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Better Data • Informed Choices • Improved Results

Applying Causal Inference Techniques to Strengthen Dual Enrollment Program Evaluation Research in Maryland

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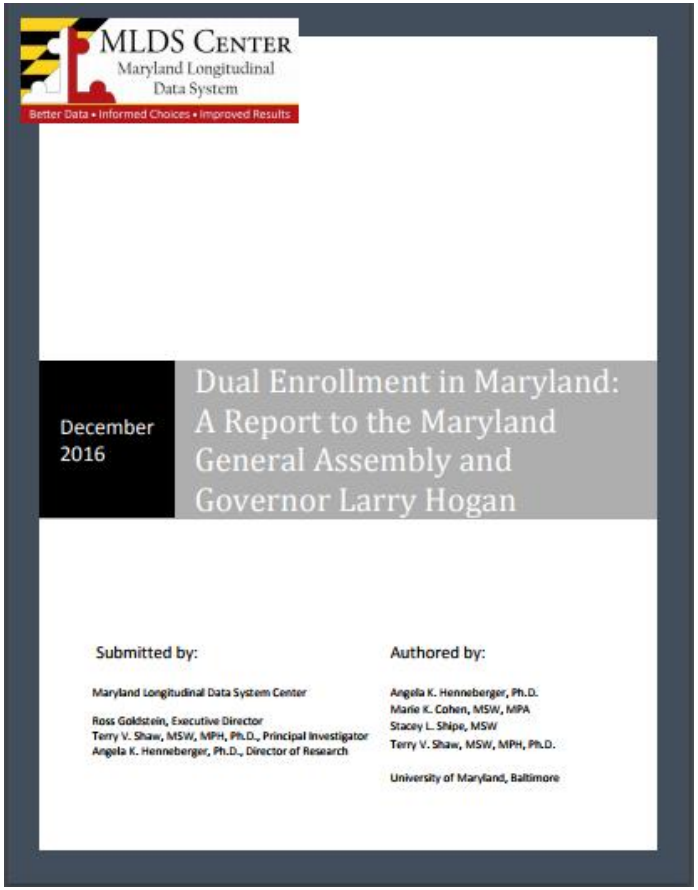
Maryland's Dual Enrollment Report

- Annual report on dually enrolled students required by College and Career Readiness and College Completion Act (CCR-CCA) of 2013.
  - Requires the Maryland Longitudinal Data System Center (MLDSC) to report to the Governor and General Assembly:
    - the number of dually enrolled students and
    - the courses taken by dually enrolled students

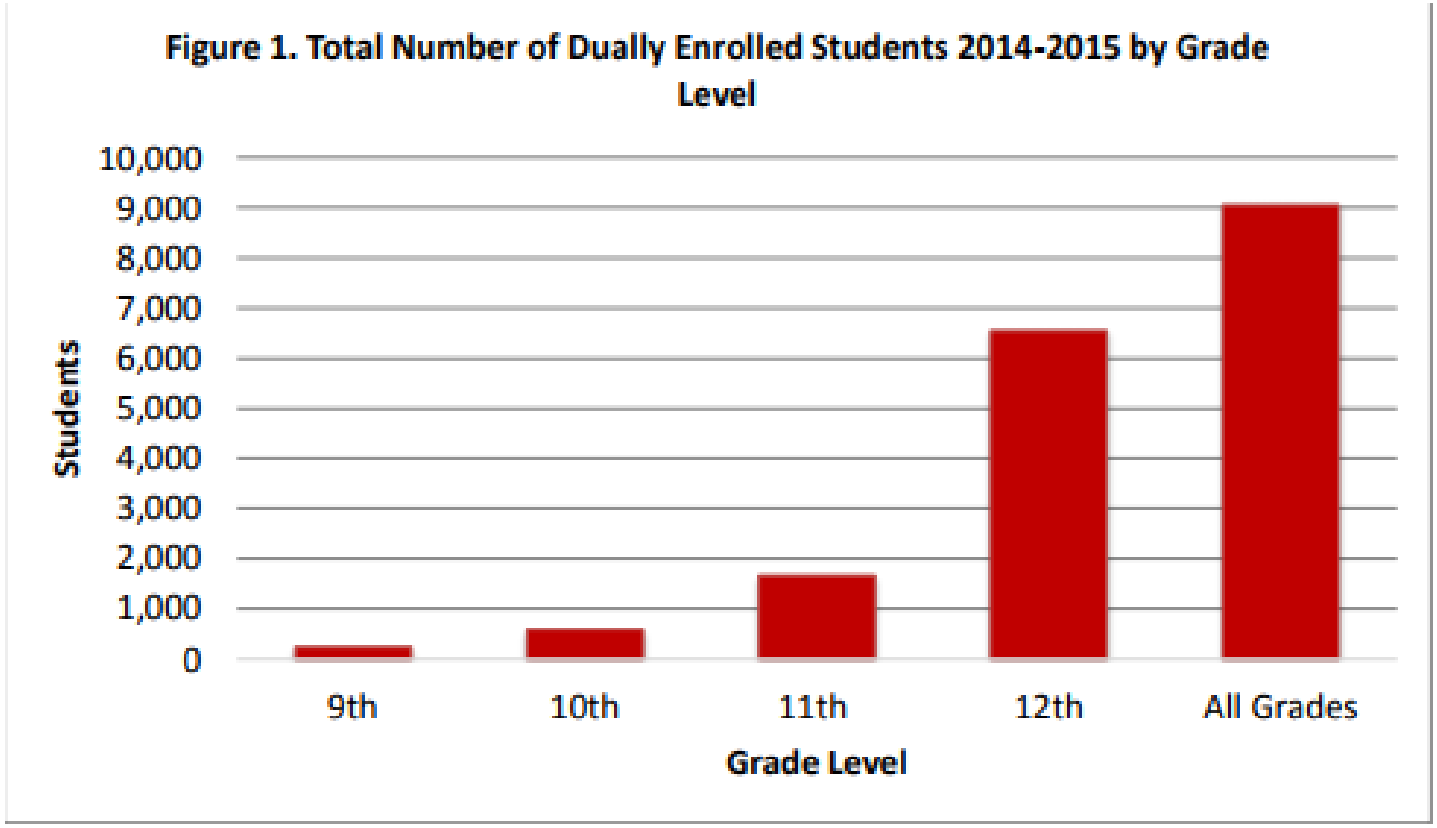
    (Education Article §24-703.1).
- A dually enrolled student is a student enrolled in both a secondary school and postsecondary institution in Maryland (Education Article §18-14A-01).

