Diversifying Science: Effects of Minority Training Programs and Why They Work

Presentation at the National Academies of Sciences, Engineering, and Medicine Committee Meeting on *Strengthening Research Experiences for Undergraduate STEM Students*, Washington, DC, September 16th 2015

The Science Study
Supported by the National Institutes of Health

California State University SAN MARCOS

WestVirginiaUniversity.

National Institute of General Medical Sciences

Minority Training

- Concerted effort for over 40 years to increase the diversity in the sciences
- Many programs promote research careers among members of underrepresented groups
  - NIH, NSF, State, Local , Private
  - Undergraduate, graduate, post-graduate & early career
- "In 2002, the number of trainees [in NIH programs] exceeded 16,000, reflecting a spending level of approximately $650 million." Assessment of NIH Minority Research and Training Programs: Phase 3

Do These Programs Work? Problems with Existing Data

1. Programs can "cherry pick" students who are likely to succeed

    - These students are likely to succeed *without* the program

2. No control group

3. Inadequate sample size (often one program)

4. Long-term evaluations outside of funding scope

5. No way to examine the "mechanisms" of success

6. Retrospective accounts can be biased

Overview: *TheScienceStudy*

- Prospective, propensity matched control
- Longitudinal study of NIH-funded R.I.S.E. (and MARC) students
- Launched in 2005
- Participants from 50 campuses nationwide
- Twice yearly surveys from students
- Starting panel of 1420 students

Longitudinal Panel

72% Female

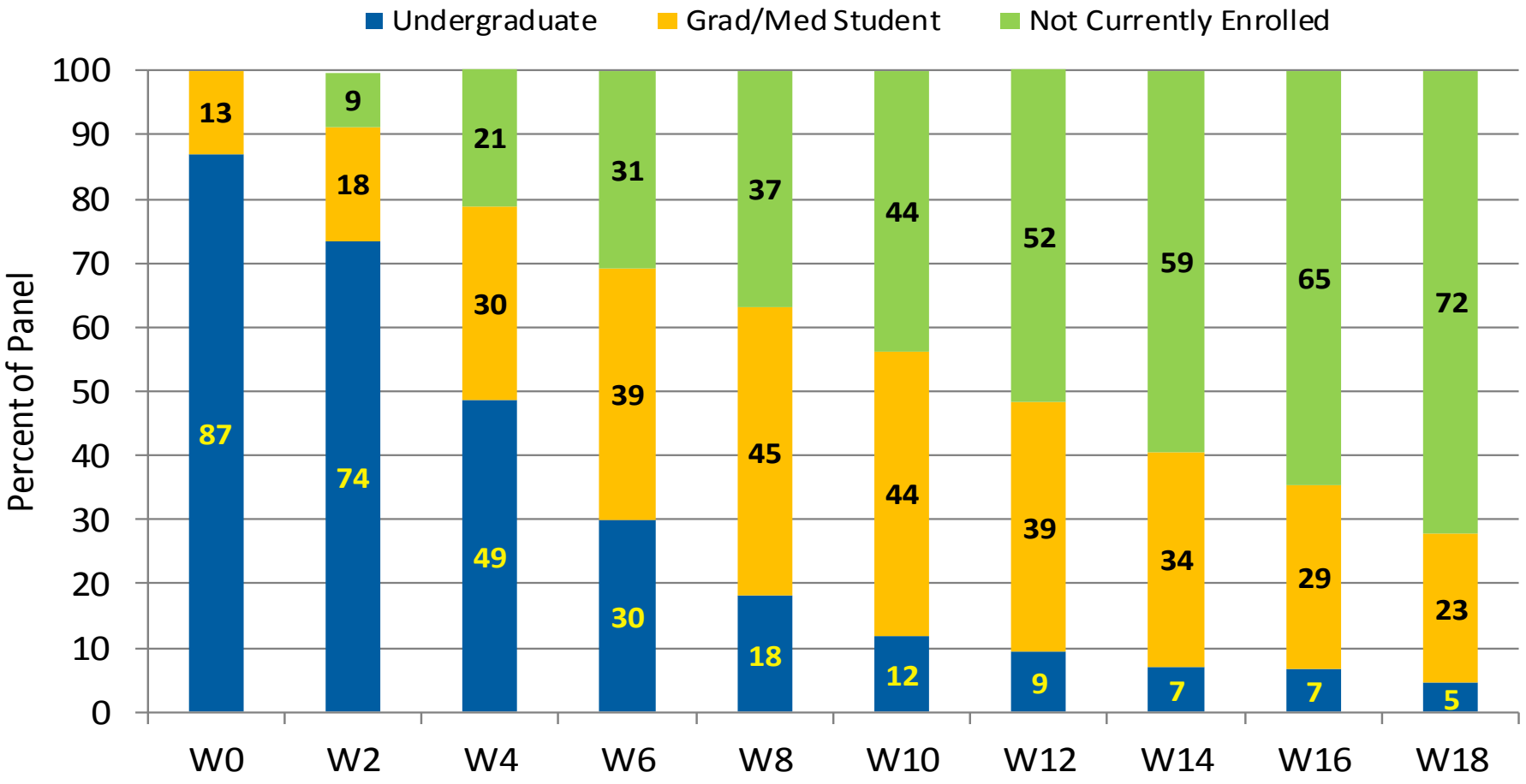
Ethnicity/Race:

- 49% African American
- 39% Hispanic/Latino(a)
- 11% Mixed/Other
- 1% Native American

Major (at Wave 0):

- 63% Biological Sciences
- 21% Natural Sciences
- 12% Behavioral & Social Sciences
- 4% Mathematics & Engineering

