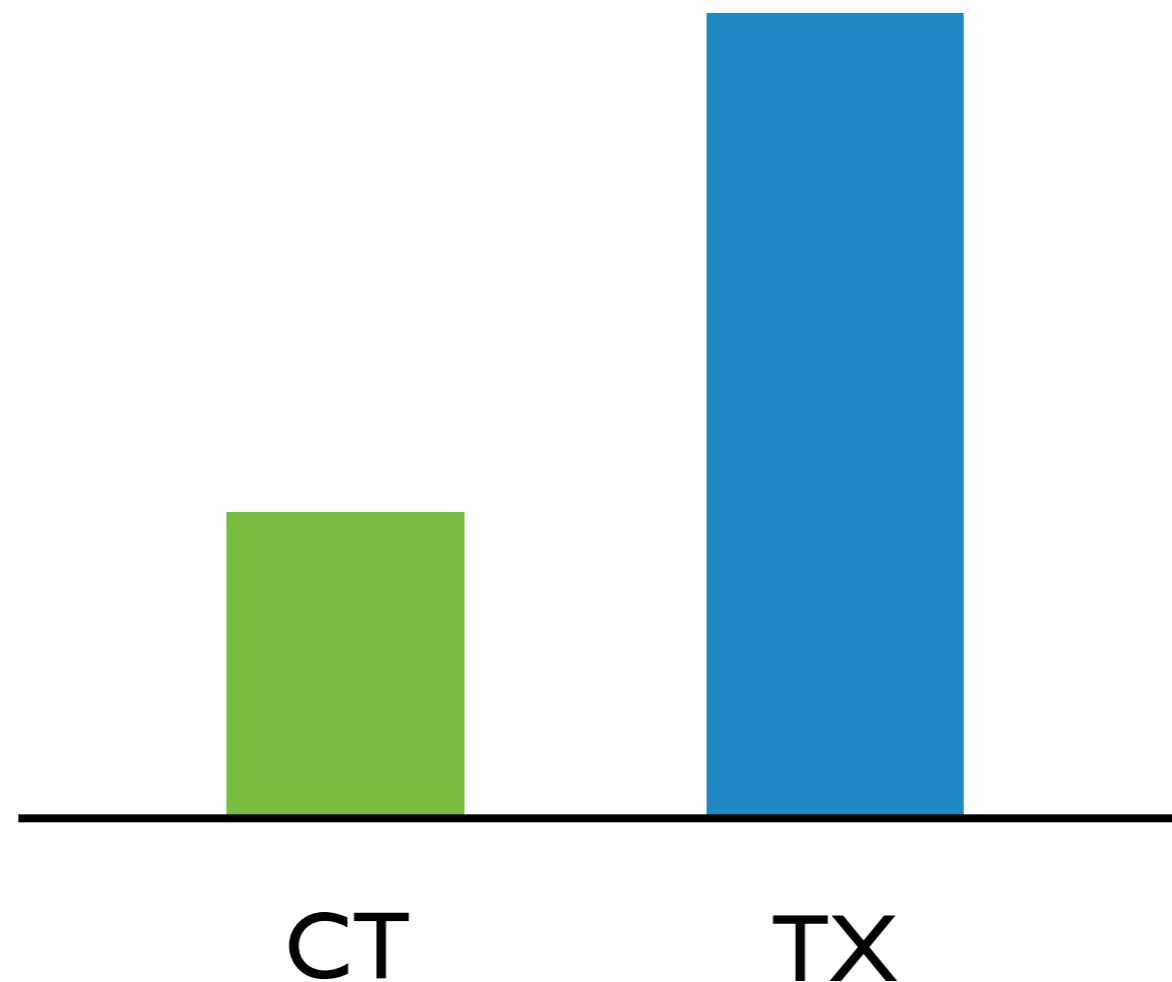
# Challenges

- Most children in Control group (40% of the sample) didn't go to any child care settings