Maryland's Dual Enrollment Report



https://mldscenter.maryland.gov/DualEnrollment.html

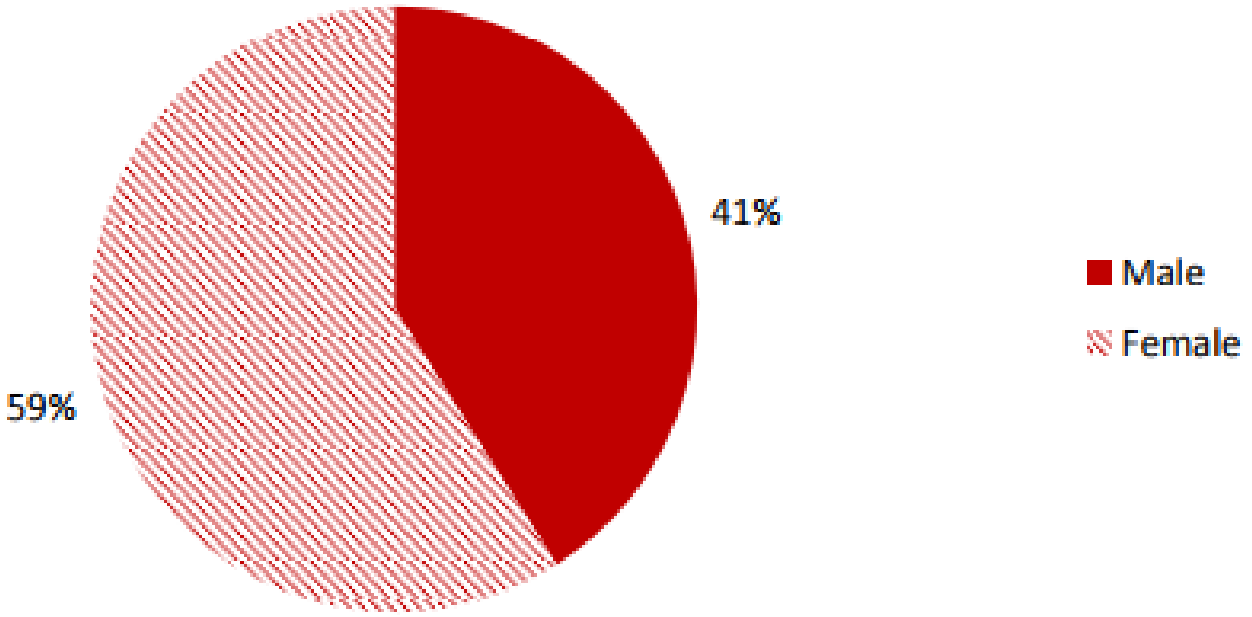
Dual Enrollment in Maryland



Source: Henneberger, Cohen, Shipe, & Shaw, 2016

Dual Enrollment by Gender

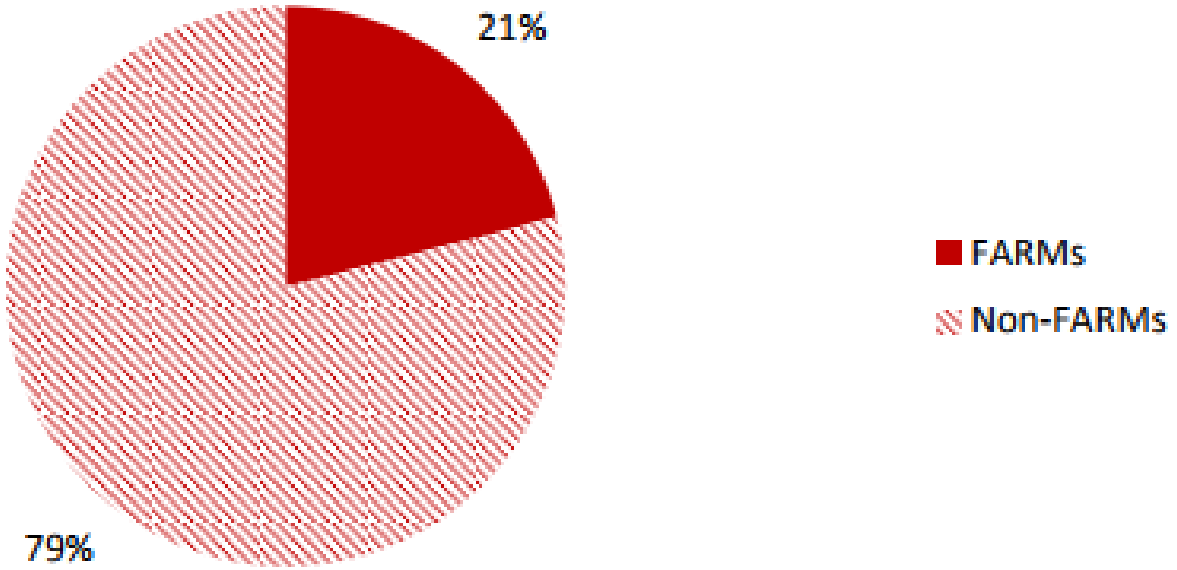
Figure 5. Gender of Dually Enrolled 12th Grade Students (2014-2015)