Panel: Educational Progress

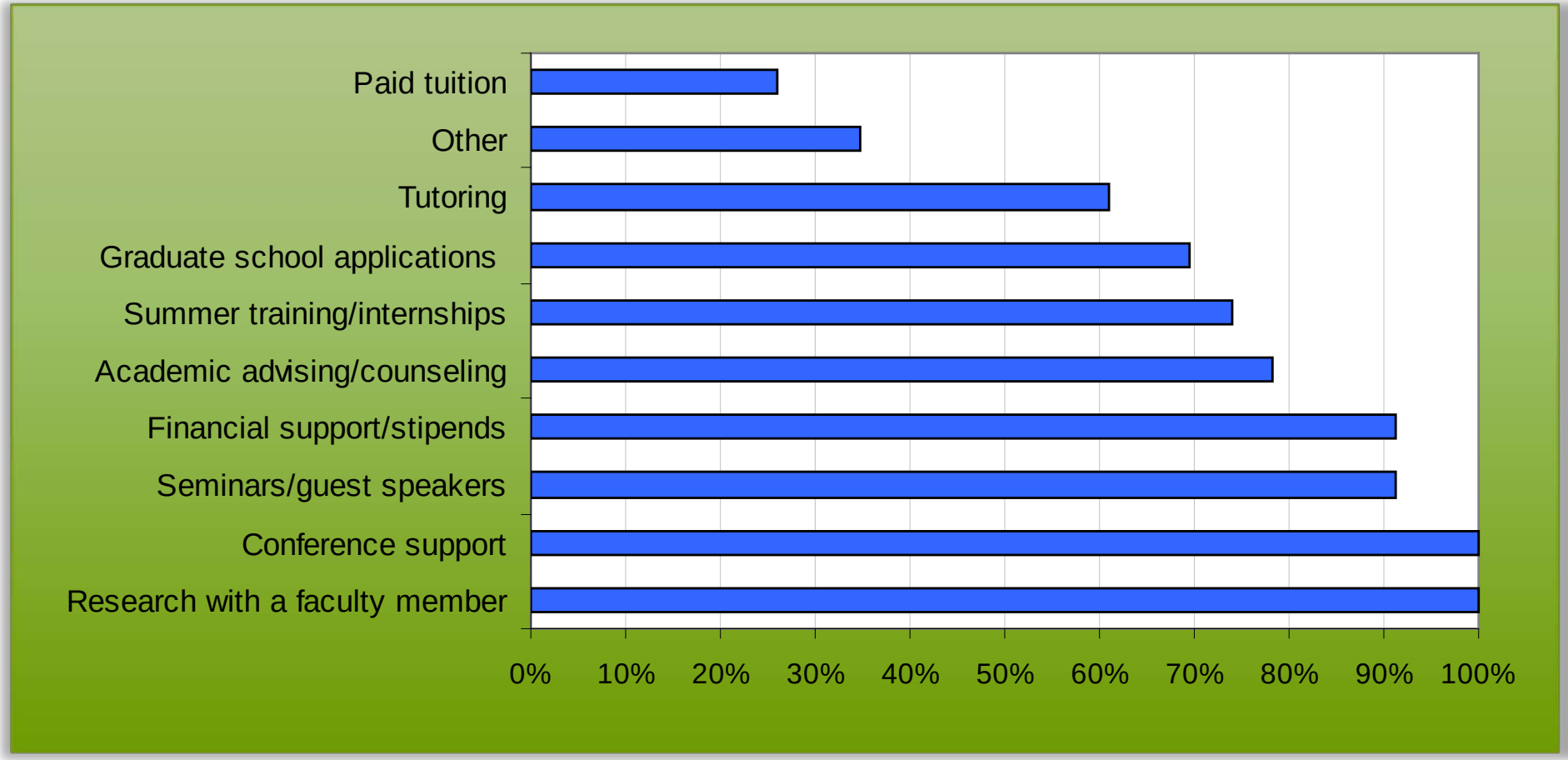


Note: The "not currently enrolled" category includes those who have graduated and those who have either permanently or temporarily left college before graduation.

