Who's Your Neighbor?
Using Matching Methods to Evaluate Intervention Effectiveness

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About Gateway

- Public 2-year technical college in southeastern Wisconsin

- First publicly funded technical college in America

- In 2023-24:
  - 7,715 degree-seeking students (3,301 FTE)
  - 20,442 students overall

- Hispanic Serving Institution

Session Objectives

Understand propensity score matching (PSM) theory & methodology

Learn how we used PSM to assess tutoring impact

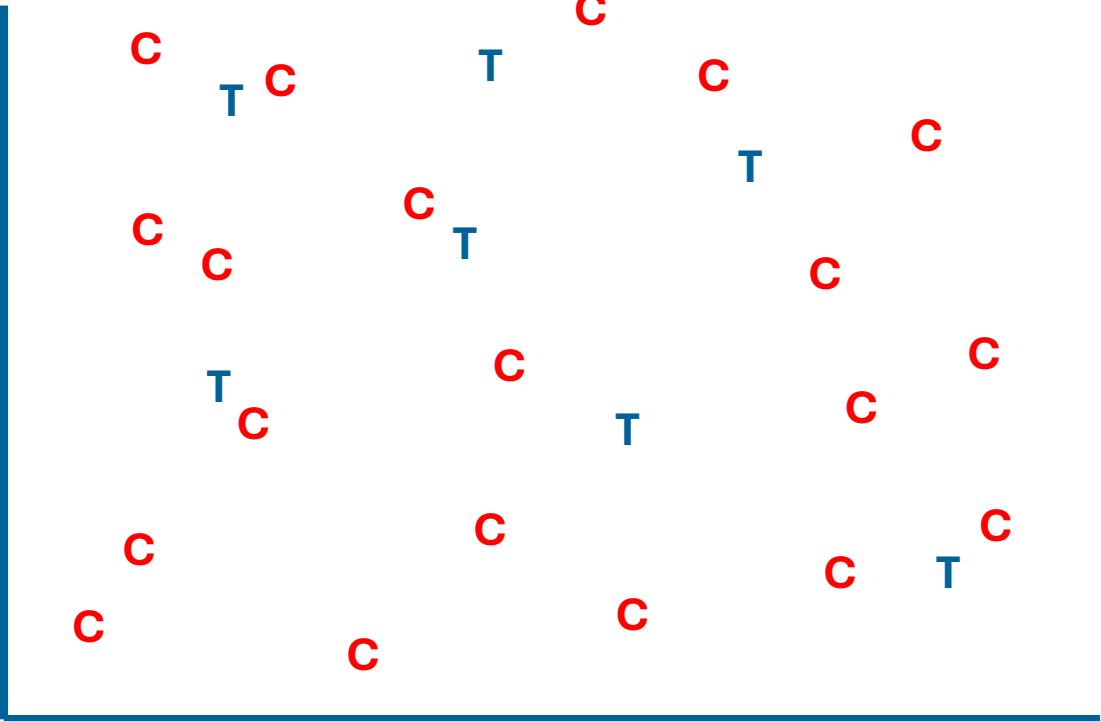Practical steps to run PSM in SPSS

Highlight impact on assessment culture

Simple Comparison
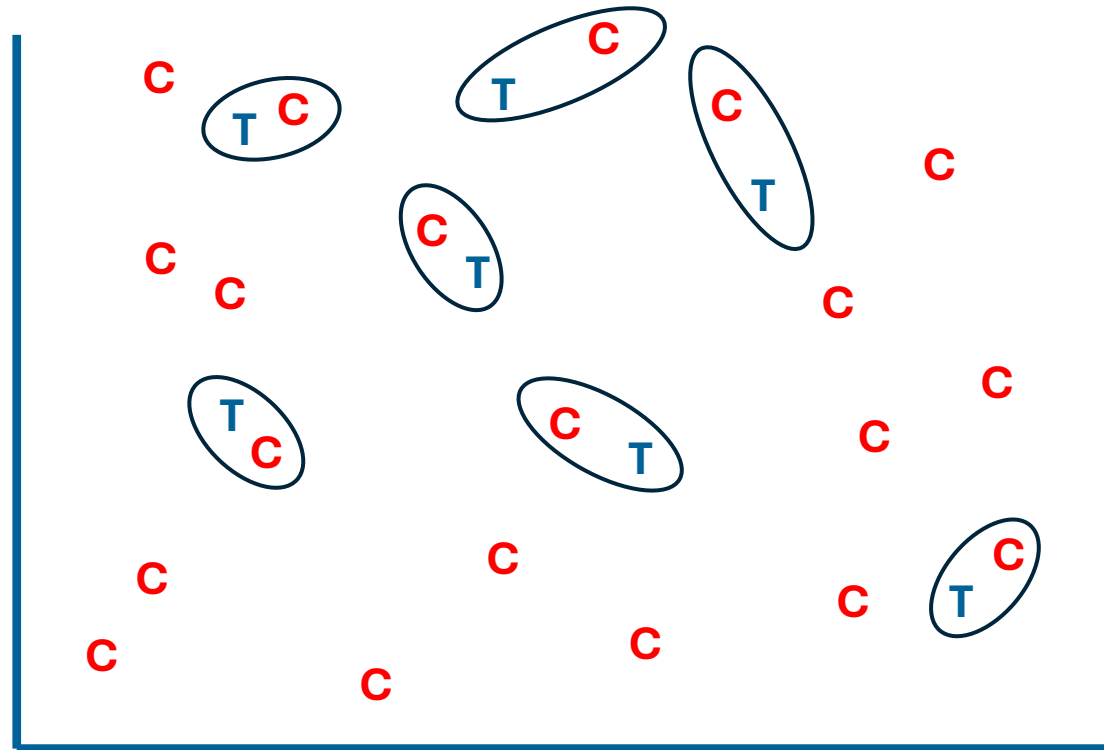
The Problem: Self-Selection Bias

T = Treatment
C = Control

Nearest Neighbors

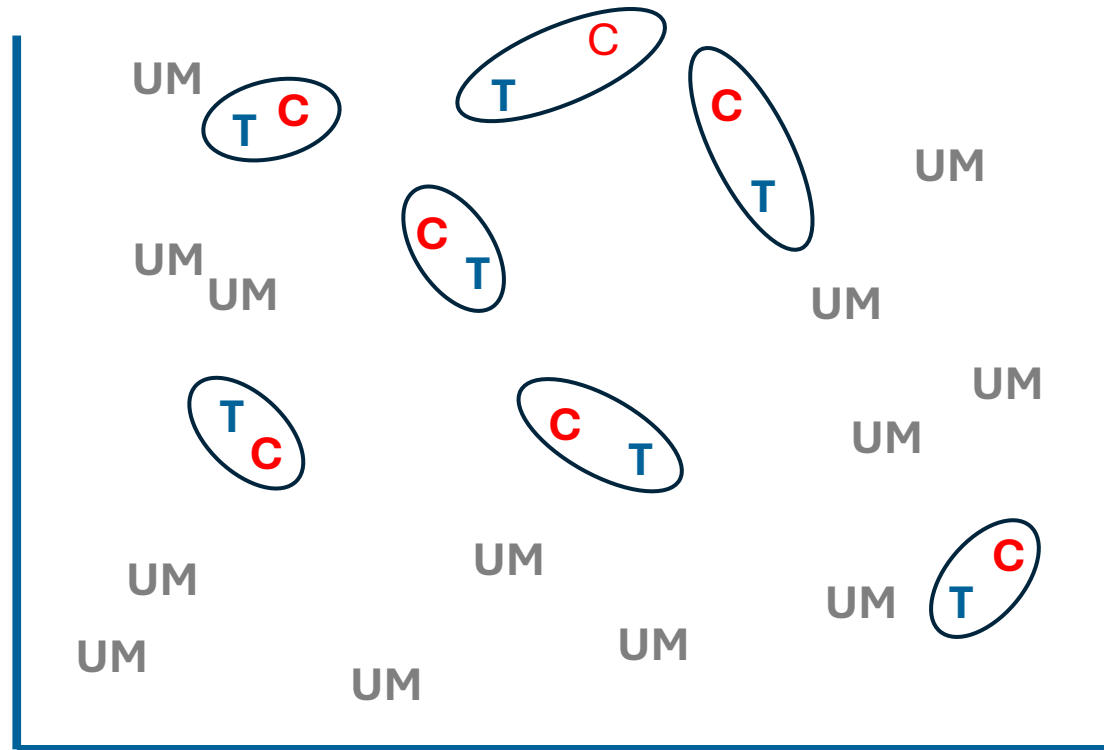Match each student in treatment group with "nearest neighbor" among the control group
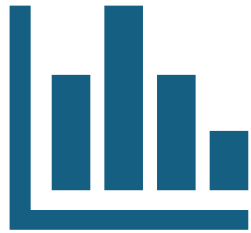
T = Treatment
C = Control