Source: Henneberger, Cohen, Shipe, & Shaw, 2016

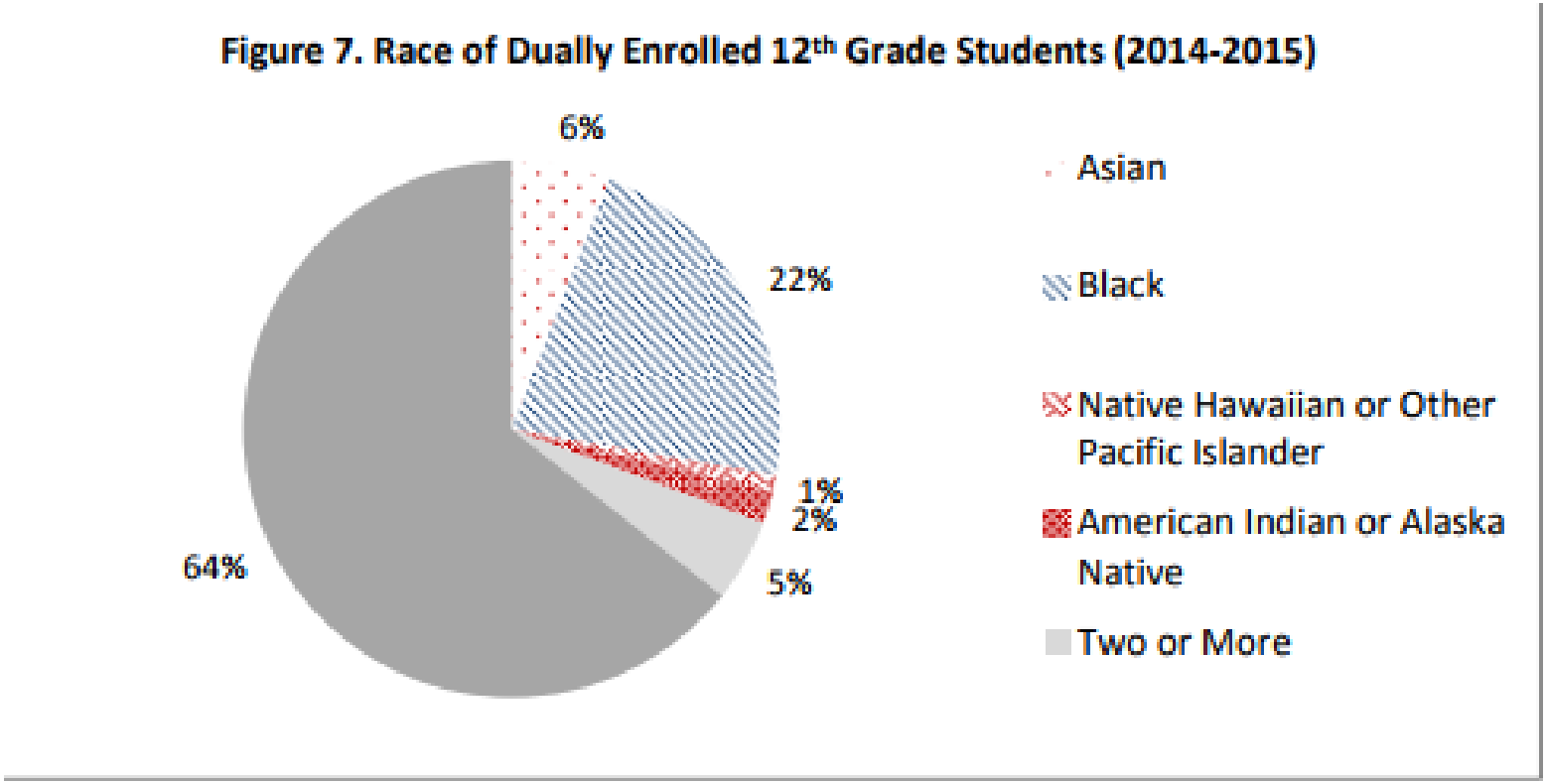
Dual Enrollment by FARMs

Figure 6. Eligibility for Free and Reduced Price Meals (FARMs) Status for Dually Enrolled 12th Grade Students (2014-2015)



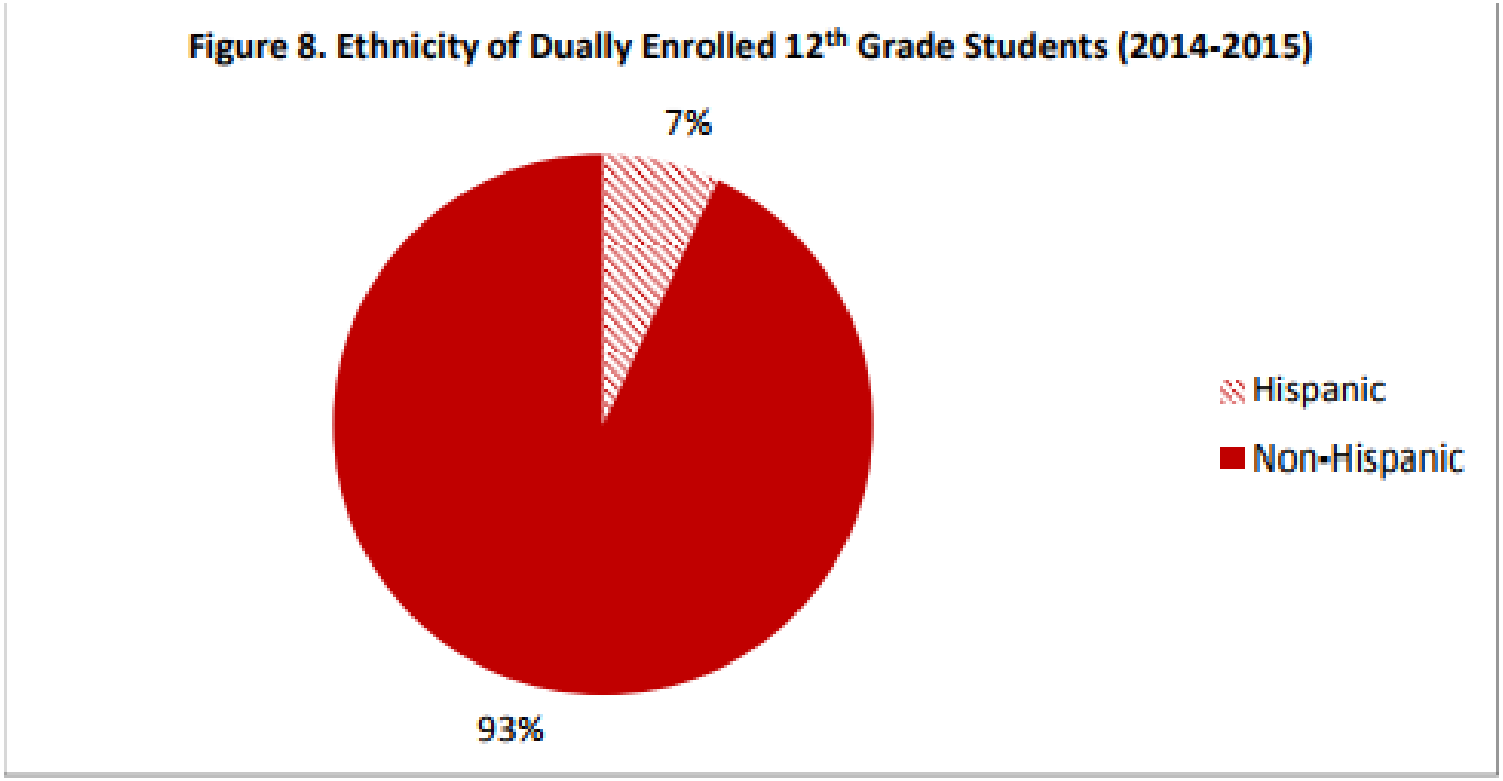
Source: Henneberger, Cohen, Shipe, & Shaw, 2016