RISE Effect

Career Choices

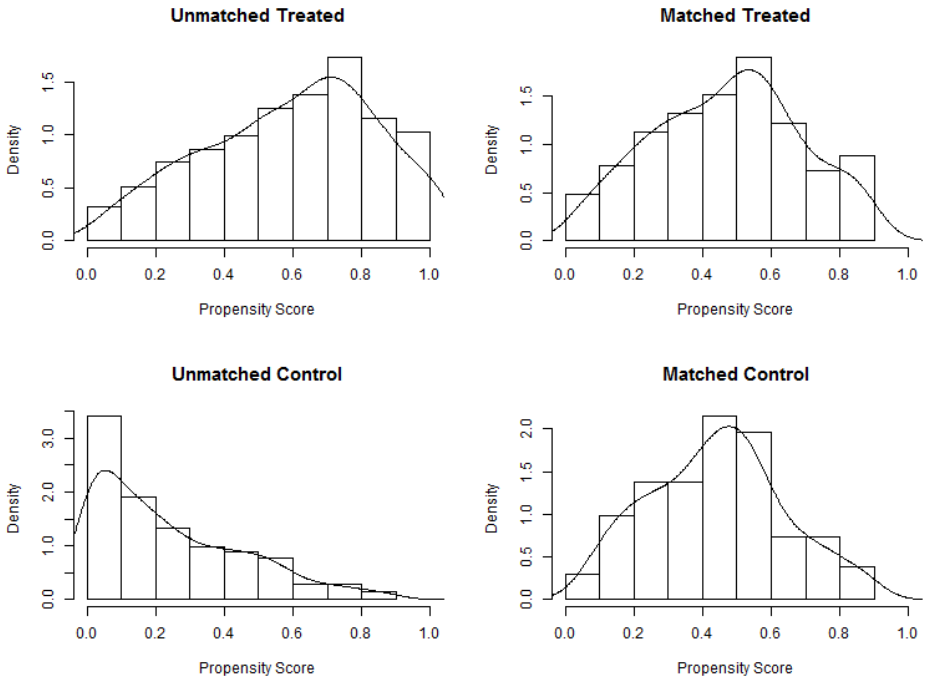
NIH RISE Program



Note: Results based on survey responses from 25 RISE directors,

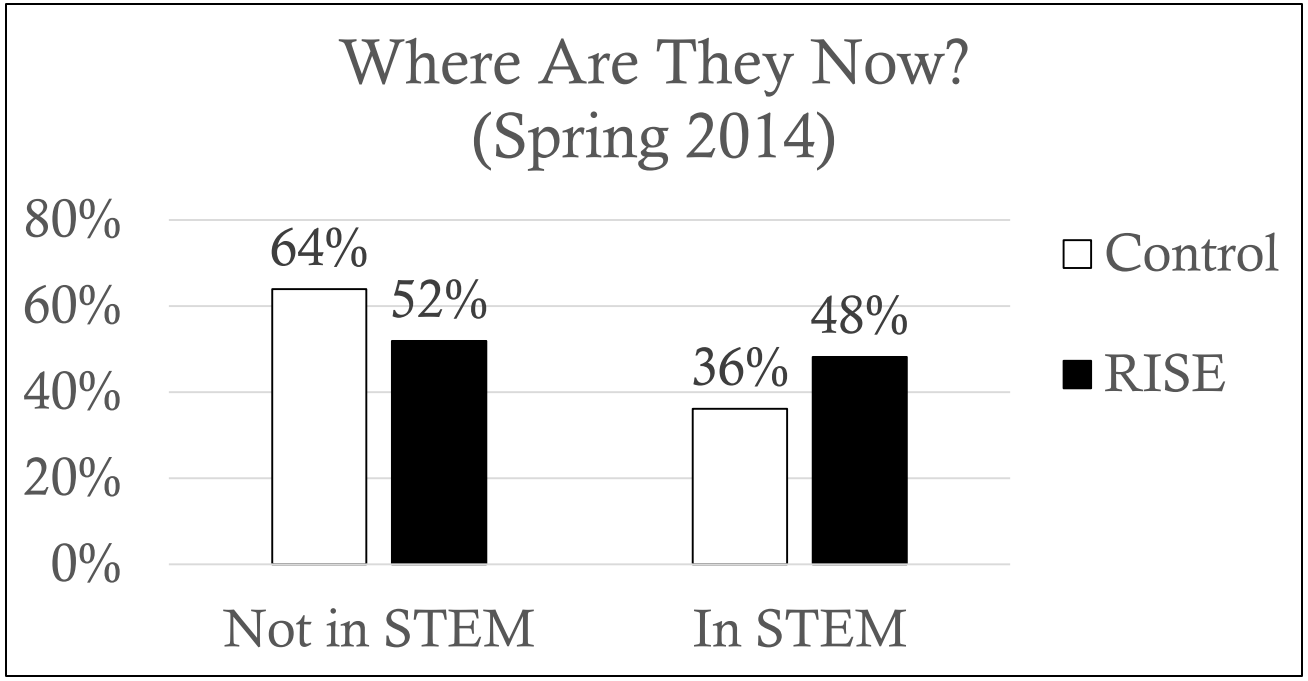
Propensity Score Matching: RISE Effects

- Propensity score matching
- Achieved balance on all covariates in propensity model
- RISE = 204, Control = 204



RISE Effect: STEM Career

- In STEM (1) vs. non-STEM career (0) in 2014 (n = 216)
  - Odds of STEM career in Control group: 0.57
  - OR_{adj}: **2.05 – RISE students 2-times more likely to be STEM career 9 years after enrolling in the study (p<.05)**.

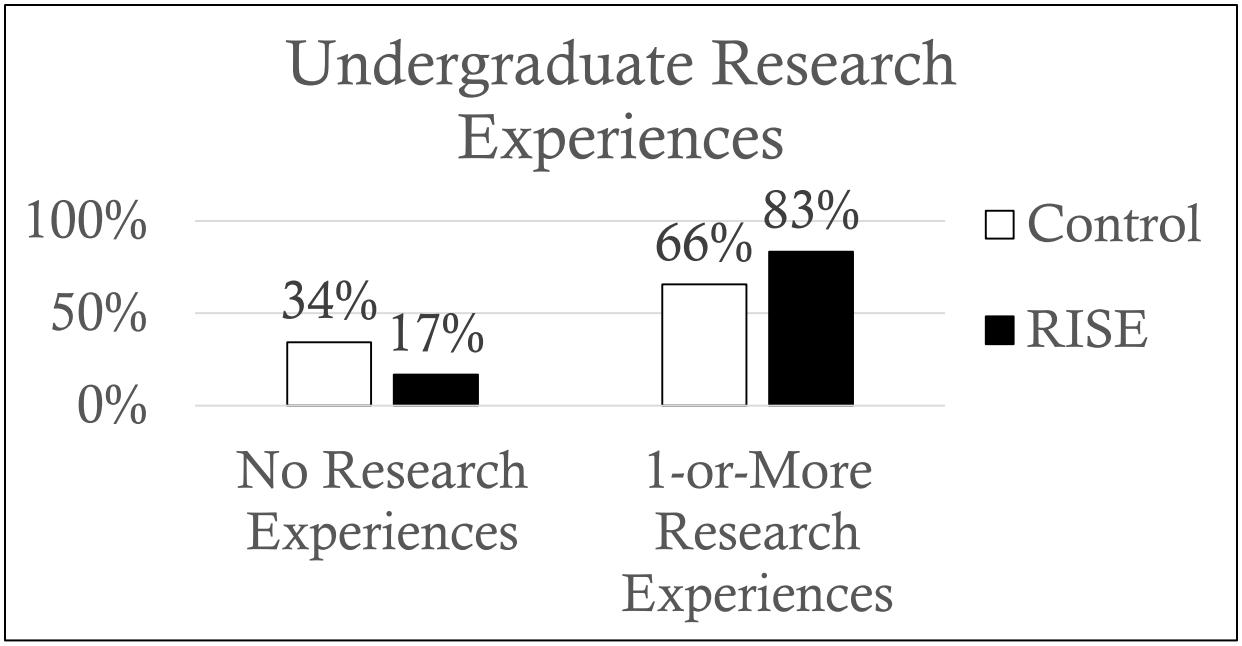


RISE Program Components

Types of Research Experiences

RISE Effect: Research Experiences

- Undergraduate Research Experience (1) vs. None (0) as an undergraduate (*n*=408)
  - Odds of 1-or-more semesters of research in Control group: 1.91
  - OR_{adj}: **2.90 – RISE students nearly 3-times more likely to have 1-or-more research experiences as an undergraduate (*p*<.001)**.



