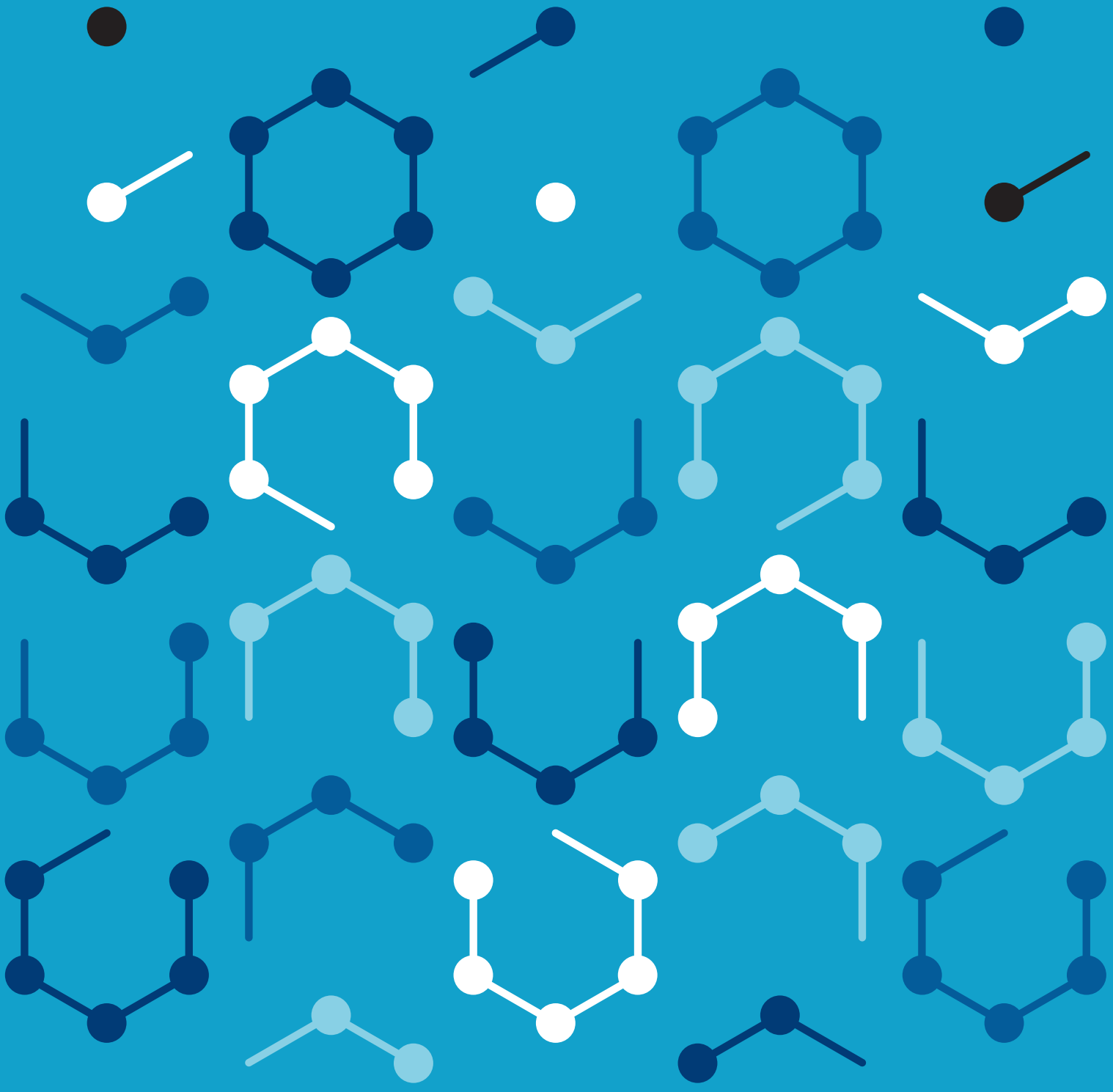
RESEARCH BRIEF FEBRUARY 2025

Tracking Persistence in STEMM

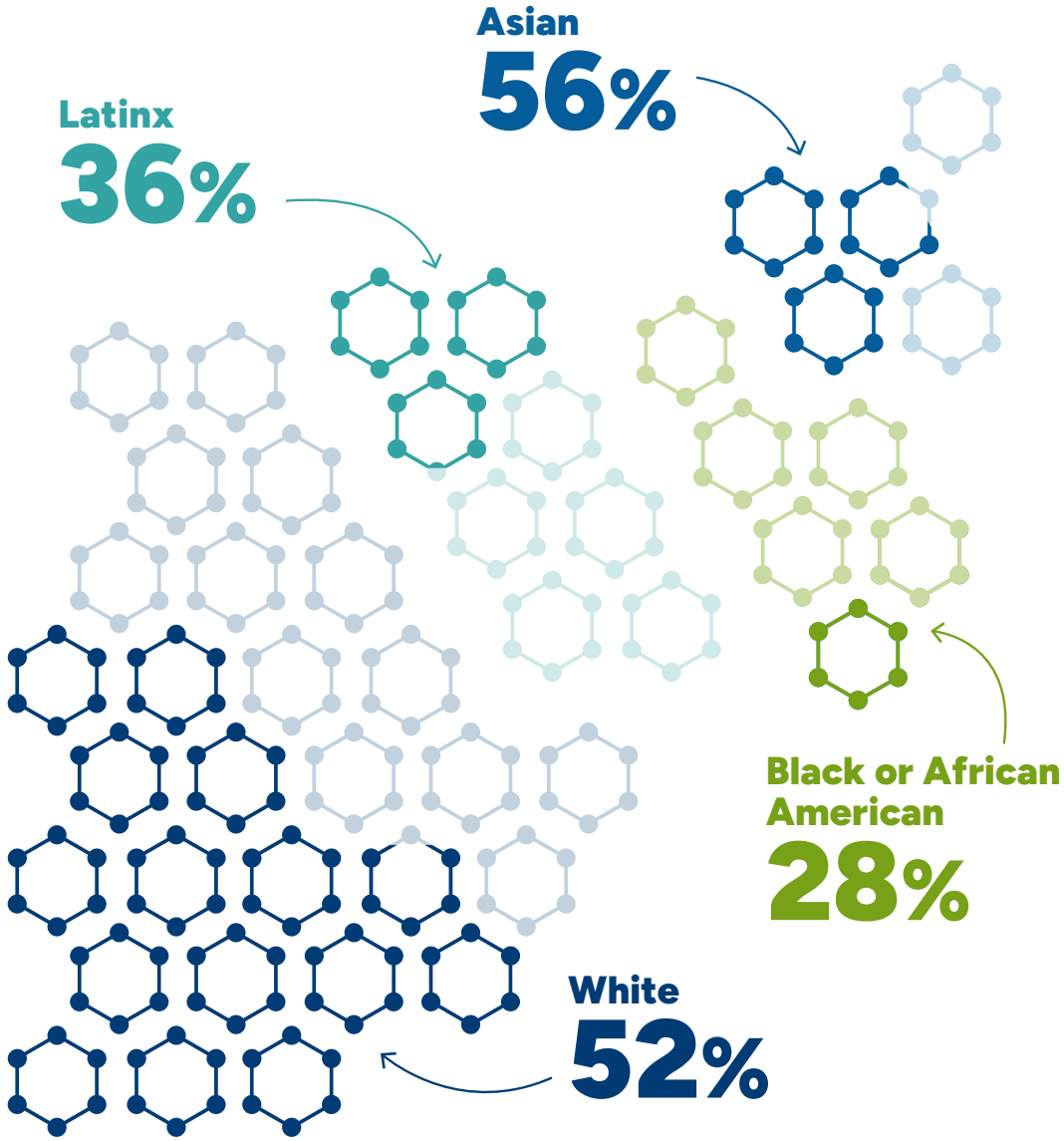
From application aspirations to college degrees



KEY FINDINGS

Tracking persistence in STEMM

Science, Technology, Engineering, Mathematics and Medicine



WHO PERSISTS

Rates of STEMM-interested applicants who ultimately get a bachelor's degree in STEMM **vary by demographic**.

Over half of continuing-generation, **White**, and **Asian** STEMM aspirants persist through to a STEMM degree, compared to just over one-third of first-generation and **Latinx** applicants, and just 28% of **Black or African American** applicants.

RATES AND REASONS FOR NON-COMPLETION

Differences in STEMM degree persistence seem to arise from:

students not enrolling on-time

or

enrolling but not earning a degree in any subject.

More than half of first-generation and Black or African American STEMM aspirants, and **just under half** of Latinx STEMM aspirants, did not have a bachelor's degree within six years of expected enrollment.

For continuing-generation and White applicants, the rate is considerably lower—**just under one-third** have no degree within six years.

Patterns are largely the same for non-STEMM aspirants.

EXTRACURRICULARS AND COURSEWORK

Just 27% of first-generation STEMM-interested applicants report a **STEMM extracurricular**, compared to 44% of continuing-generation applicants.

Similarly, 18% of Black or African American, took **2 or more AP or IB STEMM courses** in high school compared to 52% of Asian applicants.

common app

Tracking persistence in STEMM: From application aspirations to college degrees

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Introduction