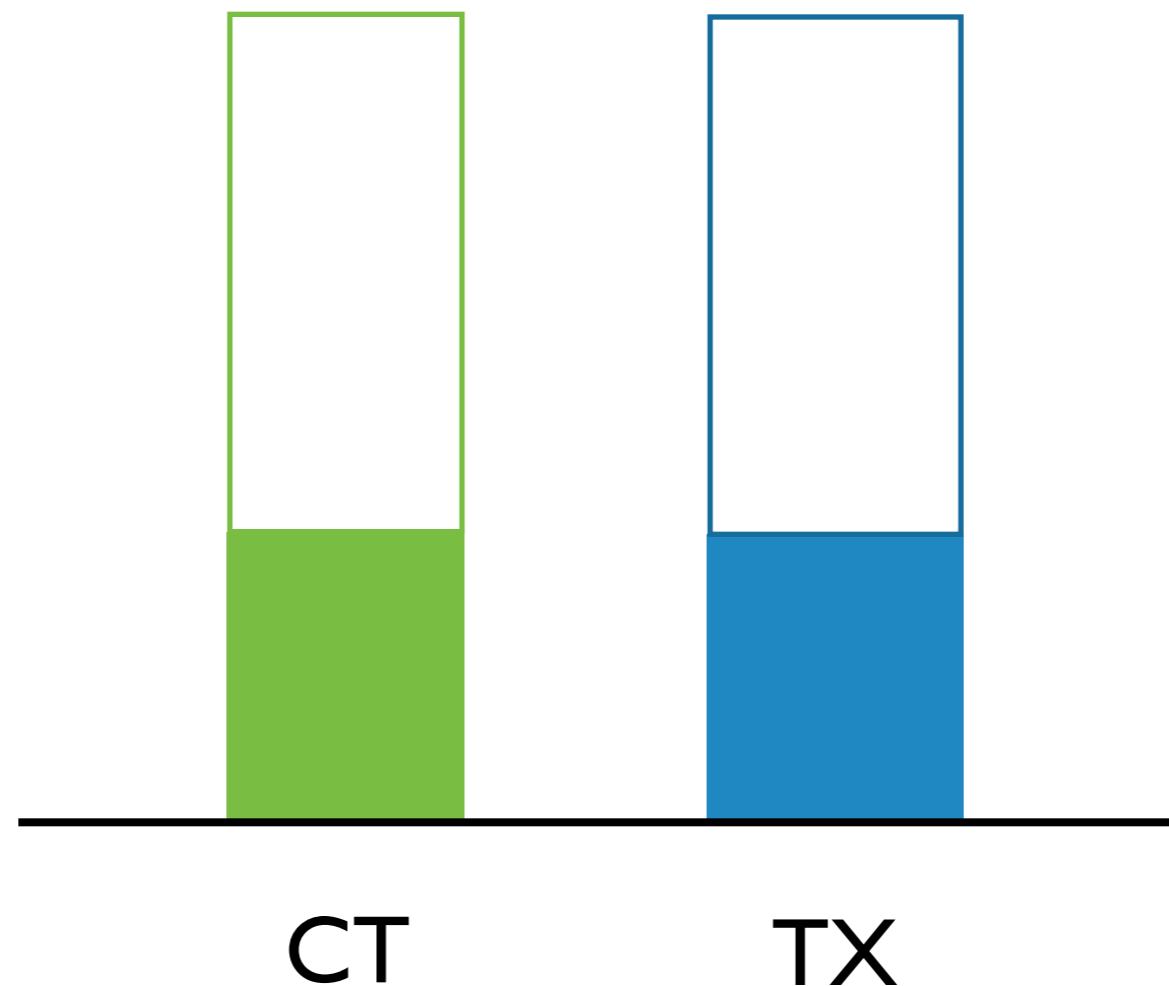
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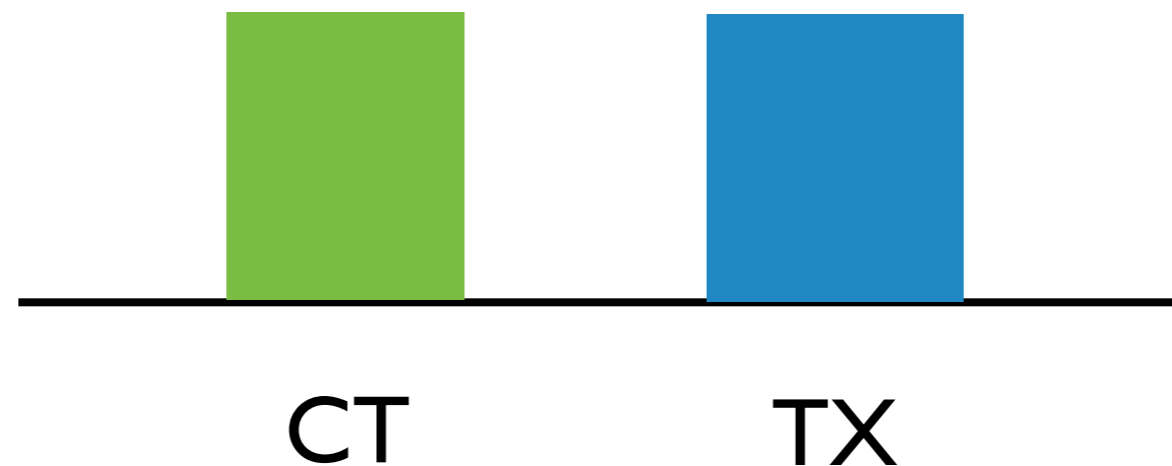
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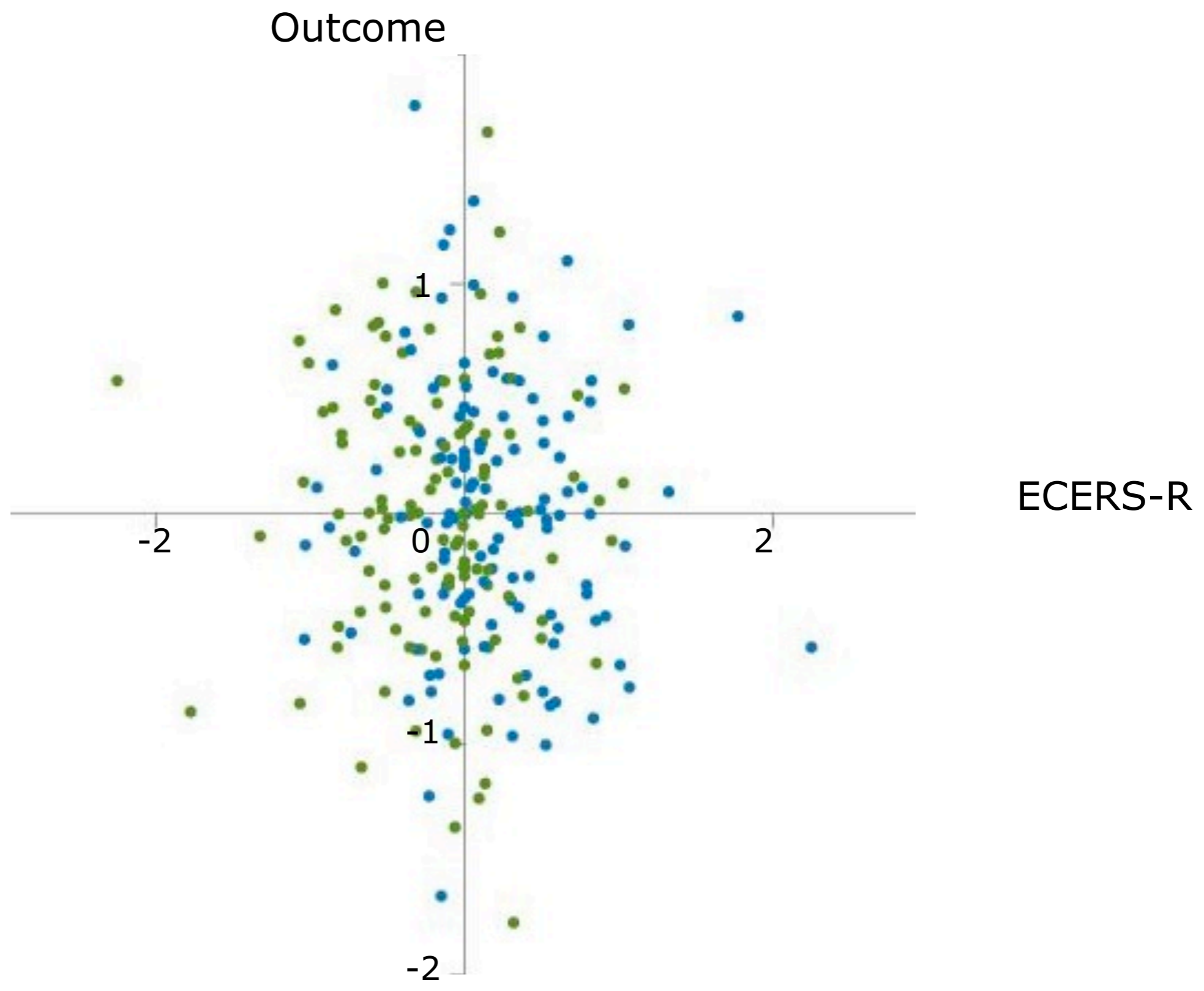
# Challenges

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# Challenges

- Most children in Control group (40% of the sample) didn't go to any child care settings
- Low 1st-stage F



# Suggestions?

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- Thank you!