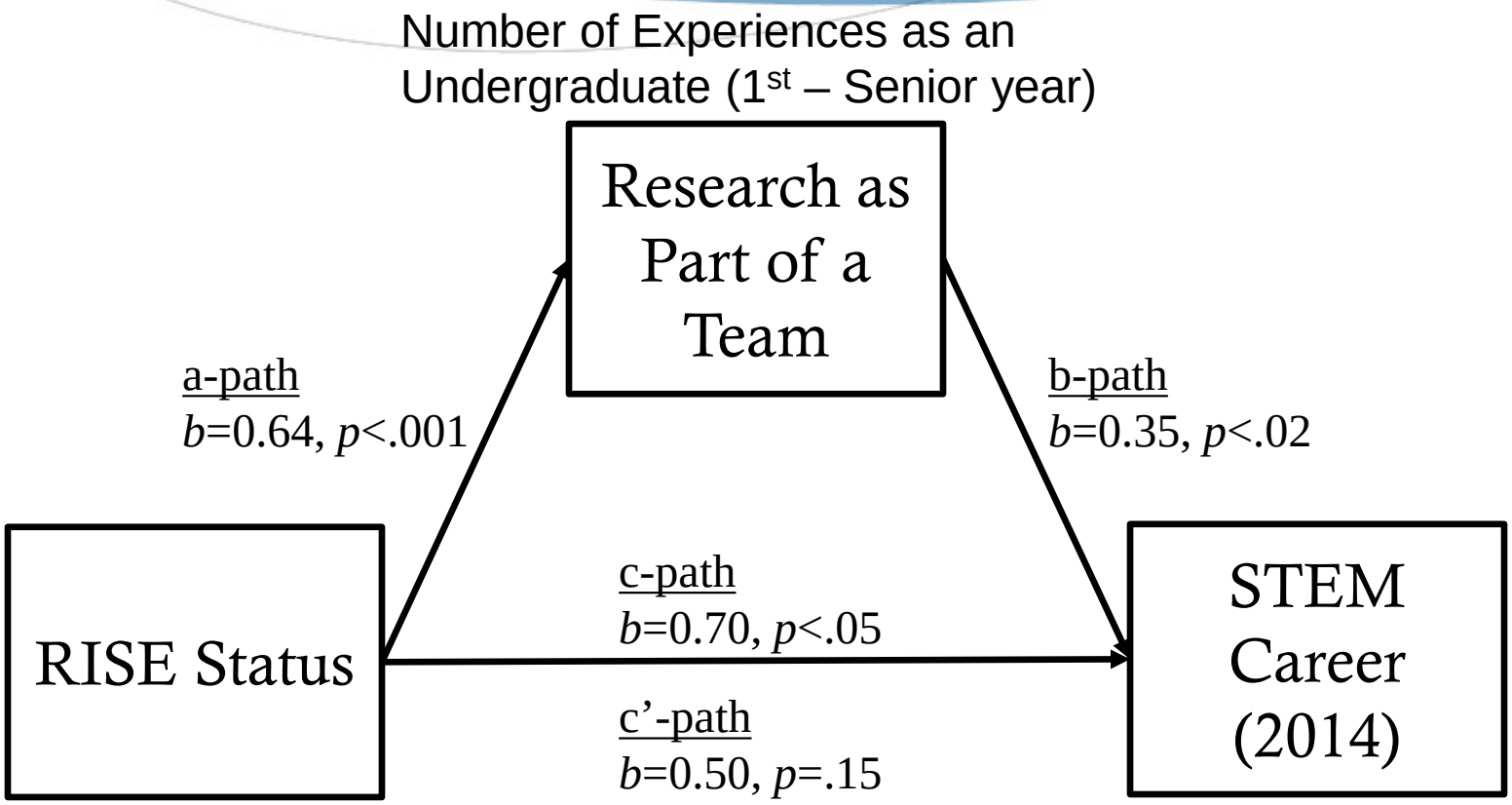
RISE Effect: Types of Research Experiences

- RISE group had significantly[1] more experiences[2] with (n=294):
  - Personally designed/conducted an original research project
    (g = .58, M_{RISE} = 1.38, $M_{Control}$ = 0.71, p<.001)
  - Designed/conducted an original research project as part of a team
    (g = .60, M_{RISE} = 1.55, $M_{Control}$ = 0.84, p<.001)
  - Submitted a paper for publication, listed as author
    (g = .36, M_{RISE} = 0.44, $M_{Control}$ = 0.19, p<.003)
  - Paper accepted, listed as author
    (g = .25, M_{RISE} = 0.25, $M_{Control}$ = 0.12, p<.04)
  - Presented original research at academic research fair/competition
    (g = .91, M_{RISE} = 1.21, $M_{Control}$ = 0.41, p<.001)

[1]Multivariate $\eta^2_{partial}$ = .20

[2]All questions framed in terms of last 6-months

RISE Effect: Process Model



Indirect Effect

a*b = 0.23, Bootstrapped 95% *CI* [0.01, 0.52]

Key Points

1. Propensity score methodology is one of the *few* principled approaches to estimating causal effects in observational data.

2. Minority training programs such as RISE have a strong effect on student persistence in STEM careers.

3. RISE group had higher rate of engagement in undergraduate research experiences, compared to PSM Controls.

4. RISE students engaged in more variety of research experiences, taking on different roles (lead, support).

5. Research experiences, in particular, conducting research as part of a team, mediated the effect of RISE membership on STEM career choice/persistence in STEM.

