



The Master's Degree: A Critical Transition in STEM Doctoral Education

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Overview of Presentation

- ▶ The Need for Change
- ▶ Growth in master's degrees in STEM
- ▶ Summary of Research Findings
- ▶ Implications for APS Bridge Programs

National Crises In STEM

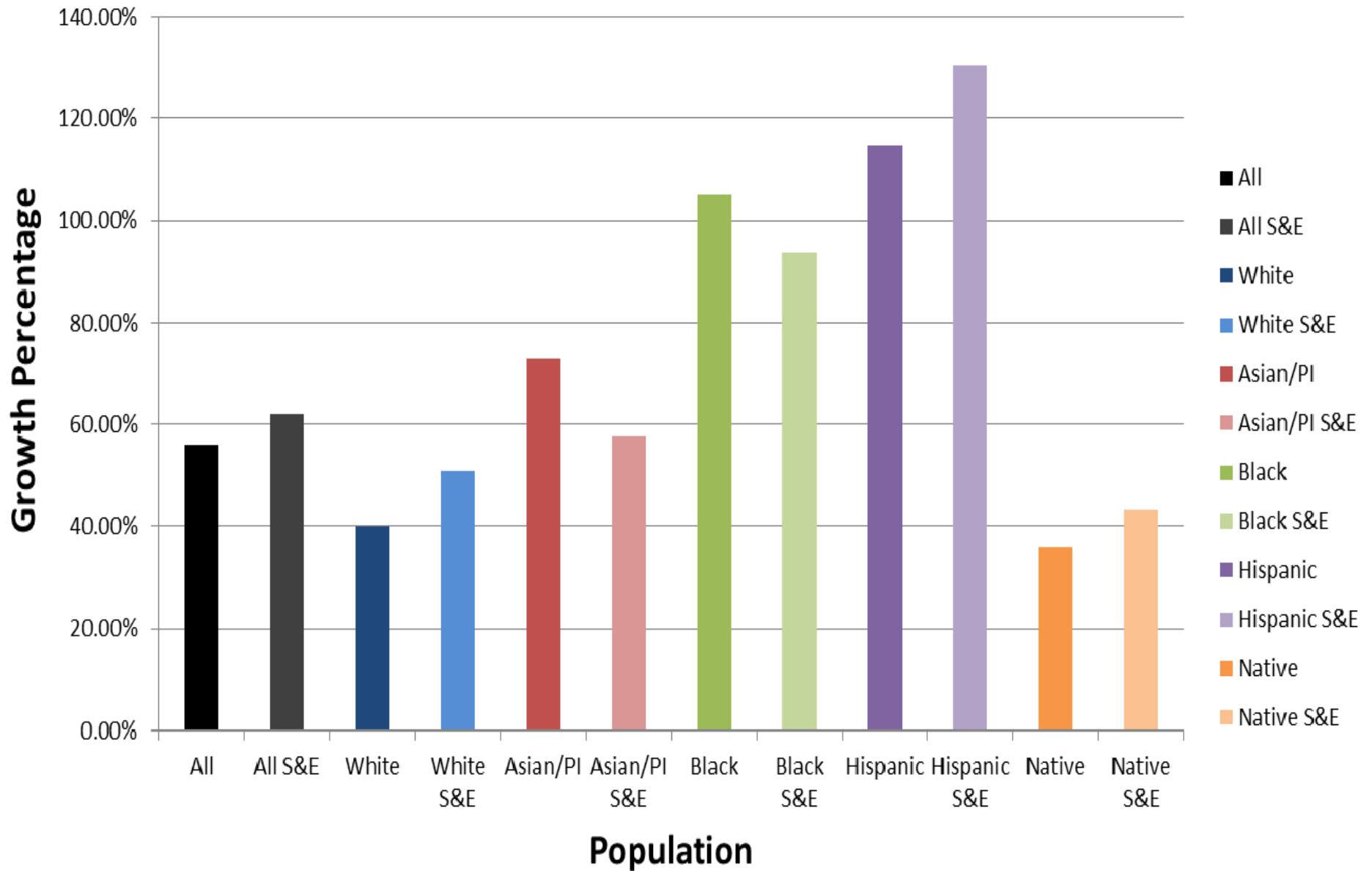
- ▶ Dr. Shirley Jackson's Perfect Storm
 - ▶ Aging STEM workforce
 - ▶ International competition for talent
 - ▶ Fewer U.S. students studying STEM disciplines
 - ▶ Changing demographics in U.S.
- ▶ "To ensure a productive future for science and technology in the United States, we must make physics more inclusive. The health of physics requires talent from the broadest demographic pool. Underrepresented groups constitute a largely untapped intellectual resource and a growing segment of the U.S." APS Joint Diversity Statement
- ▶ Complex, interdisciplinary problems require diverse talent to solve

Why So Few?