Matched Comparison

Unmatched students aren't included in final analysis

UM

T C

C

T

C

T

C

T

UM

UM
UM

C

T

T C

C

T

UM

UM

UM

UM

UM

UM

C

T

UM

UM

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UM

T = Treatment
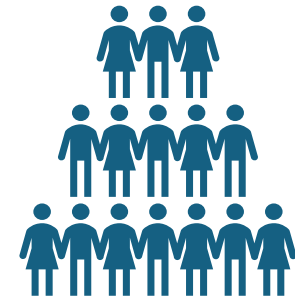**C** = Control
UM = Unmatched

Propensity Score Matching (PSM): The Basics

Assign a **propensity score** (the student's probability of using the intervention)

Match students with similar propensity scores

Creates treatment and control groups with **reduced self-selection bias**

How PSM Works: The Process

1. Literature review to identify potential covariates
2. Logistic regression
   - Confirm relevant covariates
   - Estimate propensity scores
3. Match students based on propensity scores
4. Check covariate balance
5. Analyze outcomes on matched data

Case Study:
Tutoring Program Evaluation

Research Question: Does tutoring participation improve student course success?
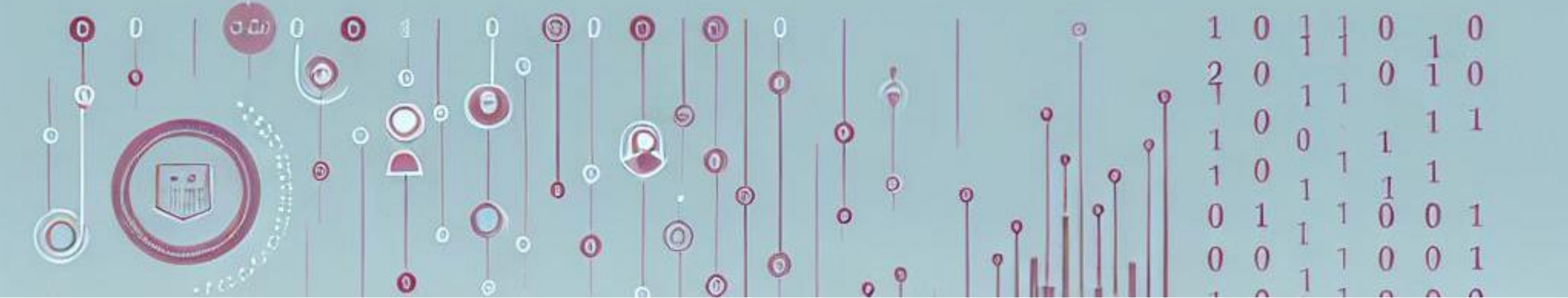
Sample Covariates

- Placement test scores
- High school GPA
- First-time student
- FYE participation
- Enrollment intensity
- Cumulative GPA
- Age
- Race/ethnicity
- Gender
- Pell recipient

Data Preparation

- Merge three streams of data

- Wide format

- Time considerations

    - Anything occurring **before** treatment is a **covariate** (e.g., high school GPA)

    - Anything occurring **after** treatment is an **outcome** (e.g., course pass rates)