Research Team

Wesley Schultz (PI)
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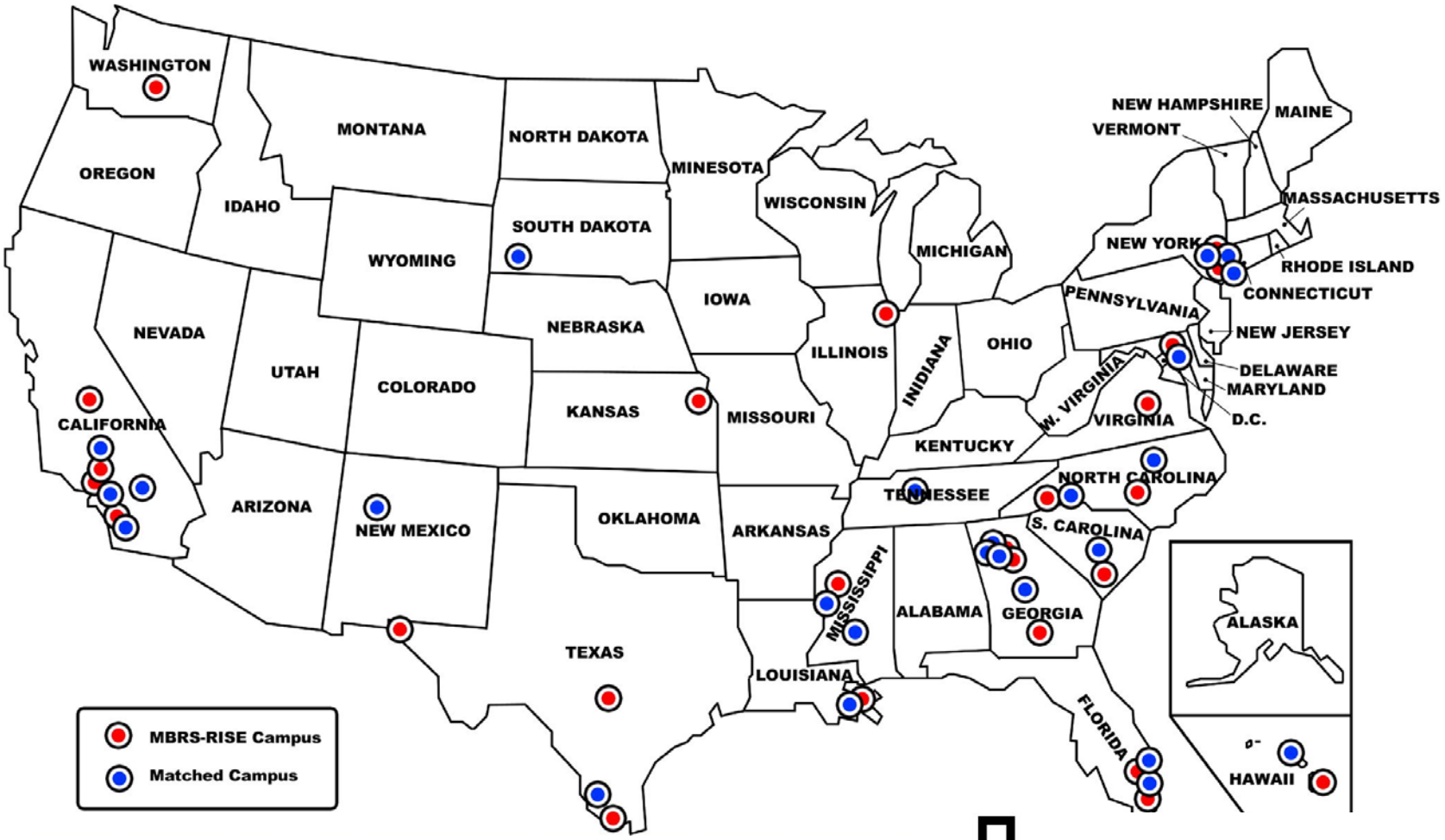
Anna Woodcock
Paul Hernandez
Richard Serpe
Victor Rocha
Stephen Quartucci

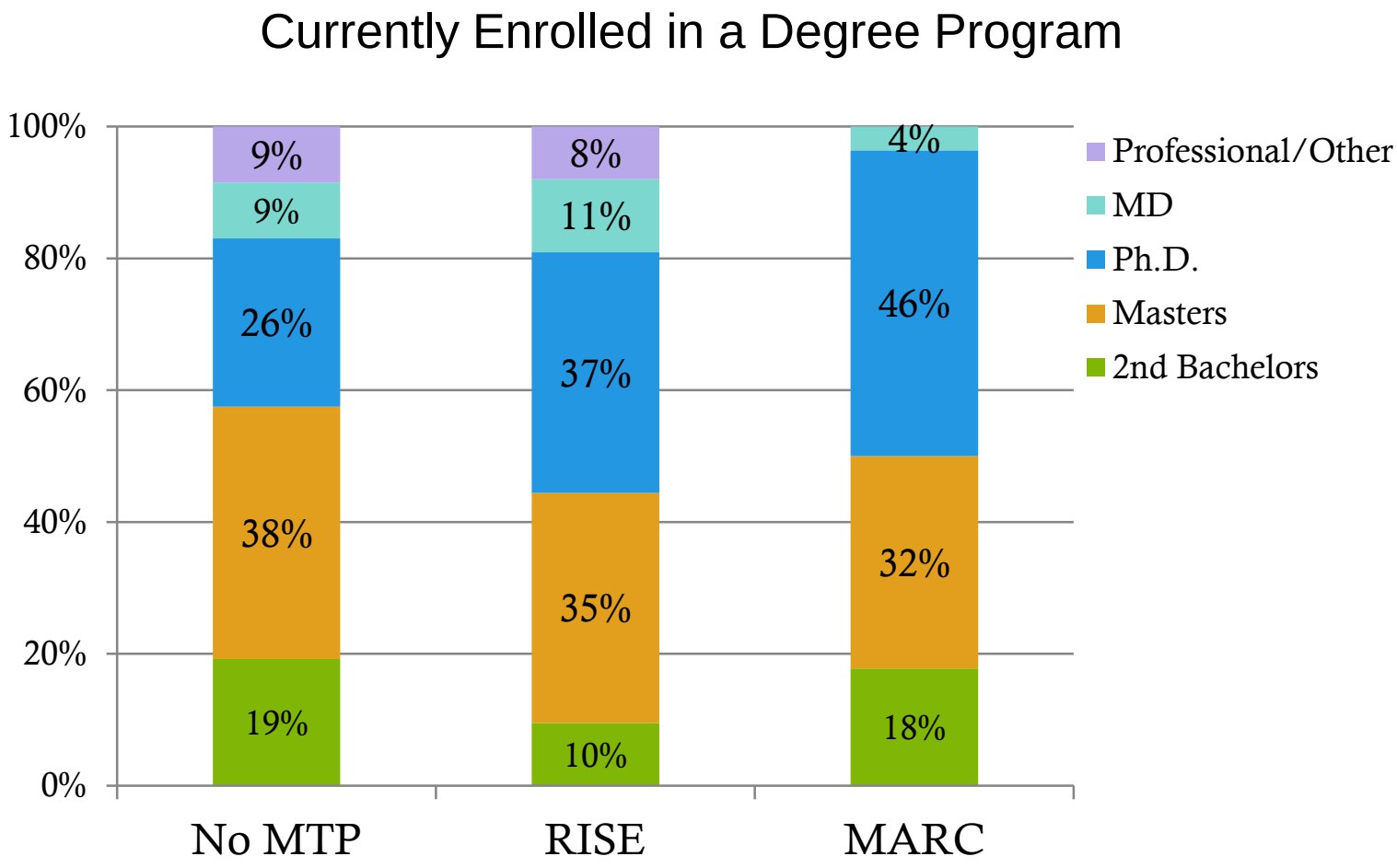
Thank You

25 R.I.S.E. Programs



The Science Study
Supported by the National Institutes of Health

Where are they now? 2005 → 2014



* W0 Juniors and Seniors who have graduated with B.A./B.S. MTP = Minority Training Program.