When applicants consider college options, their intended major is often top of mind. A student's major shapes the classes they will take, the instructors and classmates they will meet, the careers they will pursue, and, to some extent, even their economic prospects following college. Therefore, understanding access to and persistence within major pathways is essential to understanding equity in higher education more broadly.

Furthermore, which students succeed in STEMM (Science, Technology, Engineering, Mathematics and Medicine) fields has been of great policy concern given long-standing demographic disparities, particularly for African American, Hispanic, and female aspirants.

These disparities persist despite generally rapid growth in students earning degrees in STEMM and uniformly high rates of *interest* in pursuing STEMM in college among high school students across demographic groups. This asymmetry raises the question: what barriers arise between high school aspirations and walking across a college graduation stage with a STEMM degree in hand a few years later, and why do they seem to disproportionately impact certain student groups? The answer to this question has real

consequences for students' prospects and our future workforce.

In this research brief, we provide unprecedented new evidence on the pipeline for STEMM degrees by following over 786,000 Common App applicants from the point of applying to college in the 2016-2017 academic year to completing degrees within the ensuing six years. Using a novel combination of information from Common App's data warehouse and National Student Clearinghouse (NSC) StudentTracker records,[1] we observe applicants' interests and qualifications when they apply to college, as well as their enrollments, their degrees, and whether the degrees they've earned match those initial interests. This combined dataset allows us to examine a fuller picture of the STEMM pipeline by starting from the point of application, rather than enrollment.