Dual Enrollment by Race



Source: Henneberger, Cohen, Shipe, & Shaw, 2016

Dual Enrollment by Ethnicity



Source: Henneberger, Cohen, Shipe, & Shaw, 2016

Research Question and Motivation

- Motivating Research Question:
  - What is the ***effect*** of dual enrollment program participation in high school on college enrollment outcome, degree attainment, and earnings?
  - ***Effect*** implies a causal design where dual enrollment ***causes*** a change in outcomes.
  - Ideal design = randomization to dual enrollment program and control (Shadish, Cook, & Campbell, 2002).
  - But…. Our data are correlational.

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College Enrollment Outcomes in Maryland

Percentage of Dually Enrolled 12th Grade Students (2013-2014) Who Enrolled in College One Year Later (2014-2015) Compared to the 12th Grade Population

	Dually Enrolled 12th Grade Students (2013-2014)		College Enrollments (2014-2015)	
			All 12th Grade Students	Dually Enrolled 12th Grade Students
	N	%	%	%
Maryland	6,548	11	64	89

Source: Henneberger, Cohen, Shipe, & Shaw, 2016

The Problem: Confounders

- Gender
- Race/ethnicity
- Socioeconomic status
- High school attendance
- Achievement scores
- Prior academic experience

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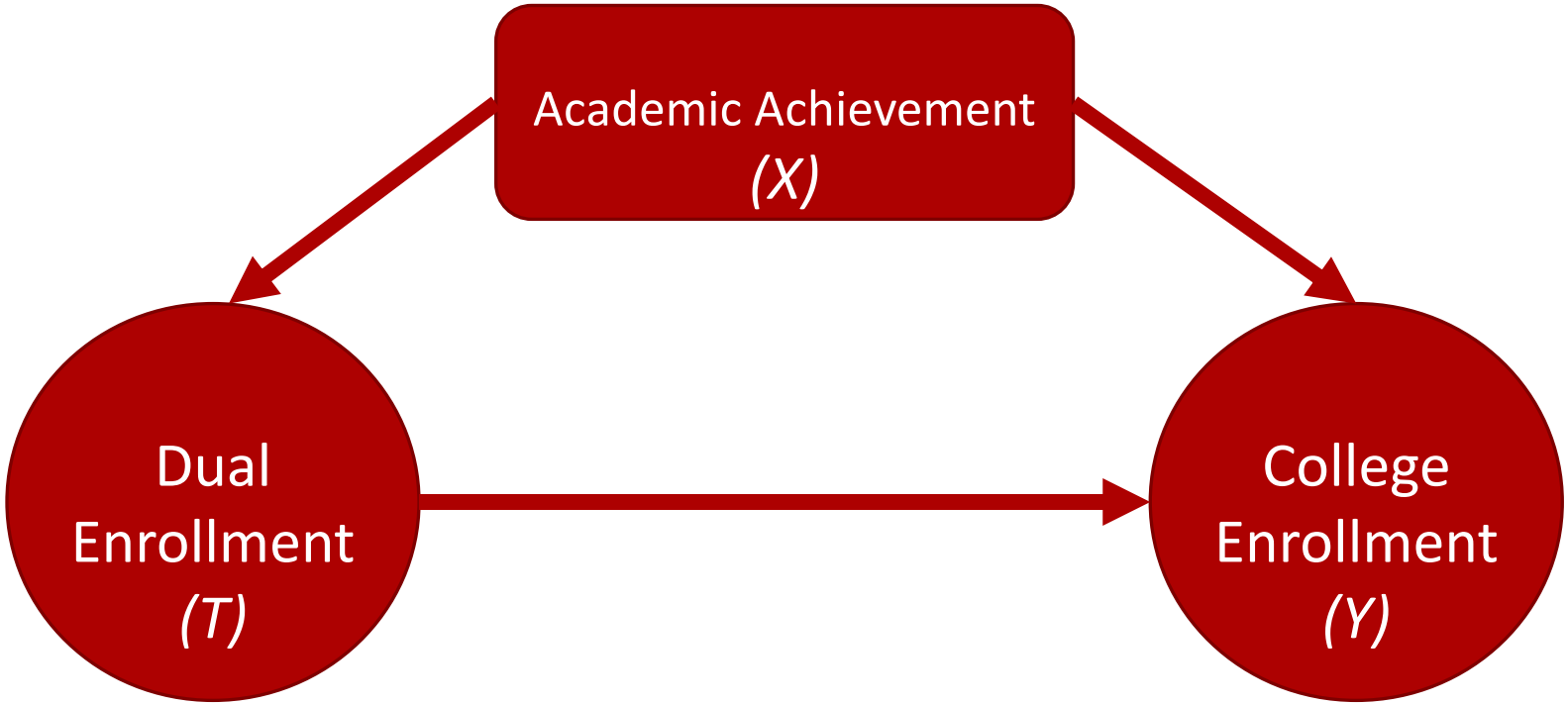
Academic Achievement as a Confounder



