

How Broad is the Impact: the Relationship between Undergraduate Research and College Graduation



Undergraduate Research Opportunities Center
UROC
California State University, Monterey Bay

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Introduction

An incoming student at a public U.S. four-year college only has a 35.5% chance of graduating in four years, and a 58.9% chance of graduating in six years (NCES 2017).

Can undergraduate research (UR), as a high-impact practice, increase a student's likelihood of graduating college?

Undergraduate research has been linked to a number of positive student outcomes, but previous studies on this high-impact practice almost exclusively fall into at least one of three significant limitations: data from a single institution; subjective measures of student success; and/or inappropriate comparison groups (NAS, 2017). We address these limitations by using data from five institutions, employing a post-hoc, quasi-experimental design, and examining an objective measure of academic success.

Research Questions

1. What is the impact of participation in UR on the likelihood of graduating in 4-years, 6-years, or ever when compared to like-peers and controlling for student background characteristics?
2. What other factors impact likelihood of graduating?
3. What is the relative predictive strength of UR participation on graduation rates vs. other factors?

Methods

Sample: prior students from 5 participating public institutions in the U.S. (N=48,992)

Institutional, census data 2008-2018 on: undergraduate research participation, student characteristics, academic performance, and time-to-graduation.

Propensity score matching (PSM), a post-hoc, quasi-experimental methodology recognized by the Department of Education's What Works Clearinghouse as means of simulating random assignment (Song & Herman 2010), is used to create an appropriate comparison group of like-peers. Only significant predictors of UR participation were used in PSM (see Table 1).

Table I: Covariates (x) Included in Calculating Propensity Score at Each University

	Univ. 1	Univ. 2	Univ. 3	Univ. 4	Univ. 5
First-time, Fulltime Student	x		x	x	
STEM Majors	x	x		x	
White		x	x		x
Black		x	x		x
Asian/Pacific Islander		x	x		x
Native American		x	x		x
Latinx		x	x		x
Multi-racial		x	x		x
Gender (Female)		x	x		
First Generation	x		x	x	
Pell Eligible				x	
Prior Academic Performance (GPA)	x	x	x	x	x

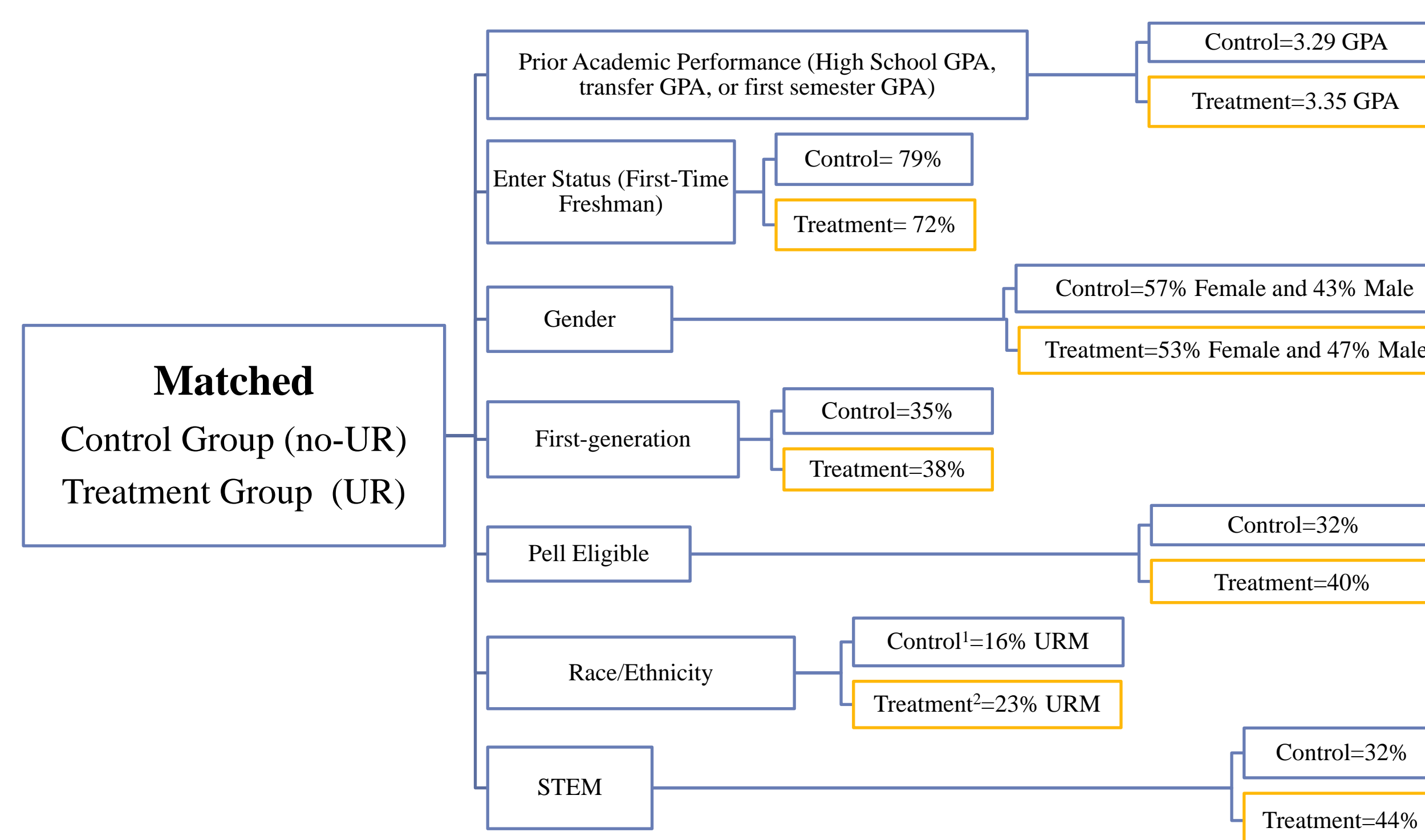
Nearest neighbor matching was used to match undergraduate researchers with similar students who had not been in UR, with a difference in propensity scores (PS) less than .000001. Models were tested for differences in prior academic performance, parental education, Pell eligibility, race/ethnicity, gender, and entering status. Prior to PSM matching, each university had a number of significant differences between UR student population and the general student population, but after matching, these differences were dramatically reduced.

