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Advancing Evidence.
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Evidence Quality and Reach Hub: Propensity Scores and Outcome Modeling

Session 3

August 27, 2024

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Introductions

Time: 3 minutes

Instructions:

In the chat, share how you are feeling today!

Image from https://www.sofiafeldmann.com/social-emotional-check-ins

Virtual Meeting/Conference Recording Notice

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AIR Inclusive Meeting Guidelines

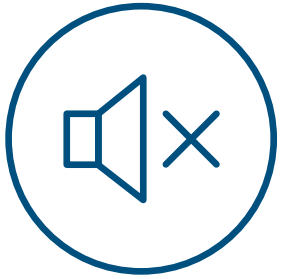
Hosting and Participating in Meetings

ENGAGE EVERYONE

BE HEARD AND SEEN

ACKNOWLEDGE SPEAKER

MAXIMIZE MICROPHONES



MINIMIZE NOISE

MAXIMIZE VISUAL DISPLAYS

Community of Practice Sessions

~~**Session 1:** Propensity Score Analysis and Estimation~~

~~**Session 2:** Propensity Score Weighting/Matching~~

Session 3: Propensity Scores and Outcome Modeling

- Objectives:
  - Understand how to estimate program impacts with propensity score matching/weighting.

Session 4: Office Hours (**Sept. 10th**)

Follow-up

Time: 2 minutes

Question from last session: Does matching with replacement introduce any statistical independent issues?

Session 3 Agenda

1. Session 2 Recap
2. Overview of Estimating Program Impacts
3. Outcome Modeling: Matching
4. Outcome Modeling: Weighting
5. Additional Considerations With Estimating Program Impacts
6. Let's Code!
7. Q&A
8. Next Steps