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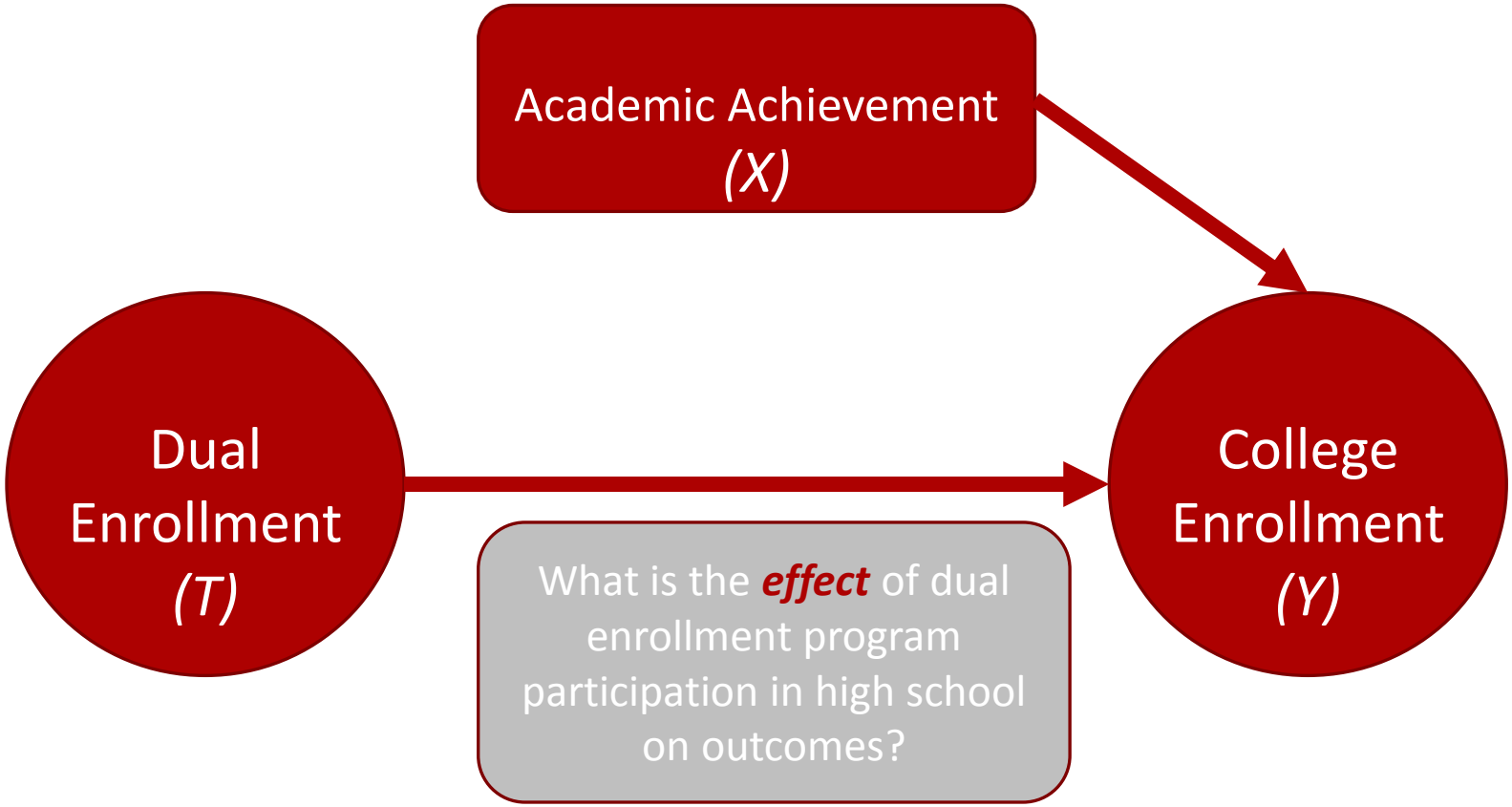
Academic Achievement as a Confounder



Modern Causal Inference Techniques

- Modern causal inference techniques can be used to account for the absence of random assignment (Schafer & Kang, 2008).
- Propensity Score Methods
  - Propensity score is the conditional probability of experiencing the treatment given individual's values on confounders (Rosenbaum & Rubin, 1983).
  - The propensity score estimates the probability to participate in the dual enrollment program.
  - Range 0-1; higher = greater likelihood to participate in dual enrollment.
- Improves the ability to make causal inferences about dual enrollment program participation.

Propensity Score Matching

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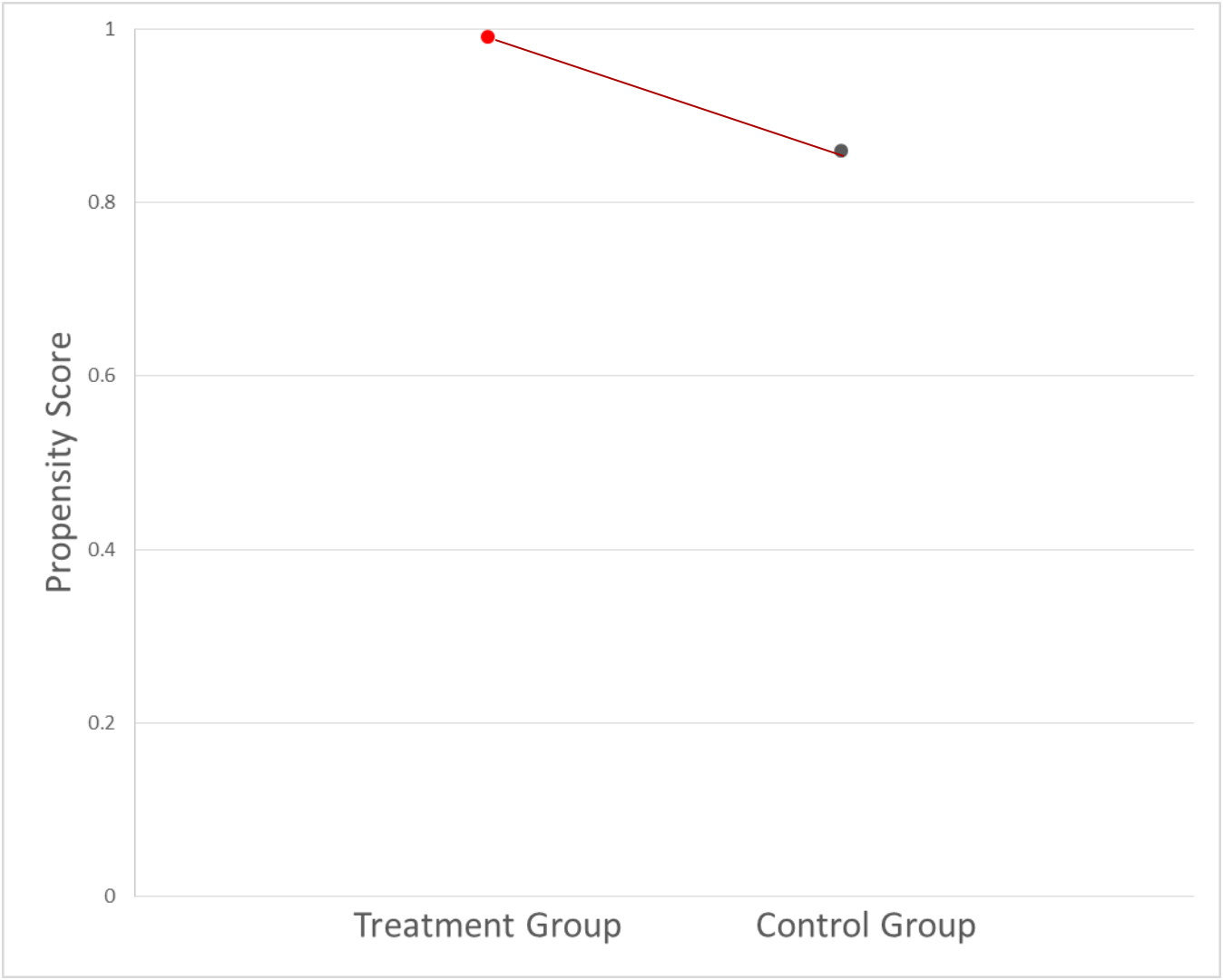