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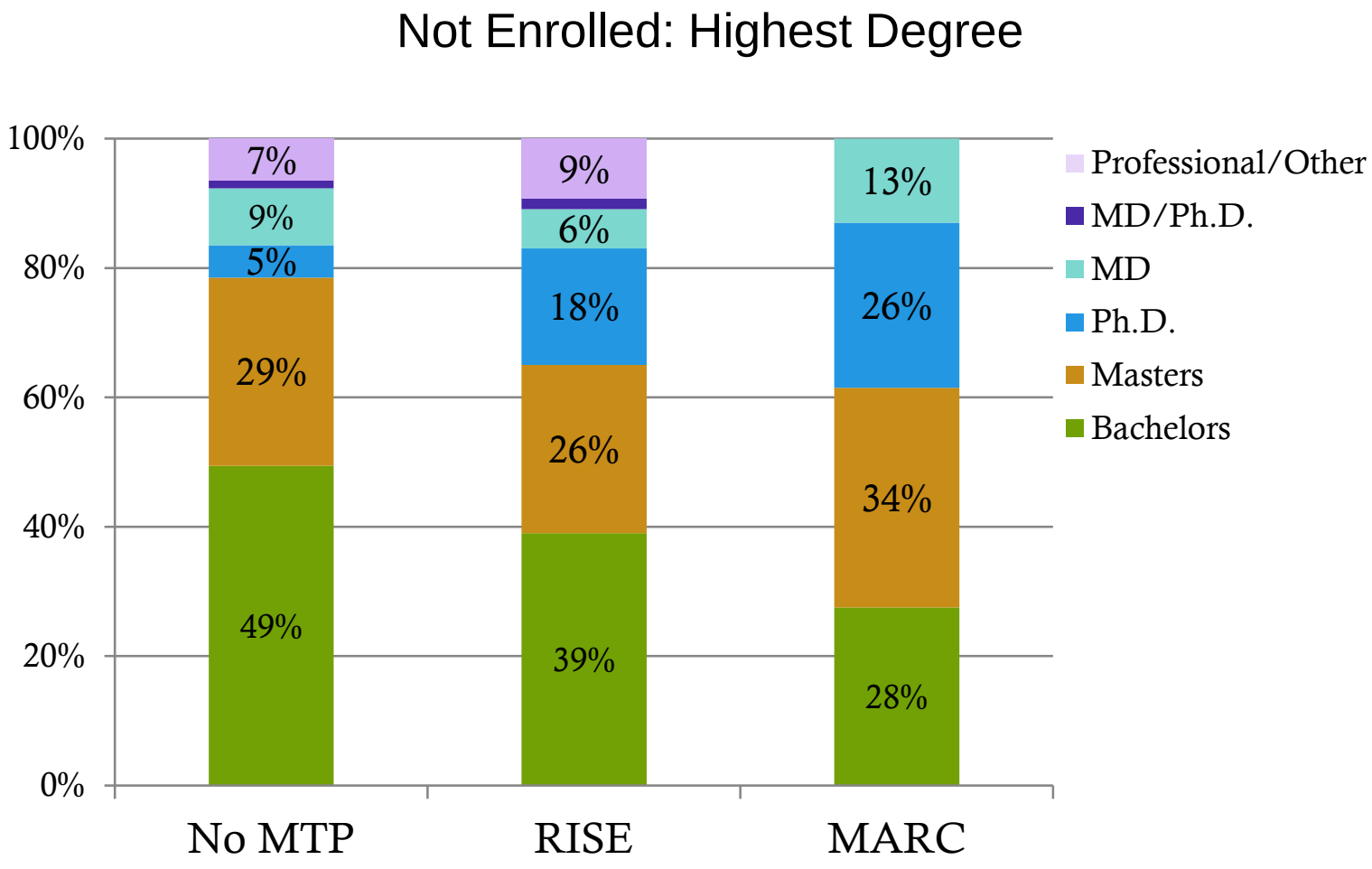

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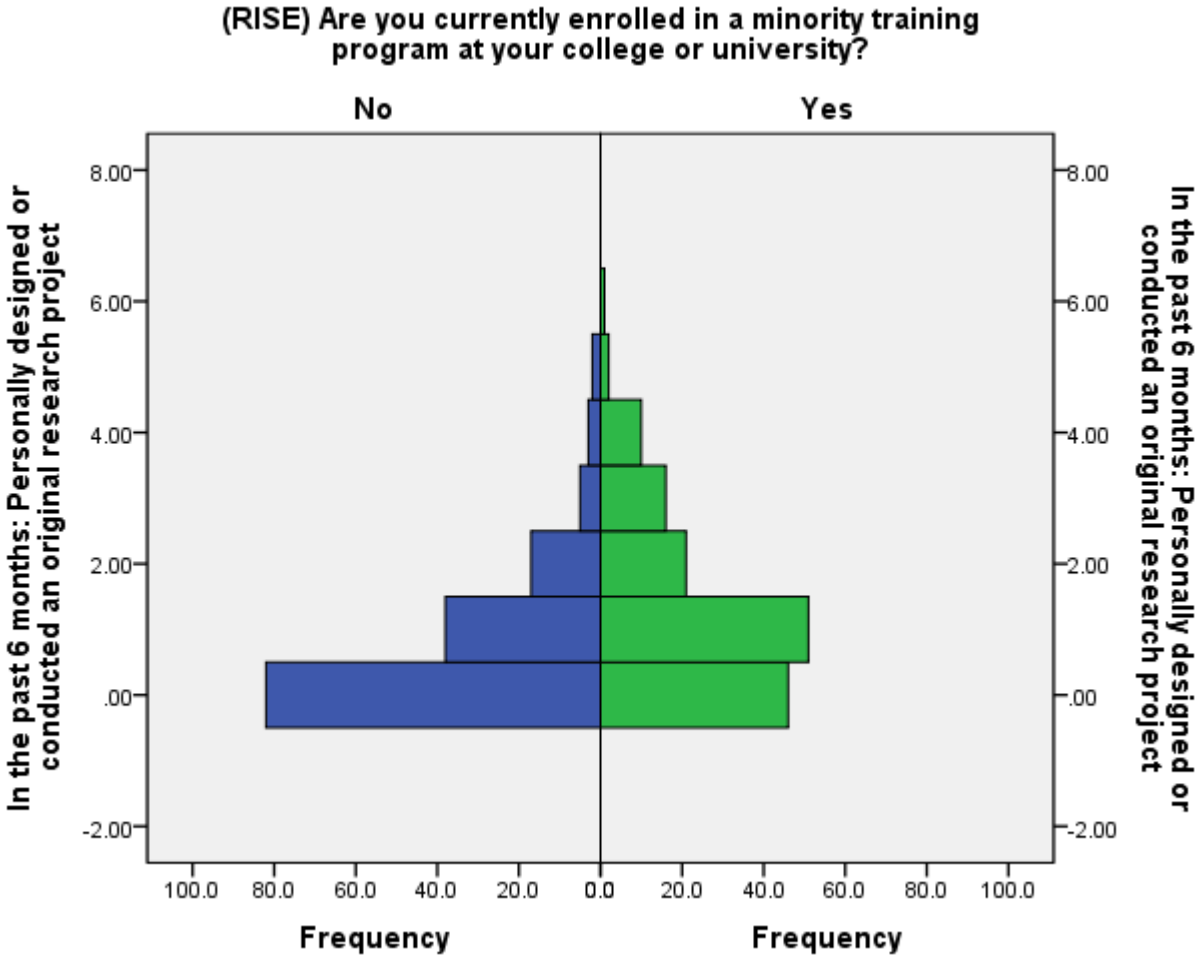
RISE Effect: STEM Career