- ▶ K-12 Preparation
- ▶ Financial barriers
- ▶ Climate in STEM unwelcoming
- ▶ Employment prospects unclear
- ▶ Compatibility with having a family
- ▶ Attrition/Switching Majors
- ▶ Lack of mentoring/role models

Growth in Master's Education by Race/Ethnicity

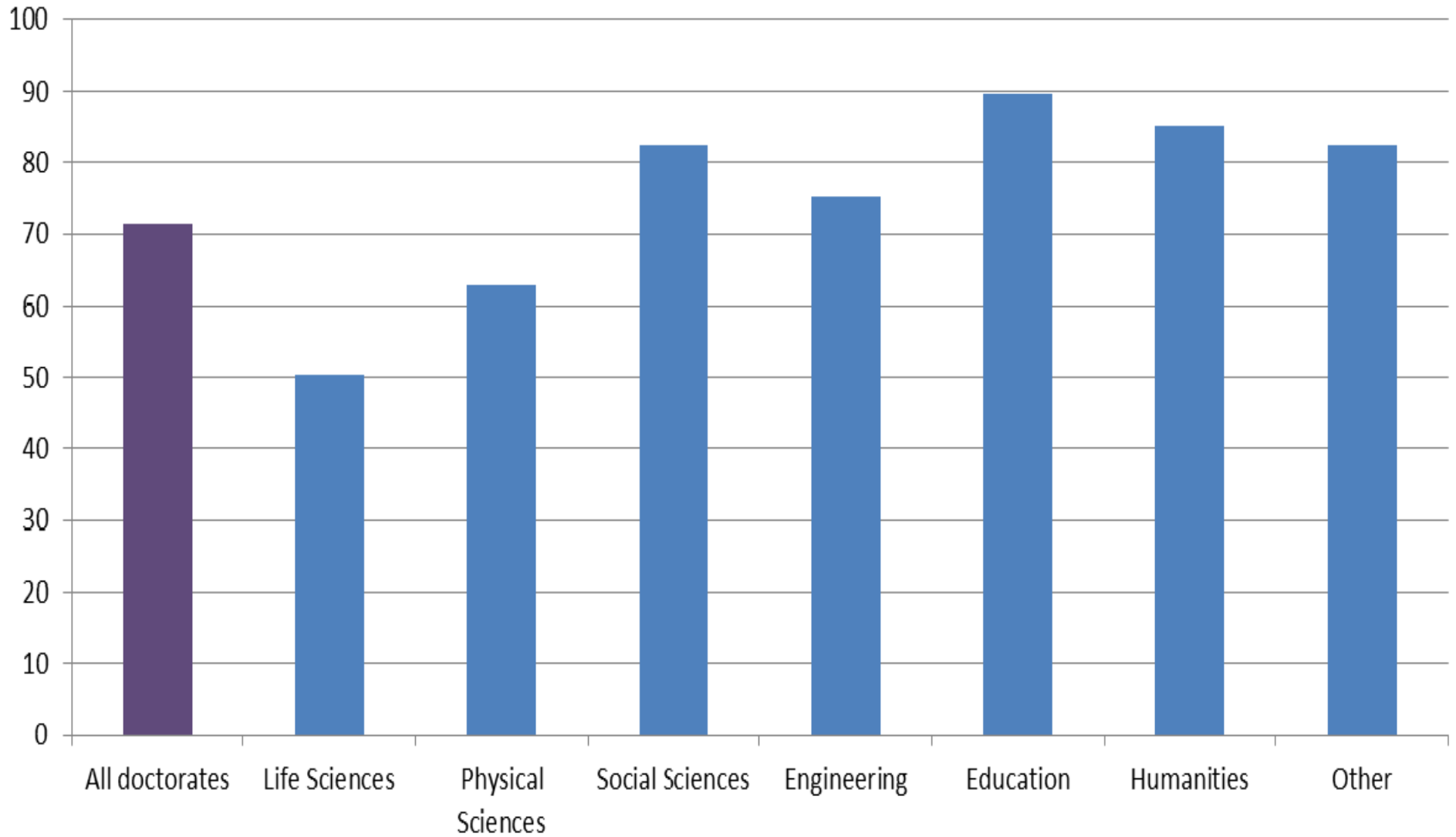
2002-2012