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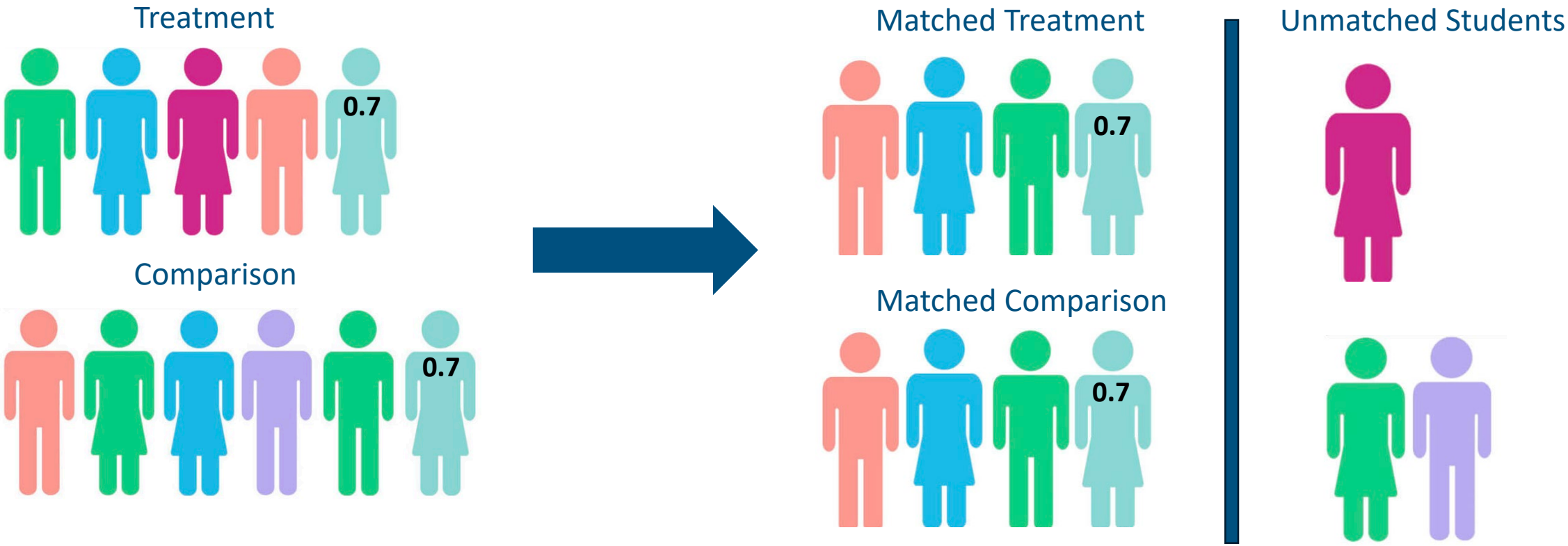
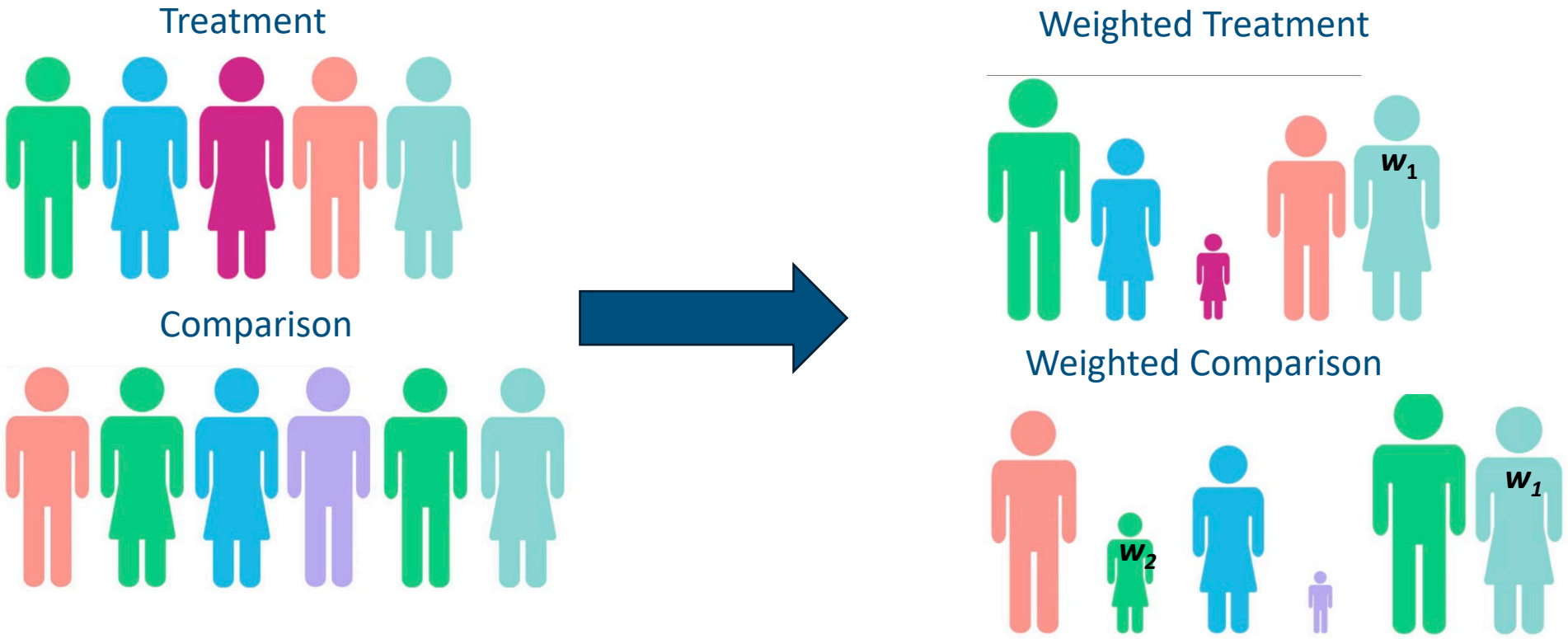
Session 2 Recap

Propensity Score Matching



RQ: What is the impact of participating in an afterschool math program on students' math achievement scores?

Propensity Score Weighting



RQ: What is the impact of participating in an afterschool math program on students' math achievement scores?

Activity: Share-Out

Time: 5 minutes

Instructions: Share (by coming off mute or typing in the chat) if there are any concepts you are struggling with.

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Overview of Estimating Program Impacts

Why do we estimate program impacts?