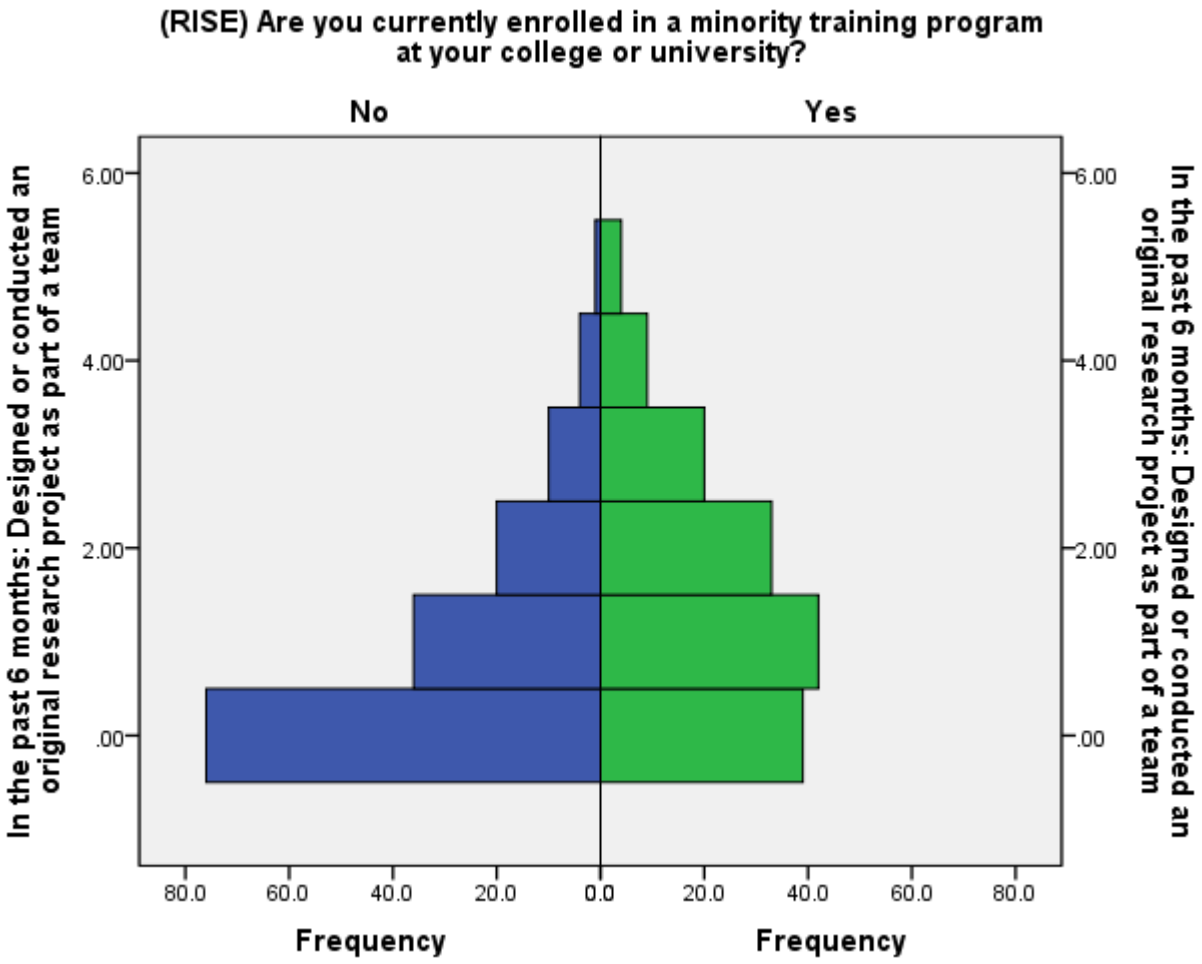
- In Medical/Clinical (1) vs non-Medical/Clinical career (0) in 2014
  - Odds of Medical/Clinical career in Control group: 0.64
  - OR_{adj}: 0.60 – RISE students 1.66-times less likely to be medical/clinical career 9 years after enrolling in the study (p=.12).

- In non-STEM/Med. vs. STEM/Med. Career (2014)
  - Odds of STEM career in Control group: 0.30
  - OR_{adj}: 0.80 – RISE students 1.25-times less likely to be STEM career 9 years after enrolling in the study (p=.53).