Covariates

Service Utilization Data

All Student Outcomes Data

Final Data Set
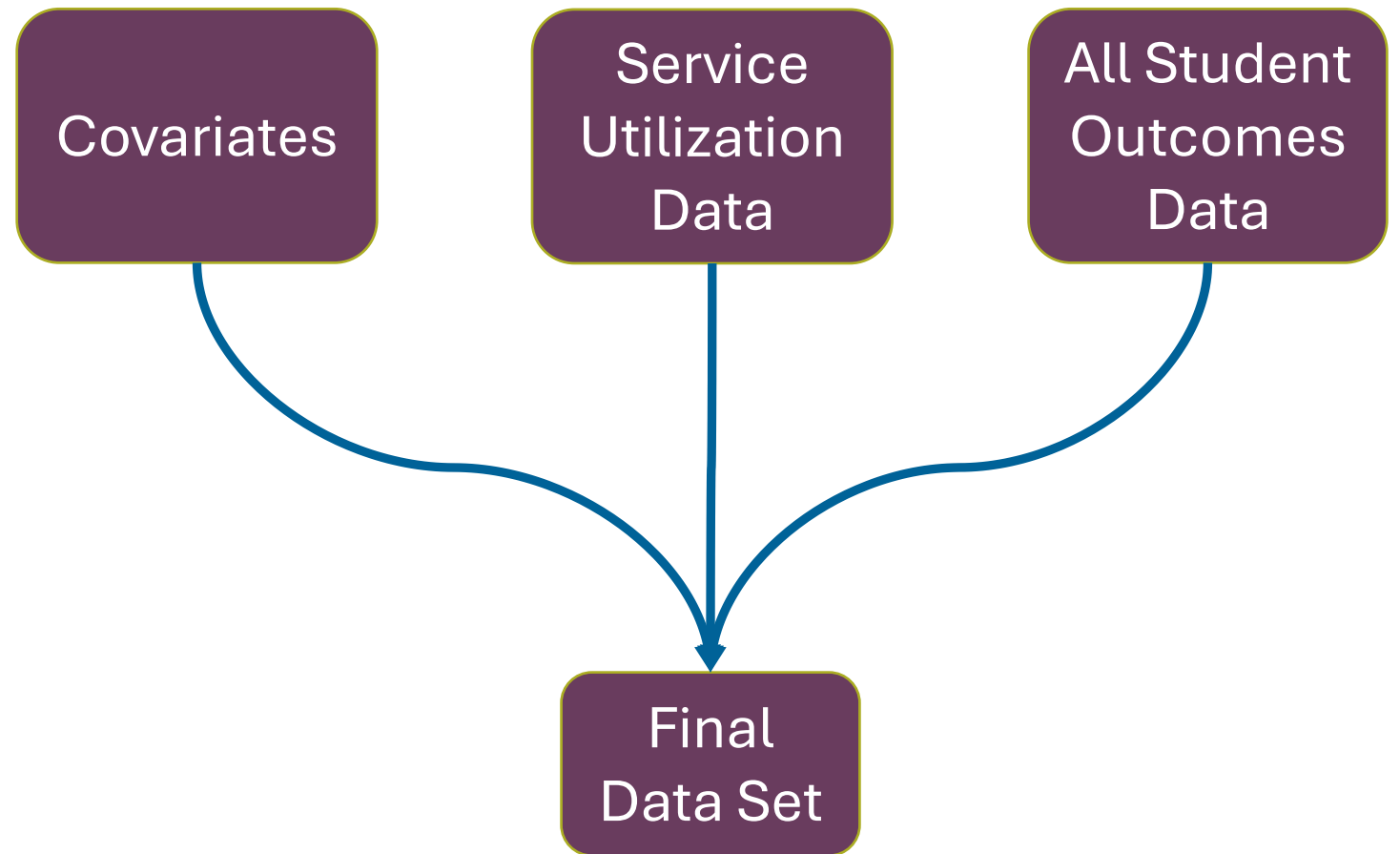
Confirming Covariates: Results of Regression Analyses

Covariate	Related to Treatment Condition?	Related to Outcome Variable?	Use Covariate?
Placement test results	YES	YES	YES
High school GPA	YES	YES	YES
First-time student	NO	NO	NO
FYE Participation	YES	NO	YES
Age	YES	YES	YES
Race/Ethnicity	YES	YES	YES
Gender	YES	NO	YES
Pell-recipient	YES	NO	YES

Propensity Score Matching in SPSS

In the menu bar, select:

Data / Propensity Score Matching

Group Indicator: whether they received tutoring services or not (0 = no, 1 = yes)

Predictors: All covariates of interest

Case ID: Student ID

Match Tolerance: How similar must the propensity scores be in order to match two cases?