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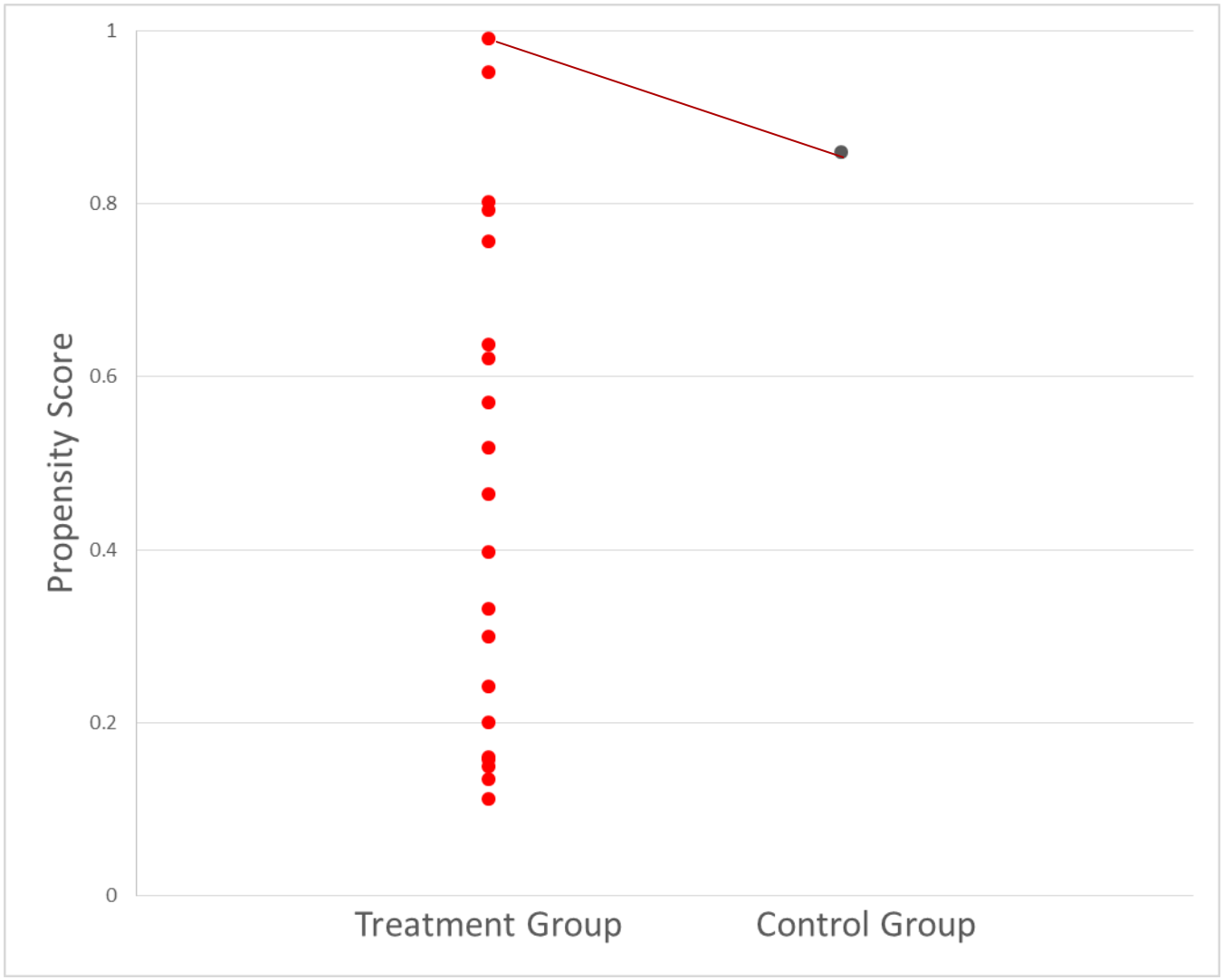