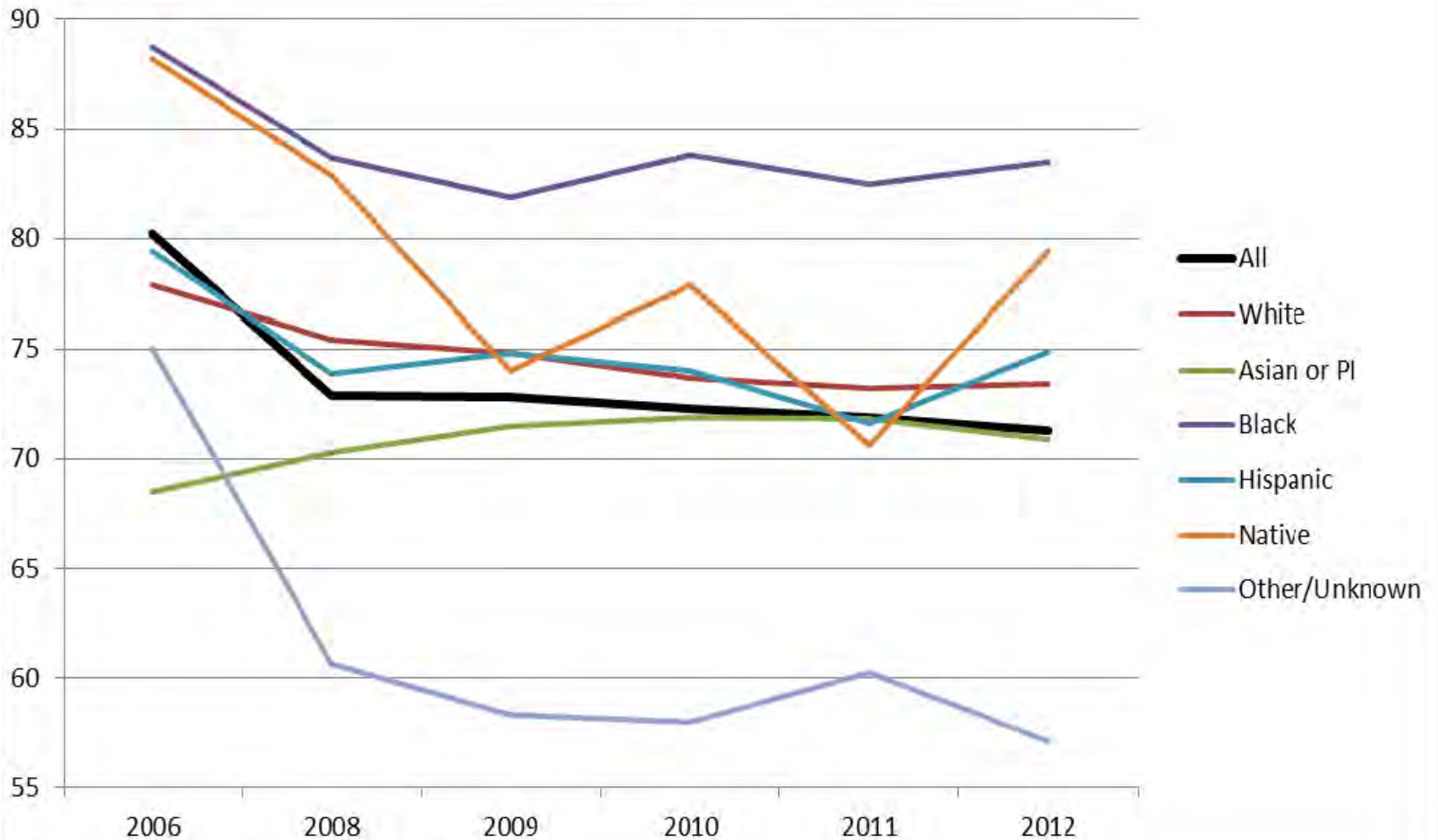
Master's & Doctoral Education

- ▶ Little is known about master's education and educational pathways to the doctorate
- ▶ Questions raised about whether master's degree is a diversion from or stepping stone to doctoral degree
- ▶ Is master's only institution source of talent loss or untapped reservoir?