In alignment with prior research, we find that over half of applicants express an interest in STEMM, regardless of their demographic backgrounds. Yet disparities emerge at every step of the college path, leading to strong differences along lines of student socioeconomics, race/ethnicity, and sex in who ultimately earns a bachelor's degree in STEMM, starting with rates of enrolling in college on-time. Some STEMM aspirants, once enrolled, switch out of STEMM and earn degrees in other subjects. Yet, in contrast to most prior research, we find that the largest driver of demographic differences in STEMM outcomes is the many students who enroll but ultimately do not earn a degree in *any* subject within six years. Importantly, this dynamic remains largely the same (though reduced in magnitude) even among the subset of high-achieving underrepresented students we would most expect to be prepared to succeed in higher education.

We also find similar demographic patterns in the college trajectories of non-STEMM aspirants. That is, non-STEMM aspirants from first-generation, Black or African American, and Latinx backgrounds are also less likely to persist in the corresponding non-STEMM fields than their peers. Switches out of non-STEMM fields are relatively similar across demographic groups, again leaving enrollment and completion in any subject as the main drivers of difference. In short, we find *both* "pipelines" – STEMM *and* non-STEMM – have significant "leaks," with broader, demographically-driven enrollment and completion rate gaps forming the main outflows.

While we cannot make firm conclusions about specific causes of the gaps we observe in this descriptive study, we can say with confidence that our research finds many more talented STEMM aspirants from underrepresented backgrounds

[1]This report is based on research funded by the Gates Foundation. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of the Gates Foundation.

applying for college than completing it. As such, policies and programs that help these interested students translate their aspirations into successful enrollments and degrees have immense potential. We hope these findings are of interest to anyone hoping to increase the number and representativeness of the STEMM workforce: college success professionals, policy leaders, economic development organizations, and STEMM employers. By providing these statistics, we hope to both celebrate the interests and perseverance of today's applicants, and also stress the work that remains.

Contents

Key findings

1. **Just over half of applicants expressed interest in pursuing a STEMM major in college, with only slight differences** (+/-3 percentage points from average) **across demographic groups**. Asian applicants are a key exception, with 72% of them expressing interest in a STEMM major.

2. **Among STEMM aspirants, fields of interest vary by applicant demographics, with the largest differences by legal sex**. For example, female applicants have substantially higher rates of interest in Biology (45% versus 25% of male applicants) and Health (47% vs 19%), while male applicants have substantially higher rates of interest in Computer Science (26% versus 9% of female applicants) and Engineering (47% versus 16%). Health is the most popular field for groups historically underrepresented in STEMM, including female students, first-generation (43%), Black or African (43%) American, and Latinx applicants (36%)

3. **Among STEMM aspirants, rates of reporting STEMM-focused extracurriculars, advanced coursework, and specialized tests reflect deep disparities**. For example, just 27% of first-generation STEMM-interested applicants report a STEMM extracurricular, compared to 44% of continuing-generation applicants. Similarly, 18% of Black or African American applicants took 2 or more AP or IB STEMM courses in high school, compared to 52% of Asian applicants.

4. **There are also stark differences by demographic group in STEMM degree persistence rates** (the percent of applicants interested in only STEMM who ultimately earn bachelor's degrees in STEMM subjects). Over half of continuing-generation, White, and Asian STEMM aspirants persist through to a STEMM degree, compared to just over one-third of first-generation and Latinx applicants, and just 28% of Black or African American applicants.

5. **Rates of switching out of STEMM** (the percent of applicants interested in only STEMM who ultimately earn bachelor's degrees in non-STEMM subjects) **are quite similar across demographic groups** - between 14% and 18%, with the largest difference between male and female STEMM aspirants.

6. **Differences in STEMM degree persistence seem to arise from differences in enrollment and earning a degree in *any* subject**. More than half of first-generation and Black or African American STEMM aspirants, and 46% of Latinx STEMM aspirants, did not have a bachelor's degree within six years of expected enrollment, either not enrolling on-time or enrolling but not earning

a degree. These rates are considerably higher than those of continuing-generation and White applicants, for whom just under a third have no degree within six years. Patterns are largely the same for non-STEMM aspirants.

7. **According to the data, applicants with high GPAs and/or standardized test scores consistently exhibit higher degree persistence rates compared to the general analysis, largely due to uniformly higher enrollment rates across demographic groups. That being said, demographic differences in graduation rates remain.** For example, 8-9% of continuing-generation and White applicants enrolled on-time but did not earn a degree within six years, compared to 12% of Latinx, 15% of first-generation, and 16% of Black or African American applicants.

8. **Among STEMM degrees earned, stark demographic differences remain in the specific fields studied.** For example, Health and Biology are popular degree majors for female, first-generation, Black or African American, and Latinx degree earners, in line with interests at application. Engineering and Computer Science are also popular majors with large demographic differences.

Data and definitions

Applicants and degrees considered in this analysis

Before we dive into results, it is crucial to discuss the nuances of our study sample and the important terms and demographics we analyze here. This analysis covers over 786,000 domestic applicants in the 2016-2017 application season. More specifically, this analysis includes any domestic applicant (U.S. citizens or permanent residents, whether applying from the U.S. or abroad) who indicated they planned to enroll in college the 2017-2018 academic year, and submitted at least one application using the Common App.[2]

We use data from the National Student Clearinghouse (NSC) to follow Common App applicants over the following six years through enrollment, persistence, and degree completion. NSC is a nonprofit organization that verifies enrollment and graduation outcomes in the United States. NSC's data allows us to observe applicant trajectories through most U.S. institutions, including those that do not use Common App for applications.