- **To understand program impact:** For evaluating the effectiveness of an intervention/program, we need to measure its impact accurately.
- **To make policy and practice decisions:** Estimating program impacts helps inform decisions on whether to scale up, modify, or discontinue a program.
- **To allocate resources:** Knowing who benefits most from a program can help target resources more effectively.

What are we interested in estimating?

- **ATE (average treatment effect):** Measures the impact of the afterschool math program on *all* students
- *If every student in the school were to take the afterschool math program, how much better would their math scores be than if every student did not take the program?*
- **ATT (average treatment effect on the treated):** Measures the impact of the afterschool math program on students who *actually* participated in the program.
- *For the students who enrolled in the afterschool math program, how much better were their math scores than if they hadn't taken the program?*

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Outcome Modeling: Matching

Outcome Modeling After Matching

- **PS matching:** Typically targets the **ATT**; some controls might be discarded.
- **Straightforward matching:** Model your outcome as a function of treatment (*Z*) on the matched data set.
- **Matching with replacement:** Account for the replacement with matching weights.

Matching without replacement

```
mod <- lm(outcome ~ treatment,
          data = matched.data)
```

Matching **with** replacement

```
mod <- lm(outcome ~ treatment,
          data = matched.data,
          weights = "weights")
```

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Outcome Modeling: Weighting

Outcome Modeling After Weighting

- PS weighting is versatile, estimating both ATE and ATT.
- Model your outcome as a function of treatment (*Z*) using the calculated PS weights.
- **ATE weights:**
  - Treated: 1/PS
  - Comparison: 1/(1-PS)
- **ATT weights:**
  - Treated: 1
  - Comparison: PS/(1-PS)

```
mod <- lm(outcome ~ treatment,
          data = matched.data,
          weights = "ps.weights")
```

Additional Considerations With Estimating Program Impacts

Standard Errors

Challenge: Estimating PS adds uncertainty.

1. **Ignore the uncertainty:** Calculate normal standard errors (SEs).
   - **Pros:** Simple, often used in practice…but don't do it
   - **Con:** Might underestimate the true variability, leading to narrow confidence intervals
2. **Account for the uncertainty:** Adjust standard errors to incorporate the uncertainty.
   - Bootstrap SEs, sandwich/robust SEs
   - **Pro:** Enhanced accuracy
   - **Con:** Computationally intensive if calculating bootstrapped SEs

Addressing Remaining Imbalance

- Post-matching/weighting might still exhibit covariate imbalance, risking biased treatment effect estimates.
- **Doubly robust estimation** combines PS methods with regression adjustment.
  - When modeling outcomes, include the covariates from your matching/weighting approach.
- Strengthening against misspecification in either the PS or the outcome model enhances robustness of our estimated treatment effects.

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Let’s Code!

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Q&A

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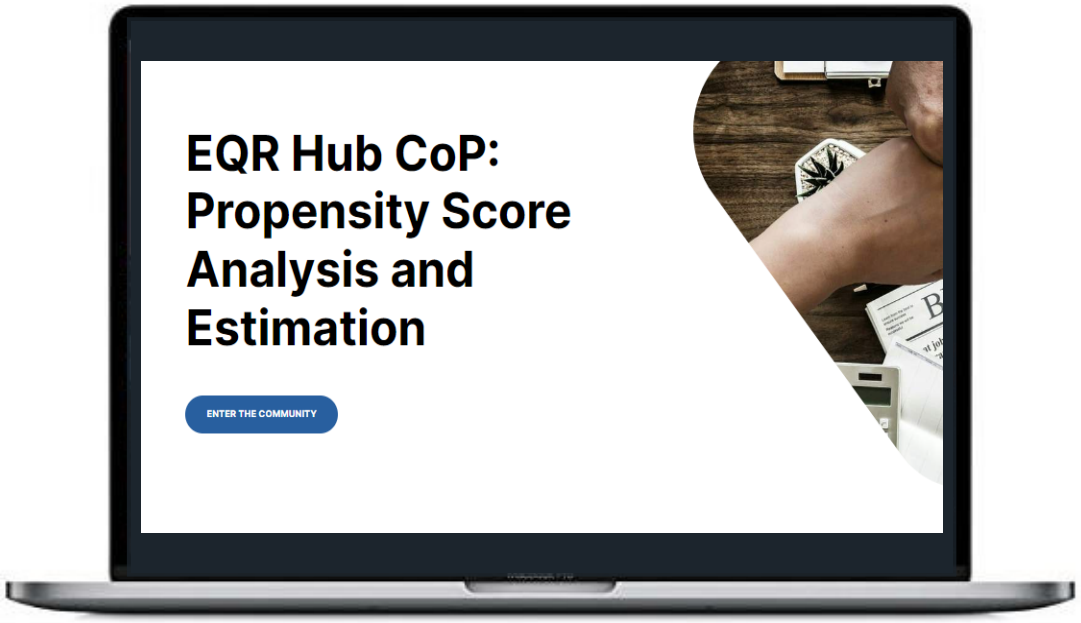
Next Steps