Doctorate Recipients Who Earned Master's Degrees by Field of Study 2012



Doctorate Recipients who earned Master's Degree by Race/Ethnicity 2006-2012



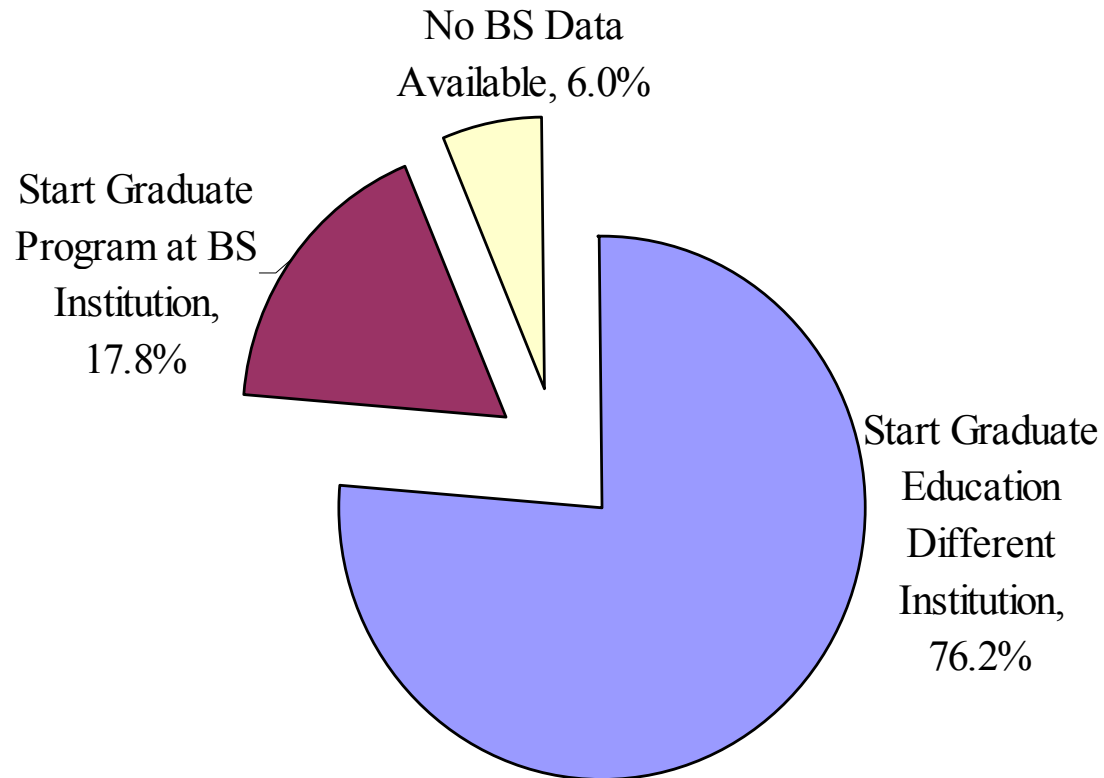
Study Methodology

- ▶ Survey of Earned Doctorates, 1998-2001
- ▶ Science and engineering fields only
- ▶ Stratified random sample, 400 from each racial category, 3200 total
- ▶ Pathways as institutional transitions between undergraduate, master's and doctoral degrees
- ▶ Chi-square analysis

Research Questions

- ▶ What are graduate degree pathways to the doctorate?
- ▶ Do pathways differ by race & gender?
- ▶ Are women & URM more likely to earn a master's degree en route to the doctorate?
- ▶ What are institutional origins of master's degrees earned en route to the doctorate?