Naming Conventions: You must give names to the output dataset, propensity variable name, and match ID variable. These can be whatever you want, but I typically use descriptive names such as:

- **Output Dataset:** PropensityScoresAdded

- **Propensity Variable:** PropensityScore

- **Match ID Variable:** MatchID

Propensity Score Matching in SPSS

The steps on the previous slide create a separate data set file with two new variables: propensity scores (added for all cases) and Match IDs (added for matched cases). The file still retains all student records, so now we must remove the unmatched cases.

In the menu, navigate to:

Data / Select Cases

In the "If condition is satisfied" screen, enter the following formula:

MatchID ~= 0

Back in the Select Cases screen, under Output, check the option "Copy selected cases to a new data set" and give the new dataset a descriptive name.

That new dataset provides only the matched cases, which you should save as a new file for your records.

Evaluate Covariate Balance

Test each covariate (whether or not it was used in the propensity score calculation) to ensure there is no statistically significant difference between treatment and control groups
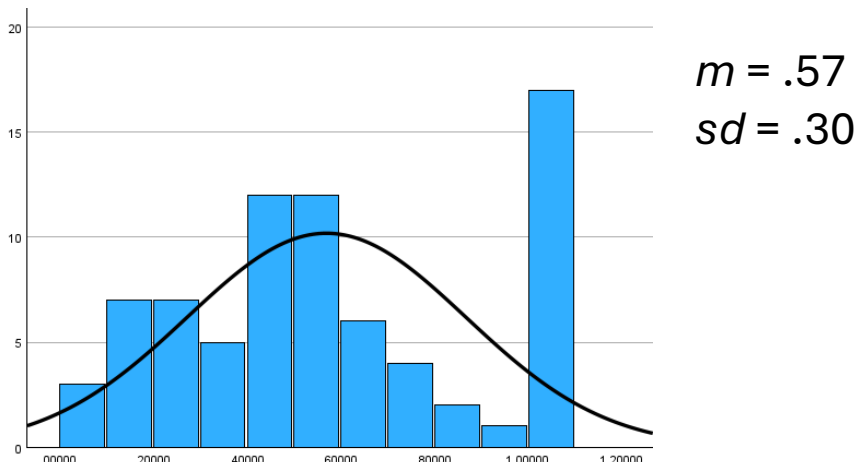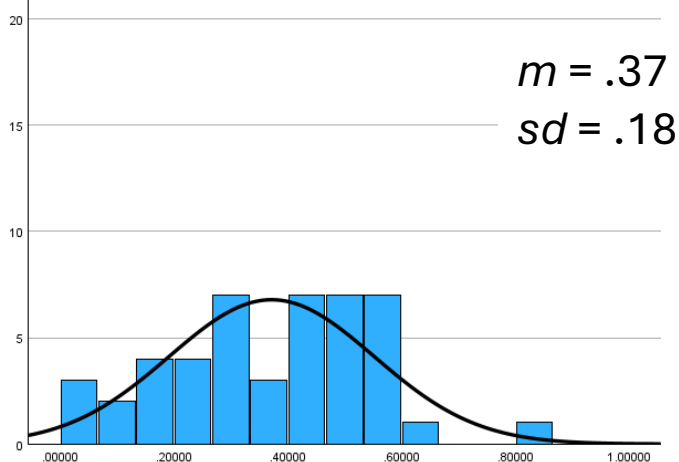
- Continuous covariates → T-tests
- Categorical covariates → Chi-square