Once the matched data was completed, data from all of the universities were merged to create the final data set for analysis.

Analysis

The matched sample includes a control group that is similar to the undergraduate researcher group; though the match is not exact.

Figure I: Matched Sample (N=7,936)



T-tests and logistic regressions were conducted to estimate the impact of UR on the likelihood of graduating in 4-years, 6-years and ever (8+ years), while controlling for students' characteristics, prior academic performance, and institution.

Findings: Impact on Graduation

Undergraduate research was a significant predictor of graduation within 4-years, 6-years or ever, even when being compared to like-peers and when controlling for background characteristics and prior academic performance.

STEM majors were less likely to graduate ever or in 6-years. Female students were more likely to graduate in 4-years. Pell eligible students were slightly less likely to graduate in 4-years.

Table II: Relationship between UR and Likelihood of Graduating (N= 7,936)

	Grad 4yr	Grad 6yr	Grad Ever
	R ² .13	R ² .299	R ² .304
	Exp (β)	Exp (β)	Exp (β)
University 2	0.516***	1.287	1.623
University 3	1.194	0.763	1.262
University 4	0.515***	1.429**	1.811***
University 5	1.129	0.397***	N/A ₁
STEM	0.794	0.713***	0.656***
Ethnicity Black ₂	0.902	0.926	0.612
Ethnicity Asian/Pacific Islander	0.792***	1.129	1.278
Ethnicity Native American	0.488	0.244	0.216
Ethnicity Latino/Latina	1.138	0.856	0.969
Two or More Races Selected	1.063	0.814	0.786
Gender (Female)	1.418***	1.039	1.050
Pell Eligible Ever	0.749***	0.839	0.862
First-generation in College	0.858	0.875	0.831
Prior Academic Performance	1.733***	1.852***	1.651***
Participation in UR	2.541***	12.11***	13.454***
Enter status: First-time Freshman	N/A	N/A	0.774**
Constant	0.068***	0.243***	0.461***

- Undergraduate researchers were:
- 2.5 times more likely to graduate in 4-years
 - 12 times more likely to graduate in 6-years
 - 13.5 times more likely to ever graduate.