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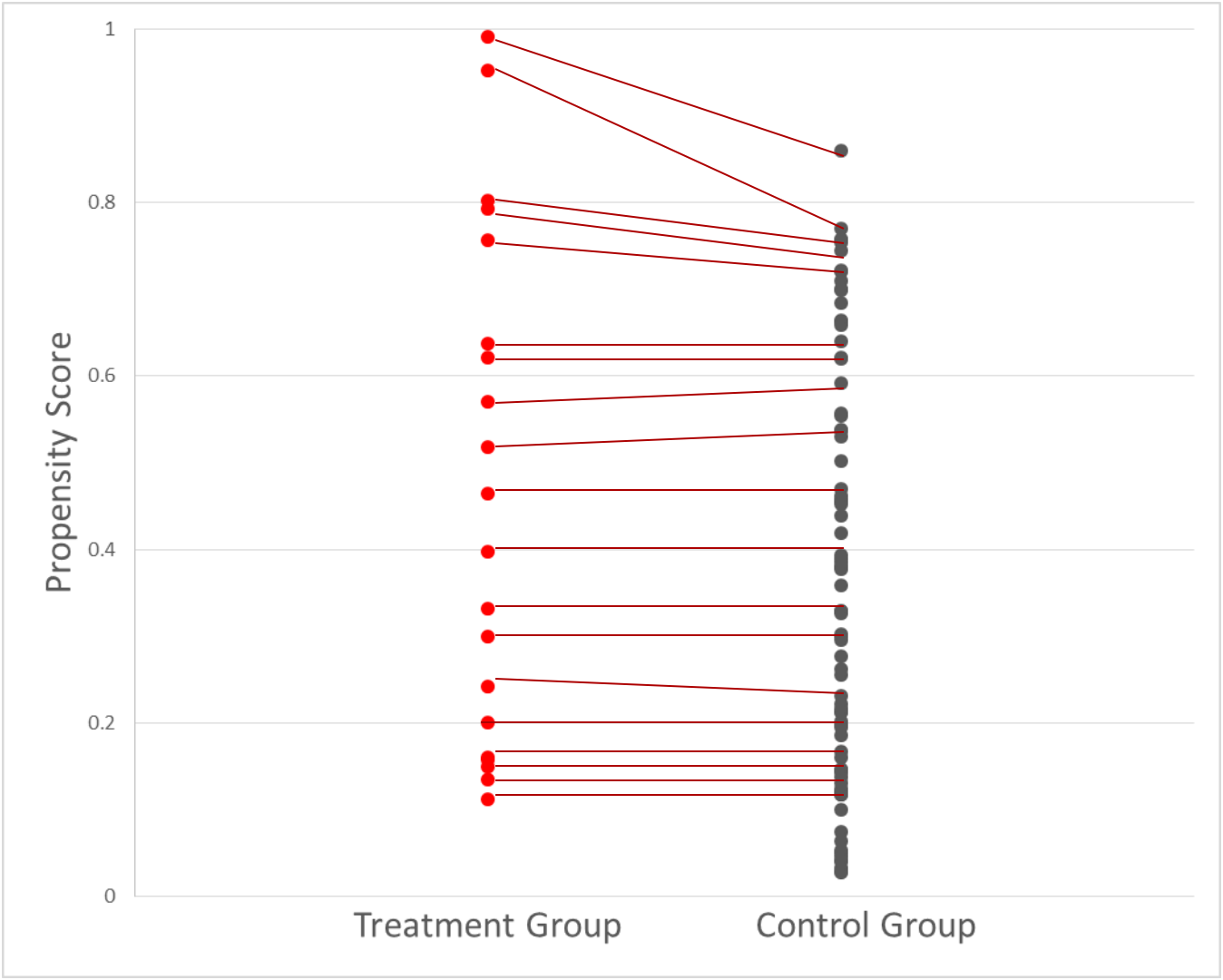

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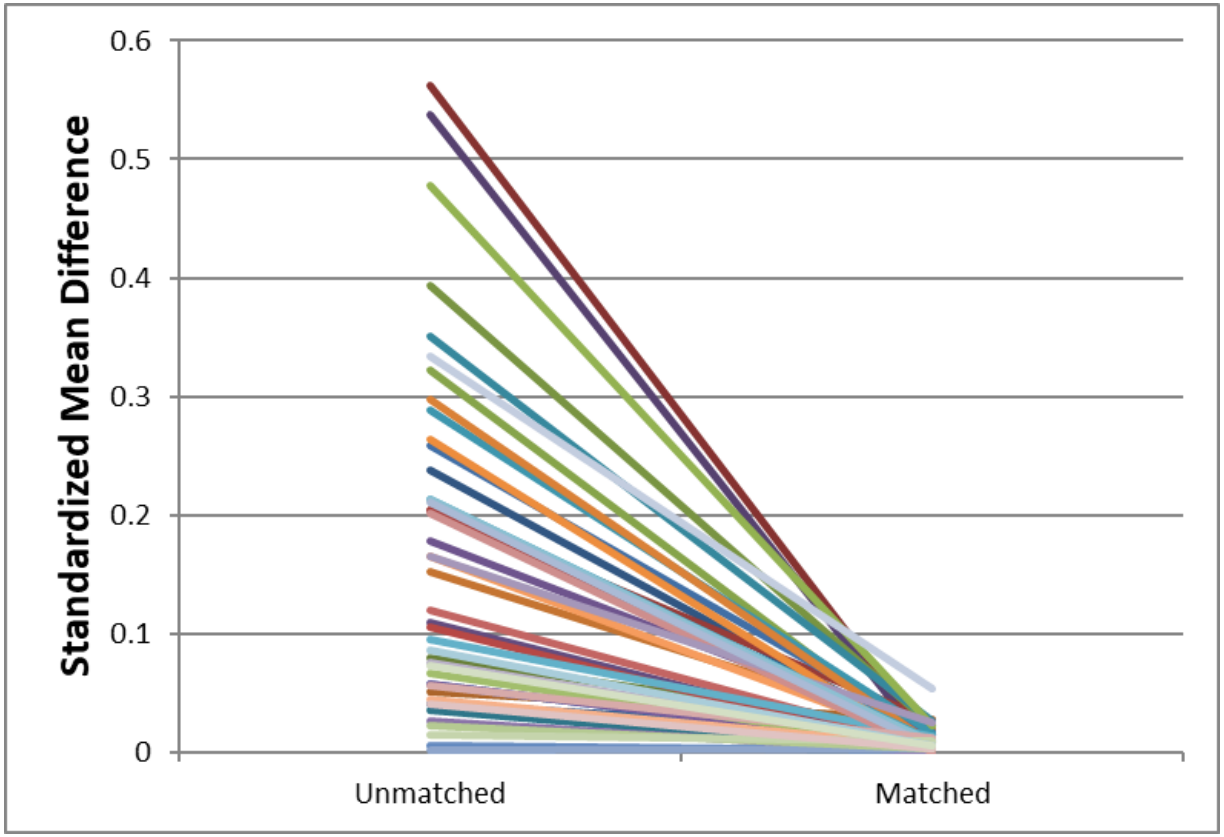
Data from the MLDS

- Student identified as dually enrolled if:
  - Overlapping enrollment dates in MD public high school and MD college
- Population for 2013-2014 cohort:
  - 62,000 12th grade students (2013-2014)
  - 4,900 were dually enrolled
  - Outcomes: college enrollment in 2014-2015
- Population for 2009-2010 cohort:
  - 63,000 12th grade students (2009-2010)
  - 4,200 were dually enrolled
  - Outcomes: college enrollment, degree completion, earnings 6 years after high school graduation

Using the 2013-2014 Sample

- Reasonably good match using this cohort



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Results: College Enrollment One Year Later