Doctoral Degree Pathways

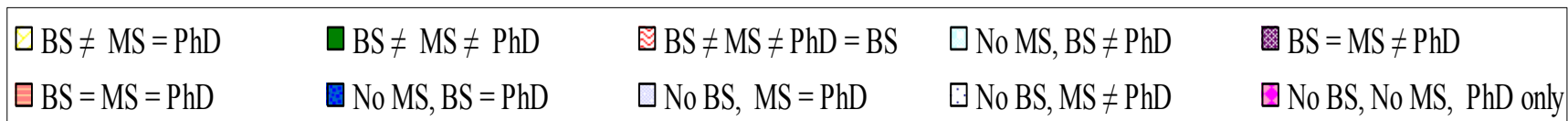
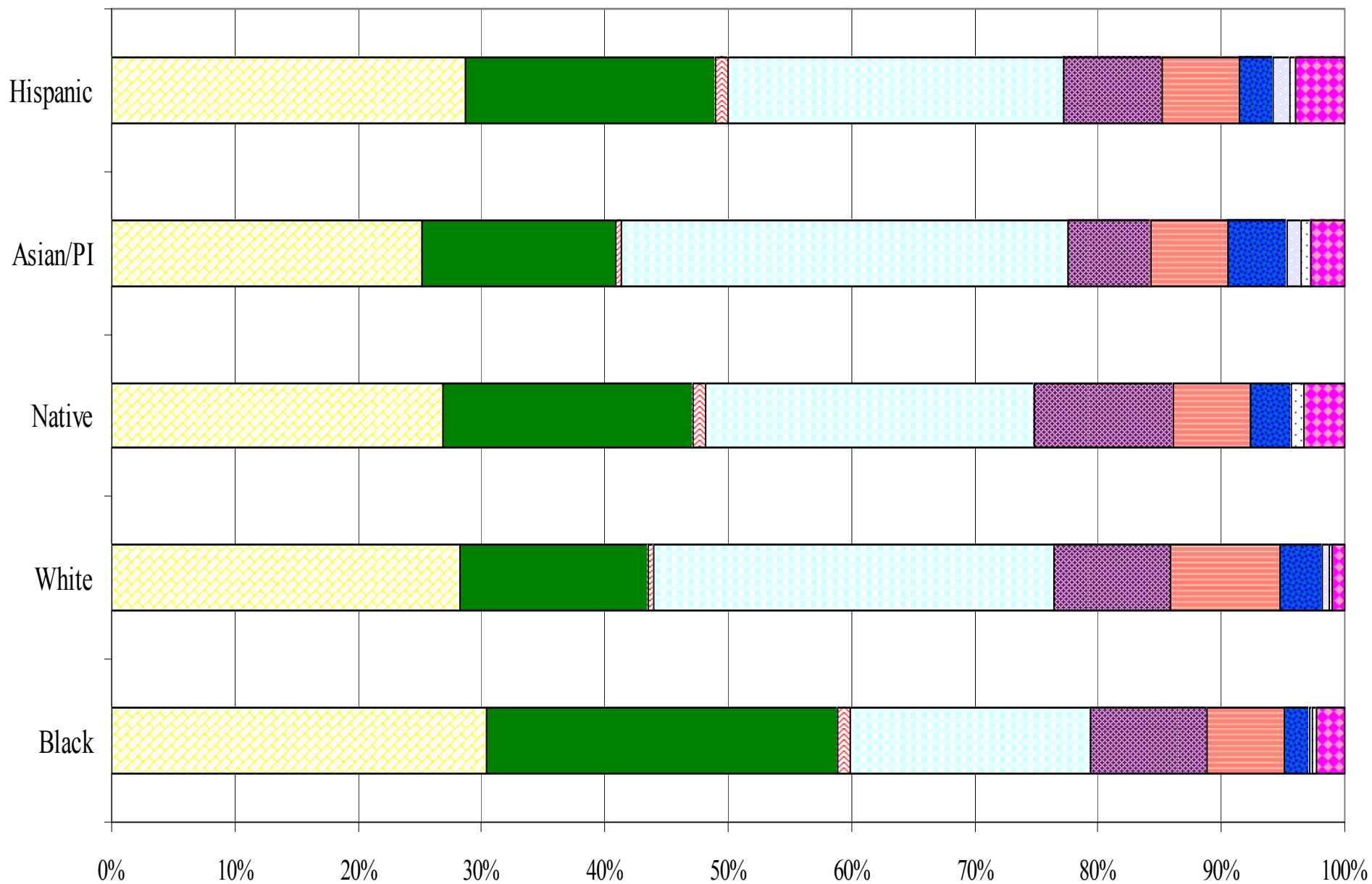