NSC's record-level data provides information on over 98% of U.S. higher education enrollments during this time period. In addition to the small number of institutions outside NSC's coverage (e.g., international institutions), this research brief does not capture enrollment and degree outcomes for students who have blocked their records under the Family Educational Rights and Privacy Act (FERPA). As a result, **our estimates of enrollment and degree rates may be slightly lower than actual enrollment and degree rates** for the applicants in this study. However, we find that both NSC coverage gaps and privacy blocks are not strongly associated with the demographics on which we focus in this brief.[3]

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[2] During the 2016-2017 application season, Common App had just over 700 member institutions, in comparison with over 1,100 institutions in the 2024-2025 season. Common App's member institutions and applicant pool have continued to diversify, with better coverage of public institutions and growth in Minority Serving Institutions (MSIs). For more on Common App's member institutions over time, see our research brief Growth and change: long-term trends in Common App membership. Just as importantly, note that our applicants imperfectly represent the broader college-going or college-applying population (see, for example, Odle & Magouirk, 2023).

[3] For more information on coverage and blocks, see this report from National Student Clearinghouse.

Demographic definitions

We consider three main demographic groupings[4] in this research brief, with the size/share of the study population for each shown in Figure 1:

- **Applicant legal sex**: During this season, applicants were asked to provide their "sex assigned at birth" with two options: Male or Female.[5] Fifty six percent of our sample reported their legal sex as female.

- **First-generation status**: We define a first-generation college student as having parents who have not obtained a bachelor's degree or higher. Among our sample, 68% are categorized as not first-generation.

- **Below median income ZIP code:** While Common App does not explicitly collect college applicants' household income information, we supplement our understanding of the socioeconomic characteristics of applicants by examining characteristics of the communities in which they reside from the U.S. Census (for students residing in the United States). We group applicants residing in a ZIP code with a median household income above or below the national median household income (per ACS 5-year estimates) in this research brief, in alignment with higher education research practices, our past research work, and our Next Chapter.[6] Note that many of our results remain consistent if we instead use student fee waiver eligibility, an individual measure of student low-income status.

- **Race/ethnicity:** We follow federal higher education race/ethnicity groupings as defined by the U.S. Office of Management and Budget and used by the U.S. Census Bureau. White applicants comprise 57% of our sample, Latinx applicants 16%, Black or African American 12%, and Asian 10%. About 5% of applicants reported two or more races, while our final two groups, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander, each comprise less than one percent of the sample.

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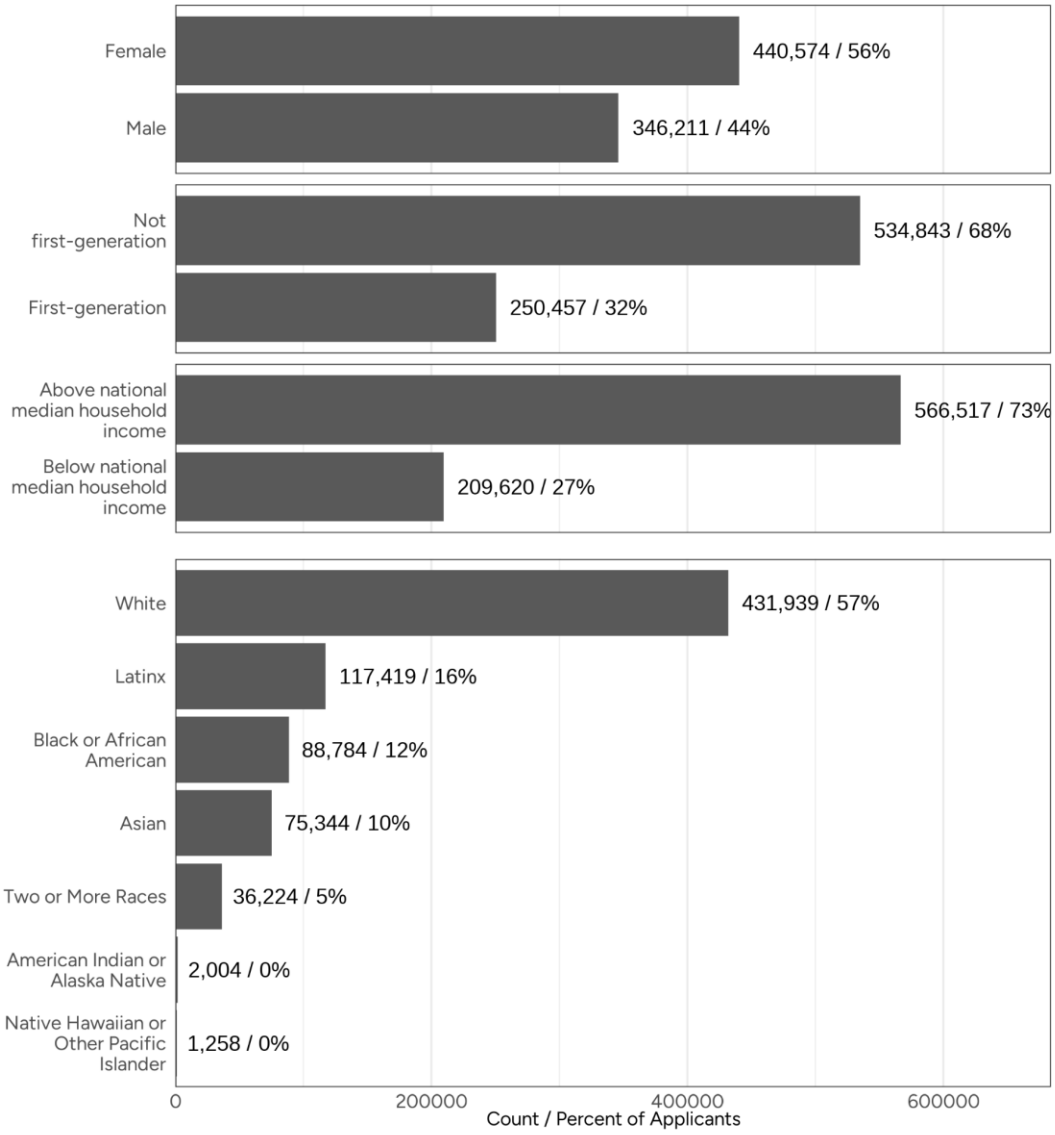
[4] We acknowledge that assigning complex individuals to simple categories loses important nuance, as Common App has unpacked for both race/ethnicity and first-generation status.
[5] More recent application seasons have expanded questions about legal sex, gender identity and pronouns; see more here: A brief guide to Common App's name, sex, and gender questions for member institutions.
[6] We use the American Community Survey five-year estimates on household income, both nationally and by ZIP code Tabulation Areas. To account for the roughly two-year lag in data availability of ACS survey data, we use ACS data from two years prior to this season for our calculations. In this research brief we use the 2010-2014 ACS to map onto applicants in this 2016-2017 application season. We exclude students residing outside the United States, or who live in ZIP codes without a median household income estimate from the ACS.