Homework Assignment

Time: Complete prior to Session 4

Instructions for Office Hours:

- Bring any remaining questions you have! ☺
- Bring your data ☺
- Feel free to send me your questions/description of your study beforehand:
  - aguzman-alvarez@air.org



NSF and CADRE Resources

DRK-12 Request for Proposals:

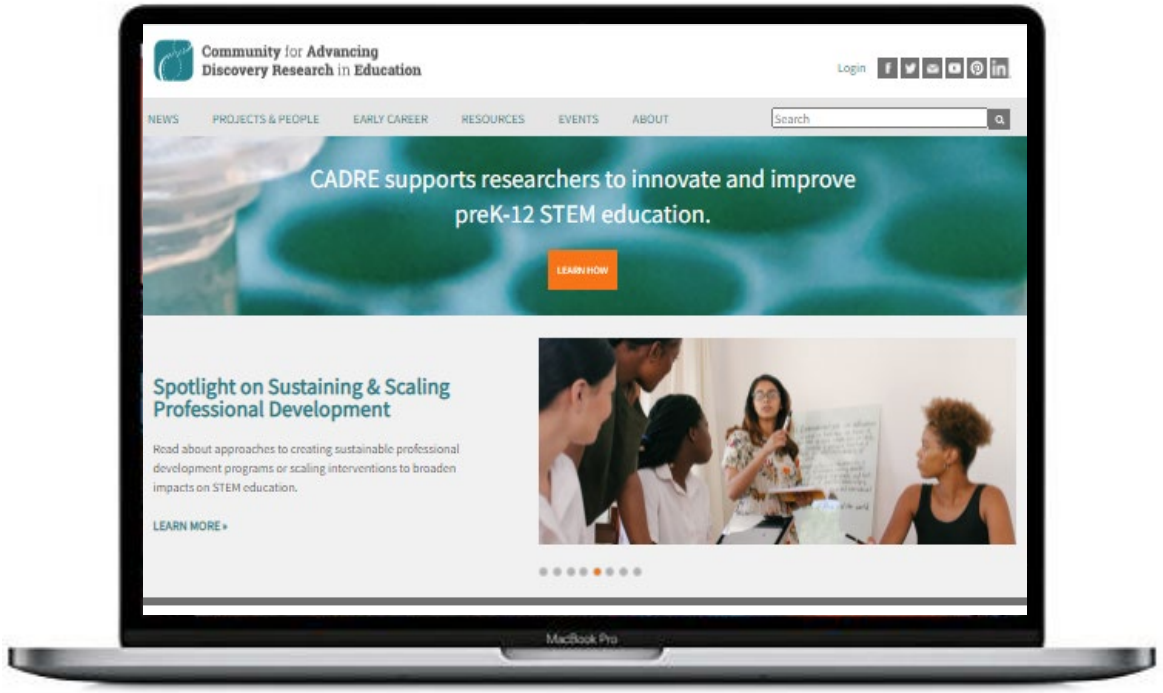
https://new.nsf.gov/funding/opportunities/discovery-research-prek-12-drk-12

Research Toolkit:

https://cadrek12.org/resources/research-toolkit#methods

NSF Proposal Toolkit:

https://cadrek12.org/resources/nsf-proposal-writing-resources



Feedback

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https://www.surveymonkey.com/r/ZQ295N3

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