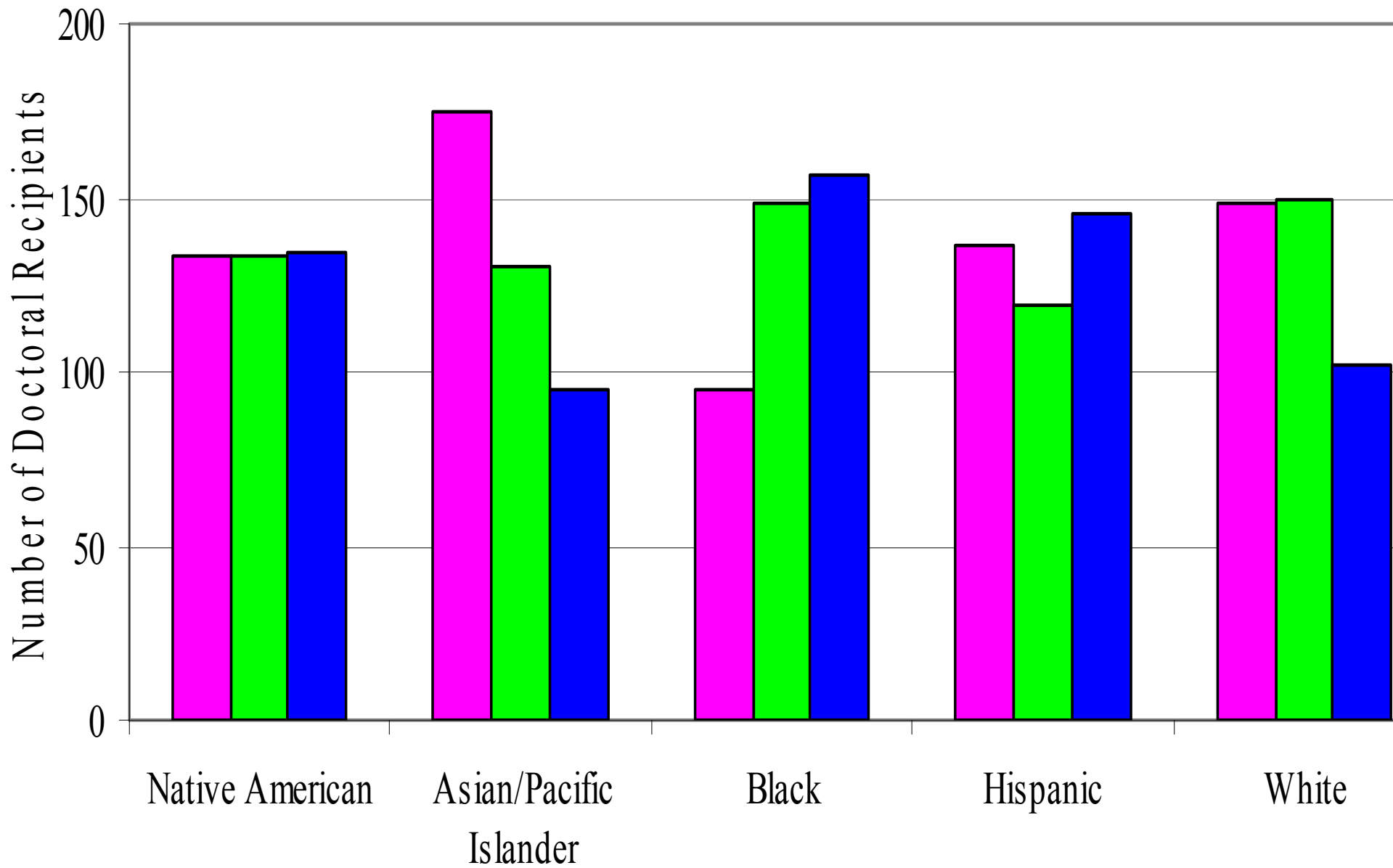
Leave BS Institution to Begin Graduate Program

- ▶ No MS, BS \neq PhD (28.4%)
- ▶ BS \neq MS = PhD (27.2%)
- ▶ BS \neq MS \neq PhD (19.6%)
- ▶ BS \neq MS \neq PhD = BS (1.0%)