Figure 1: Applicant demographics in 2016-2017 application season, as counts and percents of the applicant pool
Among 786,785 domestic applicants planning to enroll in AY 2017-18



Defining STEMM interest and degrees

STEMM fields have been defined in various ways across academic and policy research. In this research brief, we use the U.S. Department of Education's Classification of Instructional Programs (CIP) codes and the National Science Foundation's (NSF) Science & Engineering categorizations of 2020 CIP codes to assign each applicant's intended majors and degrees earned as either STEMM or

non-STEMM and further categorize STEMM interests into disciplinary fields.[7] However, we exclude majors categorized as Social Science, Psychology, and Interdisciplinary studies by NSF in our definition of STEMM.[8] This exclusion is in line with prior studies and our own initial data analysis which suggested these fields were quite distinct in demographic composition. Examples of top majors of interest and degrees earned and our STEMM and non-STEMM designations can be found in the Appendix (Tables A1 and A2).

We define STEMM interest at application by summarizing applicant responses to questions asking about intended majors. Each college on Common App can ask their applicants to select one or more intended majors and/or minors. We review each applicant's responses to these questions across their applications, and code each individual into one of three categories: Interested in STEMM only, interested in both STEMM and non-STEMM, and interested in non-STEMM only.

For the roughly 10% of applicants who did not apply to an institution asking about intended majors, we instead categorize their responses using their career interests, a question asked to every applicant. We assign each career option an indicator of STEMM/non-STEMM, and, if STEMM, a STEMM disciplinary field using the same CIP classification scheme as for intended majors.

Major interests and preparation at application

Interest in STEMM

With the study sample and definitions laid out, we can begin moving through the STEMM "pipeline" in sequence, beginning with interest at application and concluding with graduation. Figure 2 provides a summary of the first stage of applicant interests at application. Slightly more than half of all applicants express an interest in pursuing STEMM, either exclusively (26%) or in combination with expressed interest in non-STEMM fields (26%). The vertical dashed line indicates the level of STEMM and non-STEMM interest across the whole sample.

Reading down each row of Figure 2 against this dashed line, we can see that the percentage of applicants interested in STEMM is relatively consistent within each