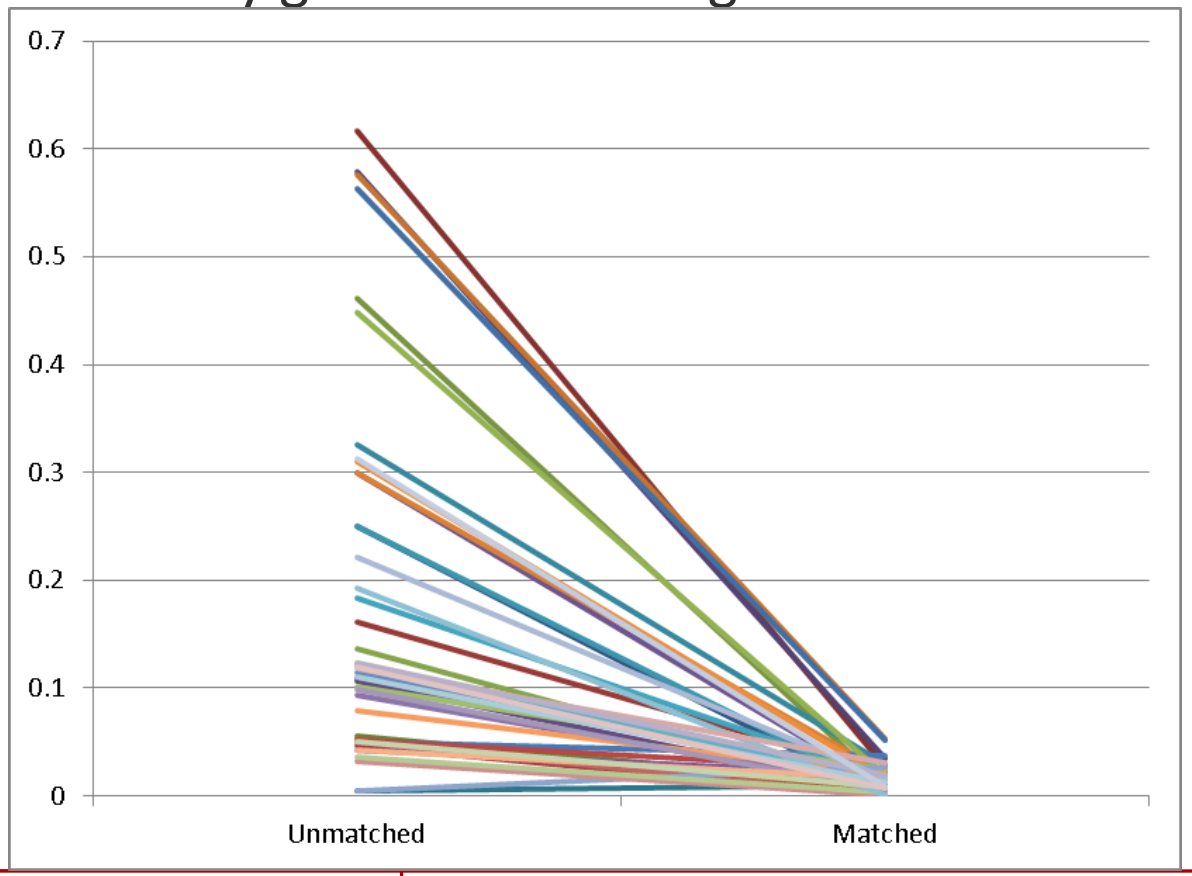
	Enroll 2-year	4-year
Logit coefficient	0.64***	0.036
Dual Enrollment	**0.134**	**0.008**
N	9,800	9,800

*** $p < .01$., ** $p < .05$

Interpretation: The predicted probability of enrolling in a 2-year college is 0.13 greater for a student who was dually enrolled in high school in comparison to a student who was not dually enrolled in high school.

Using the 2009-2010 Sample

- Reasonably good match using the older cohort



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Results: Type of College Enrollment

- One year after high school:

	Enroll 2-year	4-year
Logit coefficient	0.86***	0.008
Dual Enrollment	**0.19**	**0.002**
N	8,500	8,500

*** $p < .01$., ** $p < .05$

- Two years after high school:

	Enroll 2-year	4-year
Logit coefficient	0.62***	0.105**
Dual Enrollment	**0.13**	**0.03**
N	8,500	8,500

*** $p < .01$., ** $p < .05$

Results: Type of College Enrollment

- Three years after high school:

	Enroll 2-year	4-year
Logit coefficient	0.37***	0.34***
Dual Enrollment	**0.06**	**0.08**
N	8,500	8,500

*** $p < .01$., ** $p < .05$

- Four years after high school:

	Enroll 2-year	4-year
Logit coefficient	0.34***	0.303**
Dual Enrollment	**0.04**	**0.08**
N	8,500	8,500

*** $p < .01$., ** $p < .05$

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Results: Degree Attainment and Earnings

	Any Degree	Assoc. Deg.	Bac. Deg.	Certificate	Earnings
Logit coefficient	0.60***	0.69***	0.38***	0.46***	
Dual Enrollment	**0.15**	**0.08**	**0.09**	**0.01**	**1,986.70*** **
N	8,500	8,500	8,500	8,500	8,500

*** $p < .01$., ** $p < .05$,

Interpretation: the earnings coefficient represents the effect of dual enrollment on annual earnings in the 2015-2016 academic year (quarters 3-4 of 2015 and 1-2 of 2016). The amount is in 2016 dollars.

- **Enrollment and degree results suggest students beginning at 2-year institutions and transferring to 4-year**

Summary of Findings

- After matching students on similar characteristics, **students who were dually enrolled in high school were more likely to:**
  - **Enroll in college** (suggests 2-year first, then 4-year) and
  - **earn a degree** (associate, bachelor's, and certificate)

  than students who were not dually enrolled in high school.
- After matching students on similar characteristics, **students who were dually enrolled in high school had higher earnings (≈$2,000) six years later** than students who were not dually enrolled in high school.

Limitations

- Propensity score methods assumes no unmeasured confounders—
  - Academic motivation
  - Behavioral problems
  - Etc.
- The MLDS data do not offer the granularity needed to provide more nuanced comparisons of types of dual enrollment program participation and outcomes (e.g., characteristics of district partnership; Early Middle College program).

Future Directions

- Earnings in the year following a student's last year in an educational institution
- Moderation by race/ethnicity and FARMs
- Moderation by academic achievement
- Examining outcomes by the specific courses taken by dually enrolled students
- Examining the link between dual enrollment and remedial education, credits earned, etc.

For More Information

https://mldscenter.maryland.gov/

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Questions and Additional Future Directions