Begin Graduate Program at BS Institution

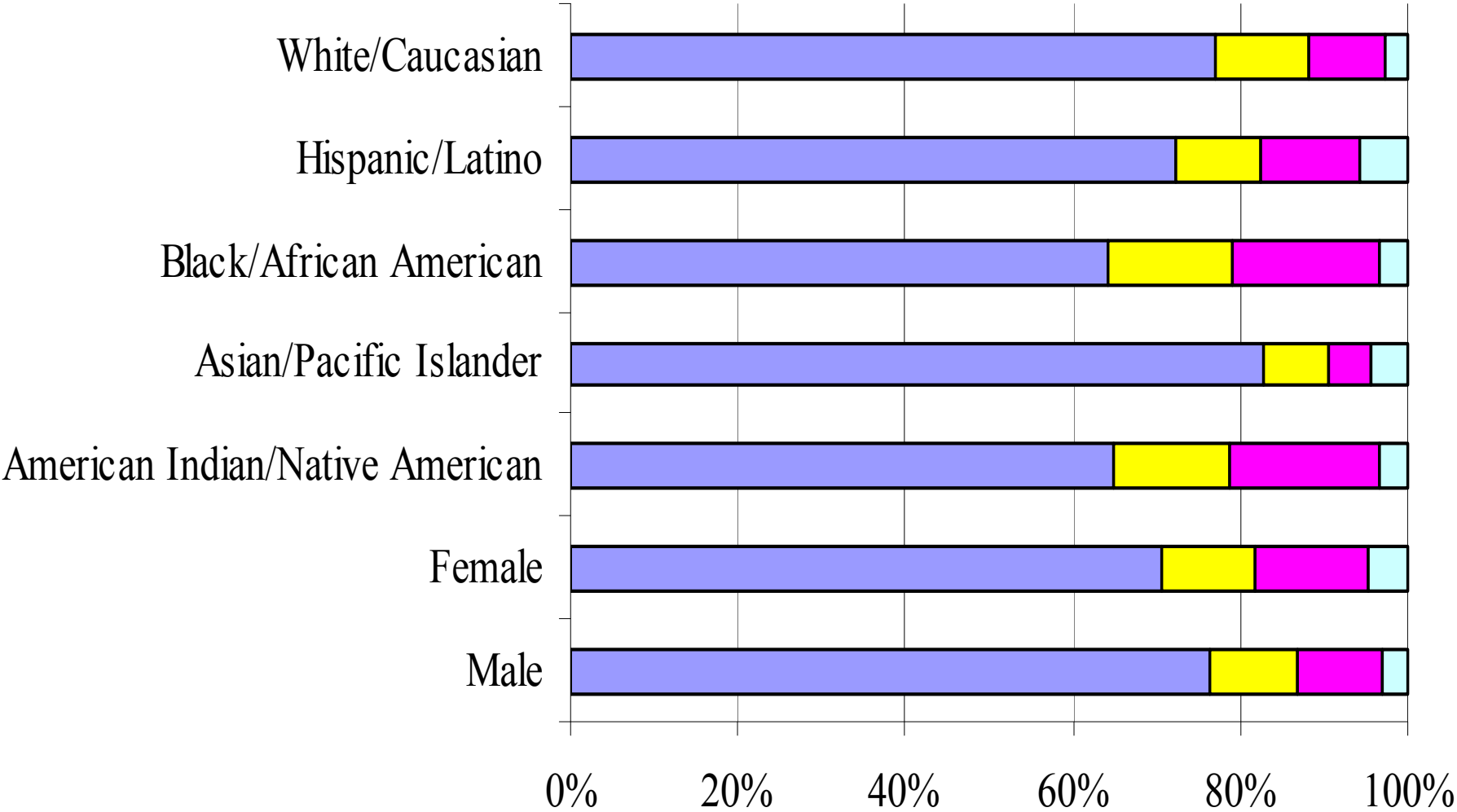
- ▶ BS = MS \neq PhD (8.2%)
- ▶ BS = MS = PhD (6.2%)
- ▶ No MS, BS = PhD (3.5%)