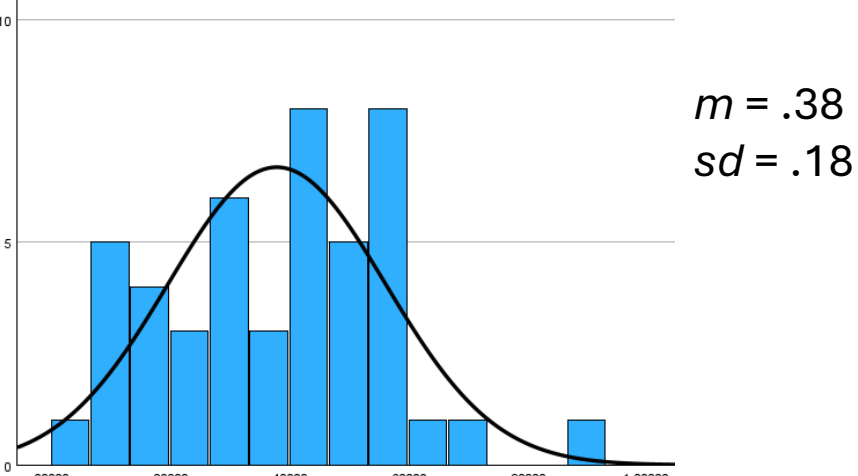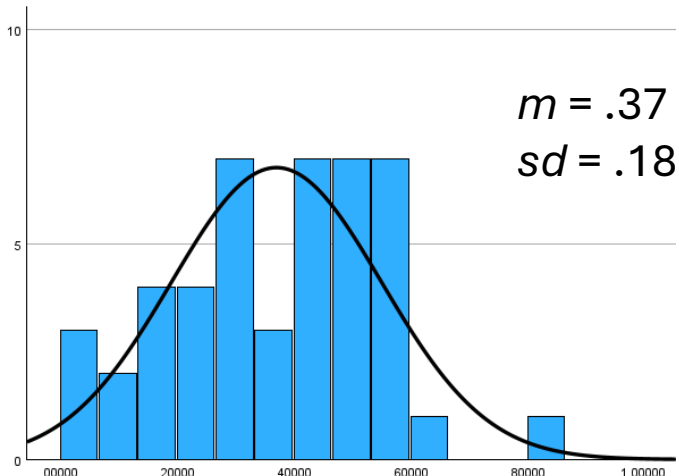# Evaluate Improvement to Self-Selection Bias
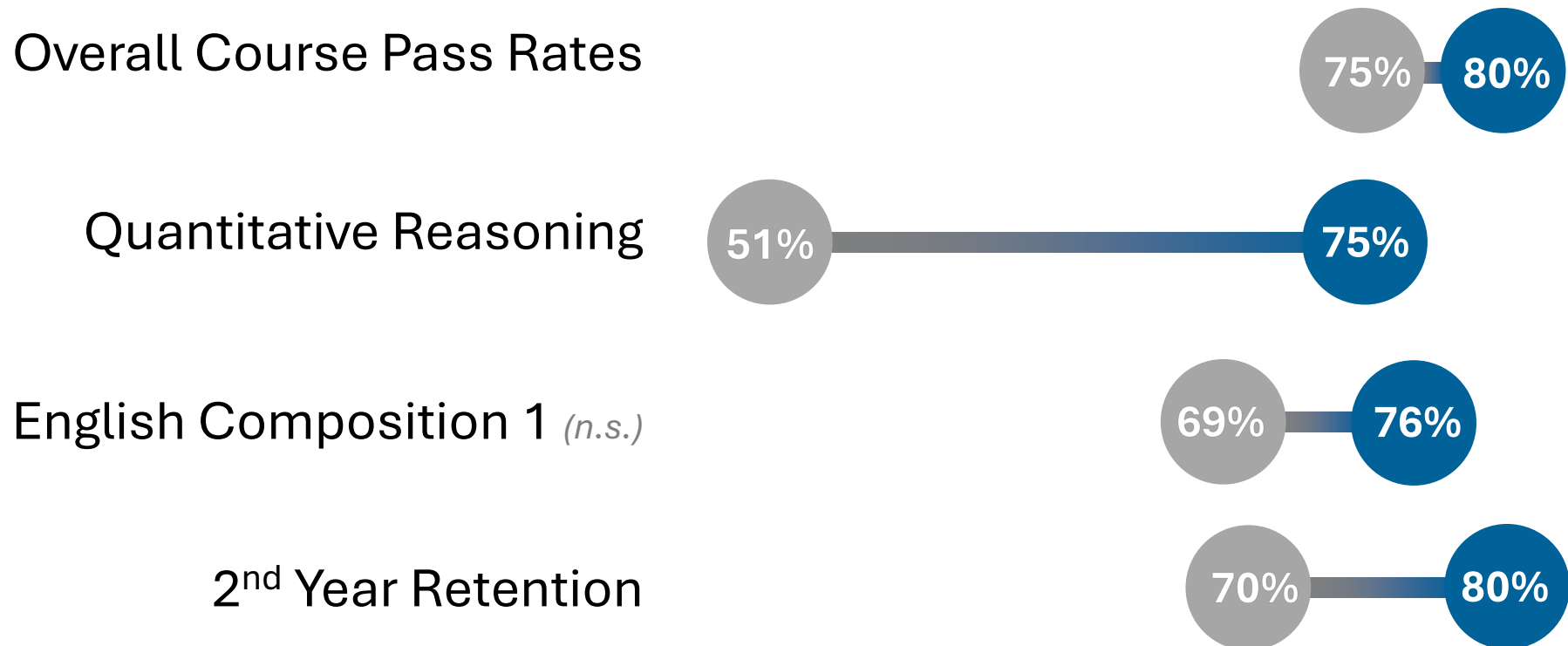