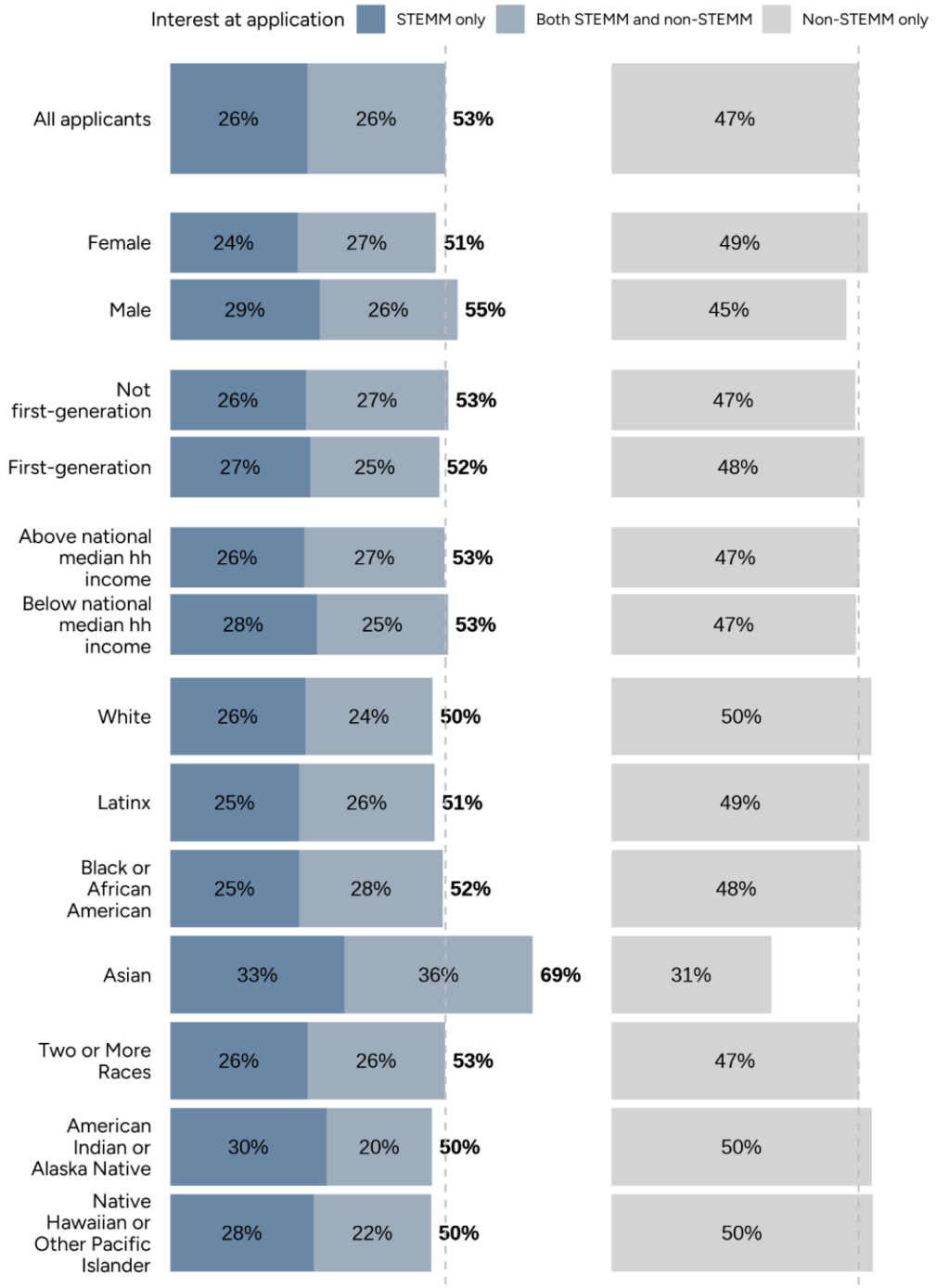
[7] This crosswalk is available from the National Student Clearinghouse under "CIP Code Lookup Table" https://nscresearchcenter.org/workingwithourdata/

[8] NSF's STEMM field code of "Multidisciplinary Studies" was excluded because it was both a small portion of majors and many of the top majors were hard to categorize, for example, "Other", "General", or "International/Globalization Studies."

demographic group, ranging between 50% up to 55% of applicants.[9] Asian applicants are an exception to this pattern, with over two-thirds interested in STEMM either exclusively or in combination.

Figure 2: Applicant interest in STEMM at application
Among 786,785 domestic applicants planning to enroll in AY 2017-18

[9] Our findings of relatively high rates of interest in STEMM fields across demographic groups are consistent with previous studies, including ACT Research reports on high school completers who registered for the ACT, and the Higher Education Research Institute's survey of incoming first-year students. Note that these studies are of earlier student cohorts and define STEMM interest in distinct ways.



Interest within STEMM fields

While interest in STEMM overall is relatively consistent across demographic groups, unpacking fields within STEMM reveals greater variation. Figure 3 shows interest in STEMM fields, as a percent of applicants in a given demographic group interested in

at least one STEMM field. Applicants can express an interest in more than one major, so percentages do not sum to 100% within demographic groups.

Male and female applicants exhibit pronounced differences in their STEMM fields of interest, as shown in the first two rows for Figure 3. Female applicants are far more interested in Biology and Health fields, while male applicants favor Engineering and Computer Science by similarly large margins. Differences by first-generation status and ZIP-code income are smaller, though first-generation applicants have somewhat higher rates of interest in health (43% versus 30%), and somewhat lower rates of interest in engineering (24% versus 33%) compared to not-first generation applicants.

Asian applicants have notably higher rates of interest in Biology, Computer Science, and Engineering (41%, 18%, and 37% respectively) than applicants in other Race/ethnicity groups. Differences between White, Latinx, and Black or African American are all less than 10 percentage points across STEMM fields.

Black or African American applicants have the highest rates of interest in Health fields, at 43%. Indeed, Health stands out as a field particularly popular among groups historically underrepresented in STEMM. Note that we do not report outcomes for the two smallest race/ethnicity groups, American Indian or Alaska Native and Native Hawaiian or Other Pacific Islander, in this and following visualizations due to increasingly small sample sizes.

Figure 3A. STEMM fields of interest within demographic groups
Among STEMM-interested domestic applicants planning to enroll in AY 2017-18