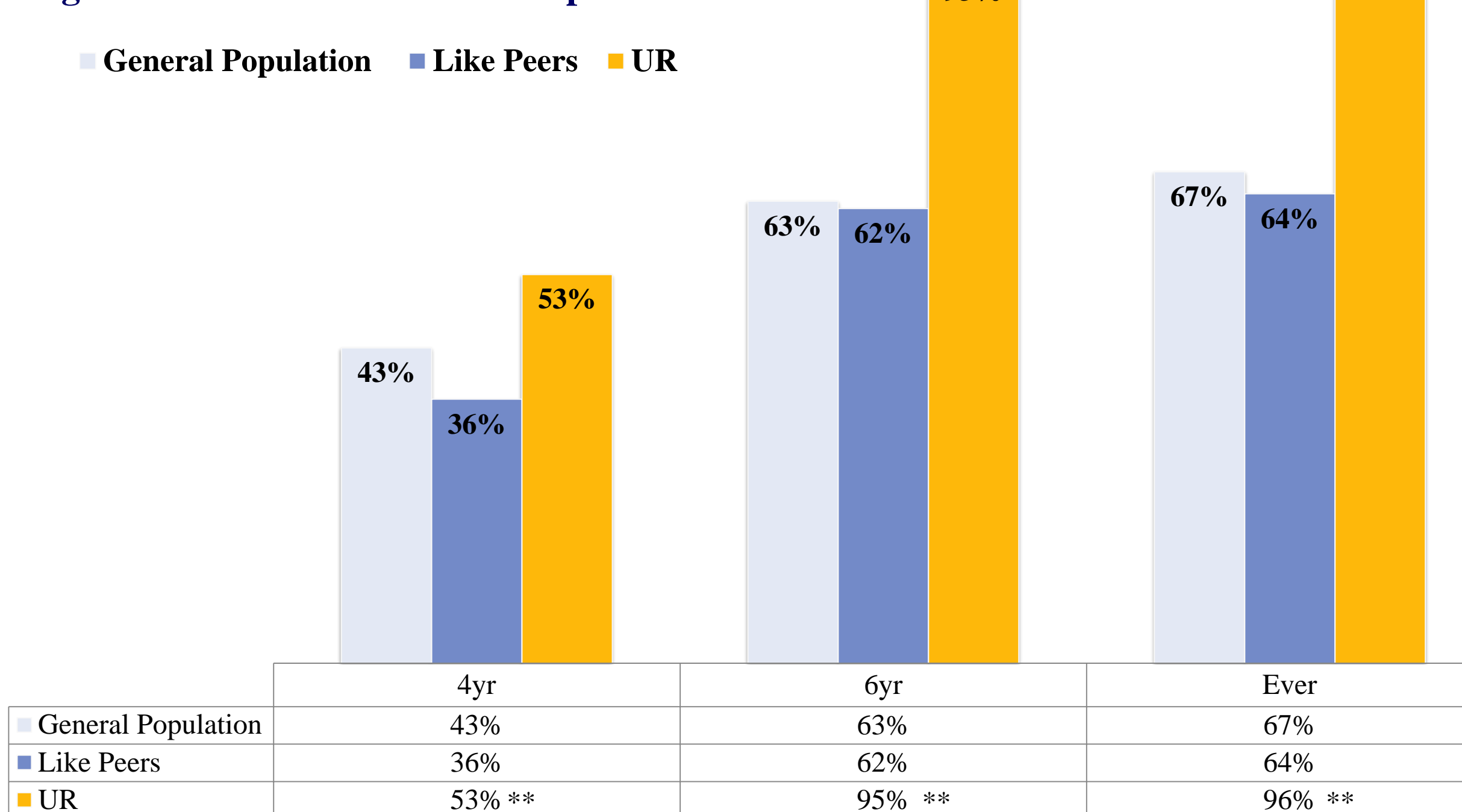
Prior academic performance was the next strongest, positive predictor of graduation.

** p < .001 and *** p < .0001
₁ University 5 did not report graduation dates past 6 years. University 1 is used as a reference group
₂ Reference group for ethnicity is White.