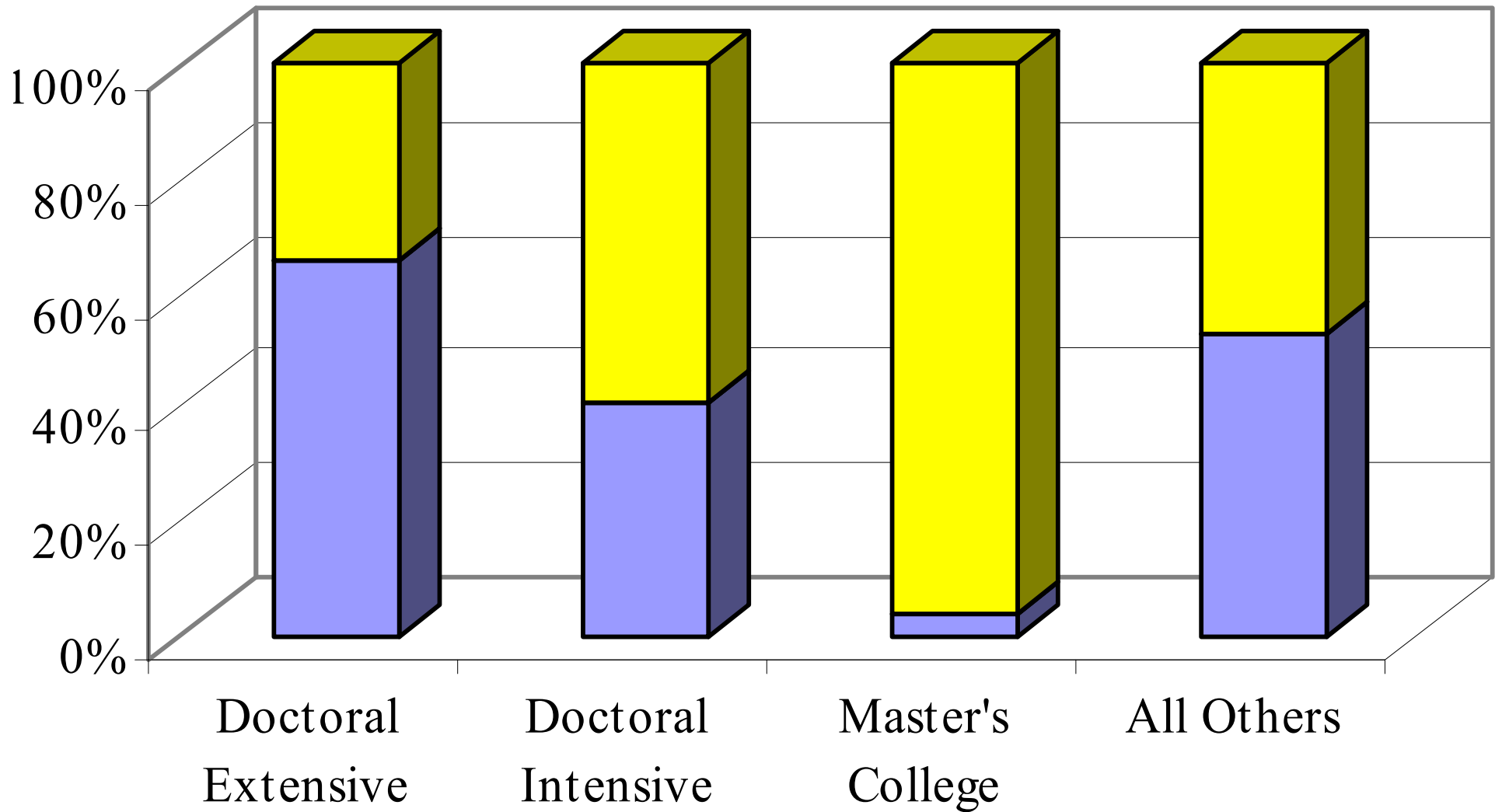




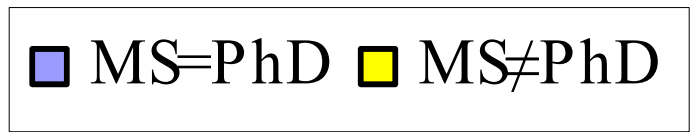
■ Not Applicable (No MS) ■ No Transition (MS=PHD) ■ Transition (MS≠PHD)

Master's Institution Carnegie Classification





Carnegie Classification of Master's Institution



Summary

- ▶ URM students are significantly more likely to earn a master's degree en route to the doctorate
- ▶ URM students take significantly different pathways to the doctorate and are more likely to earn the BS, MS and PhD at three different institutions
- ▶ URM students more likely to experience transition between master's and doctoral degrees

Summary (continued)

- ▶ Compared to White and Asian/Pacific Islander doctorate recipients, URM students are less likely to earn master's degrees at doctoral extensive institutions, so HSI's, HBCU's, MSI's and Tribal Colleges are important sources of talent

Issues Raised by Study

- ▶ Transition between the master's and PhD is neither accounted for nor explained by existing theoretical models of graduate degree progress
- ▶ We do not know why students transition or what factors hinder and facilitate transition
- ▶ We need to be more attentive to master's education, especially for women and URM students to ensure that social and academic integration occurs

Issues Raised by Study

- ▶ Resources and recruitment programs structured at undergraduate level
- ▶ Women and URM may be concentrated in less selective undergraduate and master's institutions which impacts access to doctoral institutions
- ▶ Earning master's degree first can impact eligibility for funding of doctoral program
- ▶ Time to degree is longest for students who transition between master's and doctoral degree

Main Conclusion

- ▶ Master's degree programs are untapped resources
- ▶ Facilitating the transition between master's and doctoral programs can be a powerful way to capture URM talent
- ▶ Bridge programs between many types of institutions have great potential to grow doctorates in STEM.

Limitations & Further Research

- ▶ Non-response or no master's degree - variable is incomplete, master's institution used instead
- ▶ Does not address questions about students who do not continue on to doctorate
- ▶ Does not provide us with information about why students transition between master's and doctoral degrees

Questions and Discussion