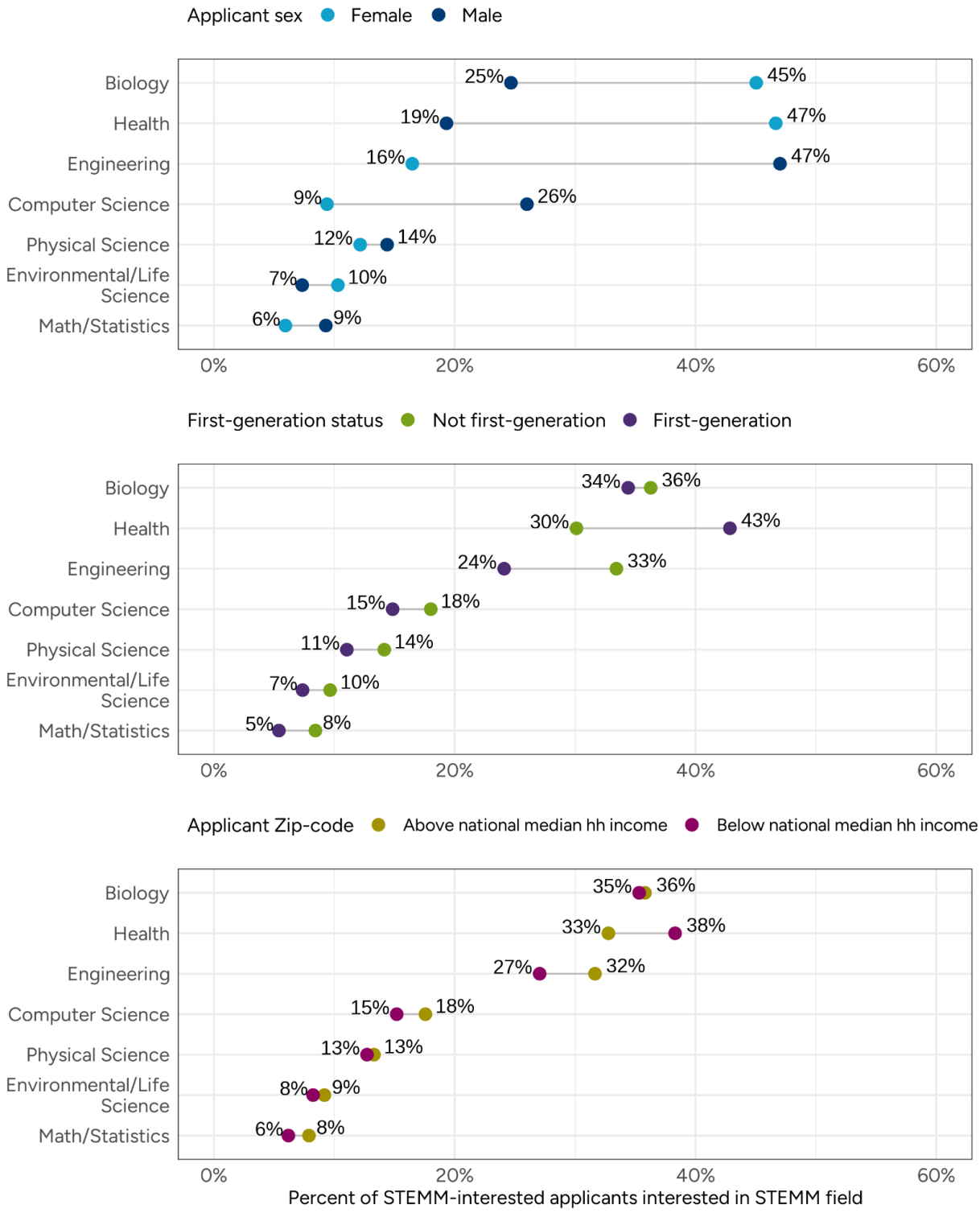
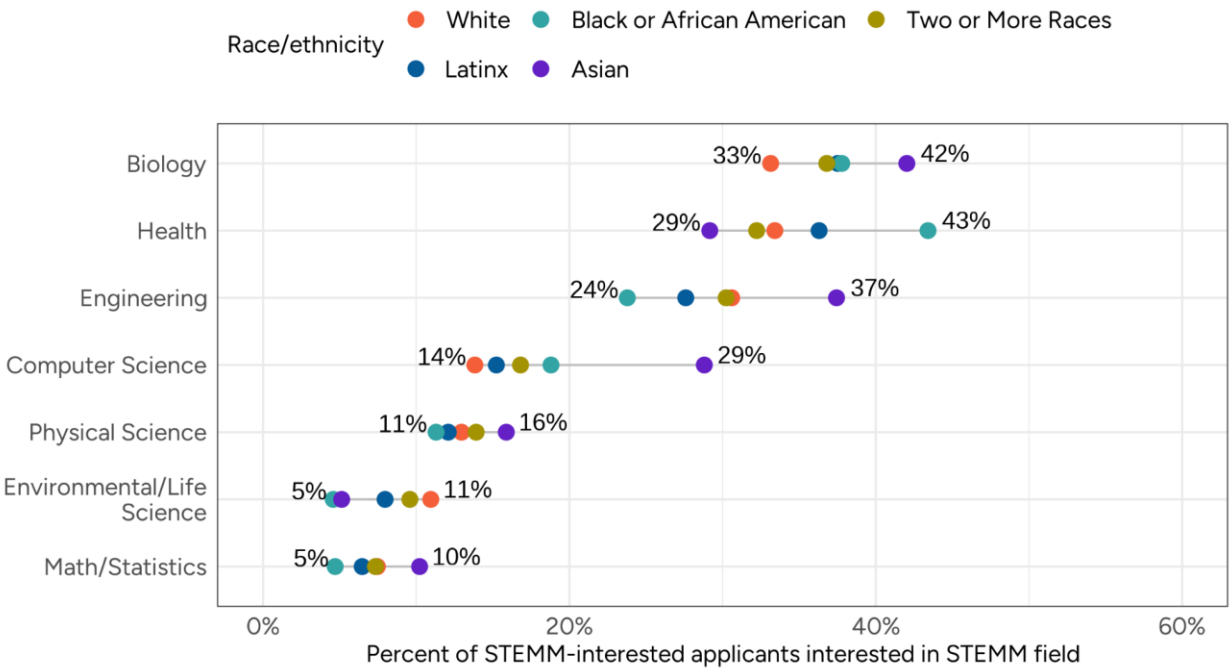