Findings: Grad Rates

Students who participated in undergraduate research graduated at dramatically and significantly higher rates than their matched peer group. More than half of undergraduate researchers graduated in 4-years compared to slightly more than a third of their like-peers (4yr graduation: t = -14.17, df = 5935, p < .001). The increase in graduation rates was even more dramatic at 6-years (6yr graduation: t = -35.83, df = 5935, p < .001) or more (graduation ever: t = -35.74, df = 579, p < .001). The pattern of significantly higher graduation rates for undergraduate researchers was also true when compared to the general student population.

Figure II: Graduation Rate Comparisons



** p < .001

Discussion

Undergraduate research had a strong and significant relationship to a student's likelihood of graduating even when compared to like-peers and while controlling for student background characteristics, institution attended, and prior academic performance.

A common critique of associating UR with academic success is the assumption that already high achieving students are the students who engage in UR. We found that undergraduate researchers did have somewhat higher prior academic performance on average (3.04 first-year GPA for the general population and 3.33 GPA for UR), but we still found a dramatic, positive effect of participation when comparing to similarly higher achieving peers and when controlling for prior academic performance.

Results from this multi-institution comparison between undergraduate researchers and like-peers suggests that the higher rates of academic success for undergraduate researchers can be generalized beyond a single program or institution; are not solely due to self-selection bias; and are evident in a more objective measure of success, namely graduating college. As we seek ways to close education gaps and increase graduation rates, undergraduate research can be a meaningful way to improve student success.

Acknowledgements

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References

National Academies of Sciences, E. (2017). *Undergraduate Research Experiences for STEM Students: Successes, Challenges, and Opportunities*. <https://doi.org/10.17226/24622>
Song, M., & Herman, R. (2010). Critical Issues and Common Pitfalls in Designing and Conducting Impact Studies in Education: Lessons Learned From the What Works Clearinghouse (Phase I). *Educational Evaluation and Policy Analysis*, 32(3), 351–371. <https://doi.org/10.3102/0162373710373389>

How Broad is the Impact at Your Institution?

Contact Heather Haeger for information on participation
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Study

Do you want to know what the impact of undergraduate research (UR) is on your campus? Your college or university could participate in a multi-institution, quasi-experimental study on objective measures of academic success.

Research Questions

1. What is the impact of participating research experience on student success as measured by, yearly retention rates, senior year cumulative grade point average (GPA), and graduation rates?
 - a. For the general student population as well and broken down by populations of students who are traditionally underrepresented in undergraduate research (e.g. first-generation, underrepresented minority, low-income, and transfer students).
2. What is the impact of traditionally mentored research and course-based research experiences (CUREs)?

Research designed to meet the Department of Education's What Works Clearinghouse standards in order to add to what we know about undergraduate research. Participating institutions can also use their data and reports in grant applications and reporting.

Your Role

Data

Provide **de-identified** student level data on entering cohort years from 2008-2012 (or more recent) on: undergraduate research participation, student characteristics, academic performance, retention, GPA, and time-to-graduation. Additional data on graduate school enrollment will be included for campuses that participate in the National Student Clearinghouse.

IRB

Research protocol has been reviewed by the IRB at California State University, Monterey Bay (CSUMB), but we will also coordinate with the IRB at your campus to ensure that they also deem the research exempt.

Research was determined to be **exempt** under Part 46 of the 45 Code of Federal Regulations because all data is de-identified and participating campuses will certify in writing that they will never identify any living individuals to the researchers at CSUMB.

Data will be de-identified at the home institution before being shared and will be checked for any identifiable information by the campus contact.

Why Participate

Report

Each institution receives a campus report including:

- Researcher and general population comparisons analyzing significant differences between the two populations at your institution.
- Institutional graduation rate comparisons between UR and general population.
- Institutional graduation rate comparisons between UR and like-peers.
- Logistic regression on the impact of undergraduate research on graduation and GPA at your institution.

Matched Data

You will also receive your data back with a group of matched peers. This data can be used for further research and assessment at your campus.

Further analysis could disaggregate by specific programs or student population for your campus.

Research Impact

Possibility of collaboration on research and publications.

The report and matched data can be used to advocate for institutional support and apply for grant funding.

Funding

This study is made possible by funding from a partnership between the Council on Undergraduate Research and California State University, Monterey Bay's Undergraduate Research Opportunities Center through the Assessment and Research Coordinator fellowship. This partnership allows us to conduct the research and provide matched reports and data back to you at **no cost to your institution** through June, 2020.