Goals: *Histograms of propensity scores* are normally distributed, visually similar with similar standard deviation and m = 0.5

Students who used tutoring had improved course outcomes and retention rates compared to similar peers who did not use tutoring.

Overall Course Pass Rates
75% 80%

Quantitative Reasoning
51% 75%

English Composition 1 *(n.s.)*
69% 76%

2nd Year Retention
70% 80%

Impact on Assessment Culture

Prior State

- No prior way to assess voluntary programs reliably
- Departments relied on hunches for decisions

The Change

- AIR Forum
- Post-finals statistics musings
- Tutoring asked for an outcomes evaluation
- Took the leap!

Growing Interest

- Tutoring assessment results shared college wide
  - Included a simplified methodology explanation (think cheesy clip art of apples and oranges)
- Many new requests for similar evaluations
- Organizational learning theory
  - Academic vs faculty advising
  - Inclusive access pilot

The Imperative

- **Elevate 2028 strategic plan** now prioritizes systematic assessment and data-informed decision-making

- **HLC Criterion 4:** Data-informed decision-making

- **Grant applications** and "evidence-based practice"

Challenges and Solutions

Messy service utilization data

If possible, automate ETL; try and get in the room early

Limited covariate selection

Literature review; new data warehouse; develop strong partnerships with IT

Too many data requests

Code snippet libraries; automate as much as possible
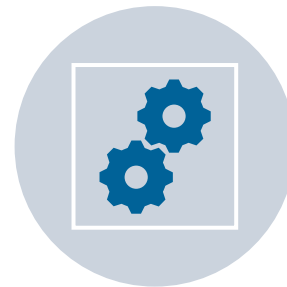
Rapid Insight/Veera Construct

Key Takeaways

PSM reduces self-selection bias

Develop key relationships and find early adopters

Keep learning as an IR professional

Build IR capacity and automate what you can

Resources

- Bai, H., & Clark, M. H. (2019). *Propensity score methods and applications.* SAGE Publications, Inc.

- Pan, W., & Bai, H (Eds.) (2015). *Propensity score analysis: Fundamentals and developments.* The Guildford Press.

- Porter, S. (2023, August 25). *Introduction to matching and propensity score analysis* [Webinar]. Percontor Educational Research and Training. https://www.percontor.org/research-methods/introduction-to-matching-and-propensity-score-analysis/

- Reichardt, C. S. (2019). *Quasi-experimentation: A guide to design and analysis.* The Guildford Press.

Questions & Discussion

Thank You & Contact Info

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