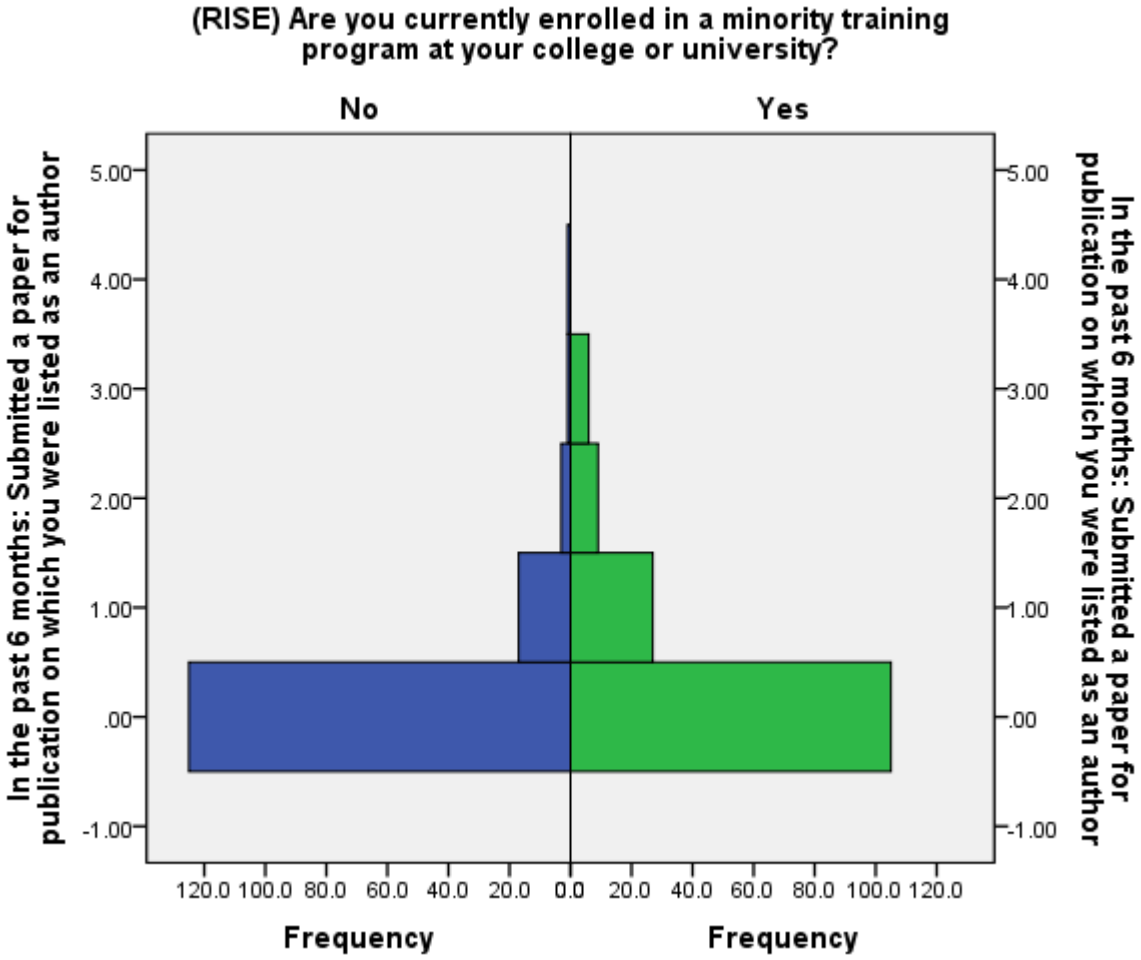
RISE Effect: Personally Designed Research Project



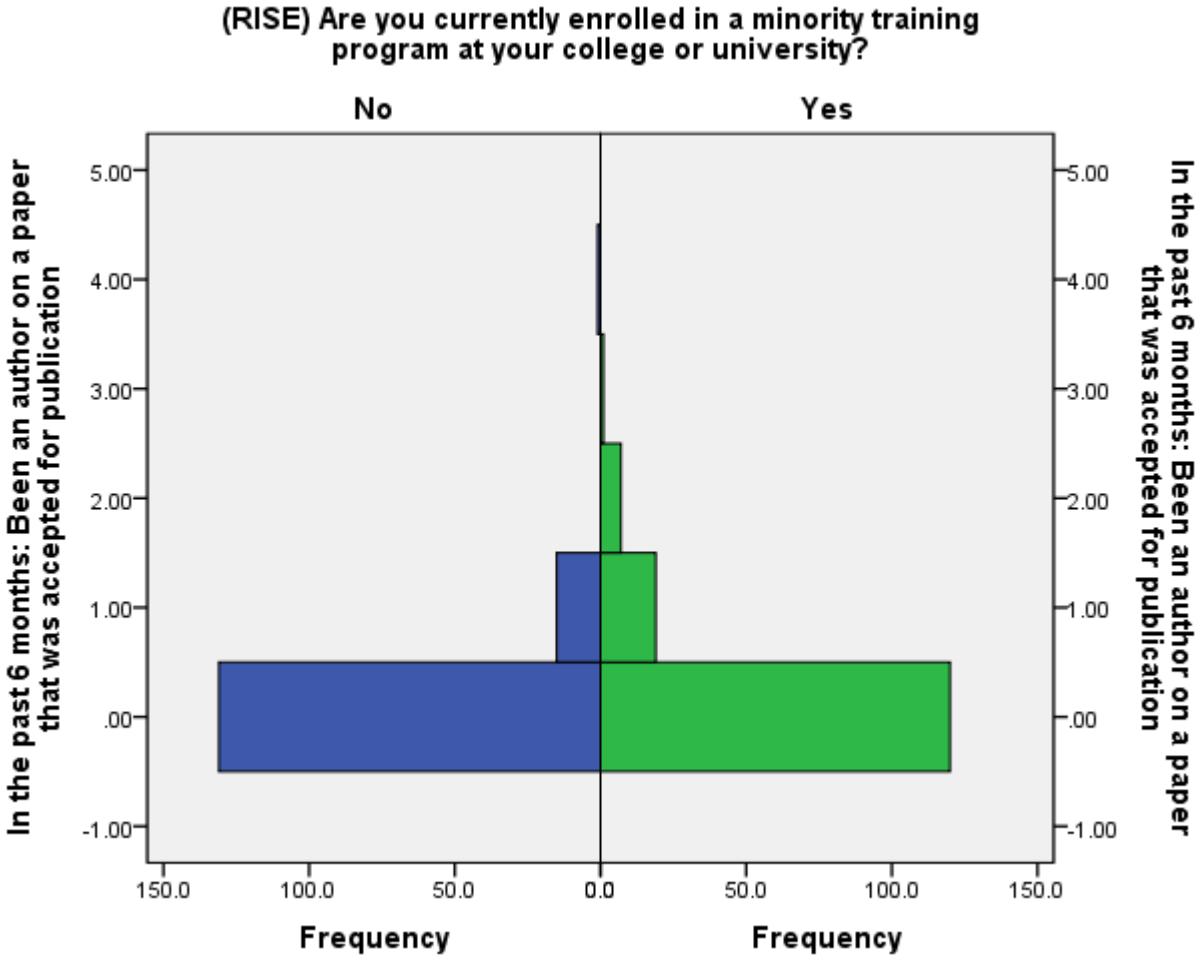
RISE Effect: Research as Part of a Team



RISE Effect: Submitted Paper for Publication



RISE Effect: Paper Published



RISE Effect: Presented Research