Figure 3B. STEMM fields of interest within demographic groups
Among STEMM-interested domestic applicants planning to enroll in AY 2017-18



STEMM experiences reported on application

In Figure 4, we display the rates of STEMM-interested applicants reporting the following pre-college experiences:

- **STEMM extracurriculars:** We review applicant extracurricular, volunteer, and work activities and code an applicant as having a STEMM extracurricular if an applicant:
    - Categorized a reported activity as being within "Computer / Technology", "Science / Math", "Research", "Robotics."
    - Included one or more STEMM-related keywords in their activity description, for example, "Science Olympiad" or "Math competition," in an activity categorized more ambiguously (e.g., "Other," "Academic," or "Work").

- **2+ Advanced STEMM courses**: Applicant reported taking two or more AP or IB courses in a STEMM subject as part of their application-year coursework.

- **Took a STEMM test:** Applicant reported a score on an AP test, IB subject test, or SAT subject test in a STEMM field.

- **Passed STEMM test:** Applicant took one of the above tests and scored a 3 or higher on an AP test, a 4 or higher on an IB test, or above 75th percentile

for SAT subject test, based on these recent percentile ranks from College Board.

Figure 4A. Reported STEMM experiences within demographic groups
Among STEMM-interested domestic applicants planning to enroll in AY 2017-18

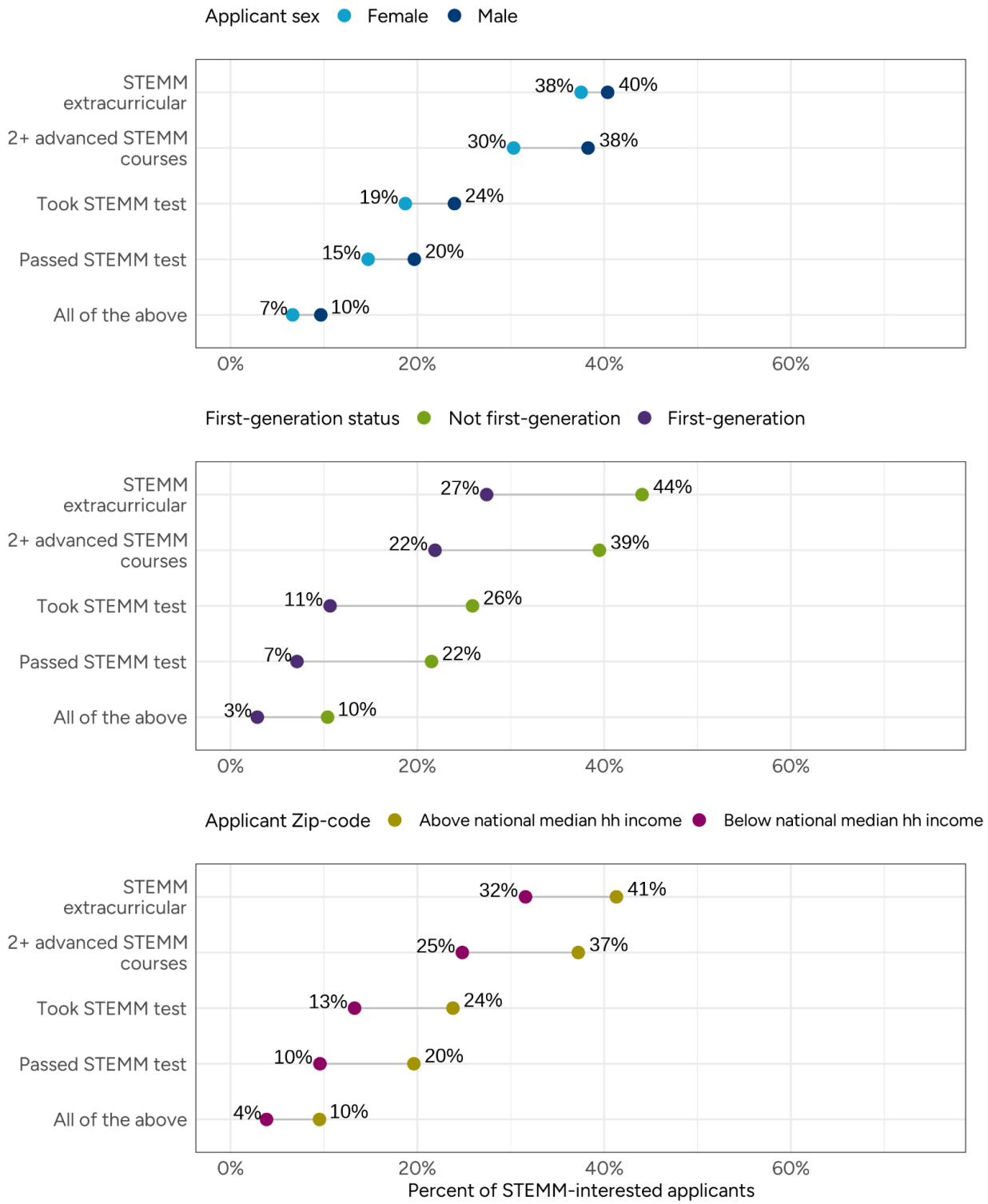
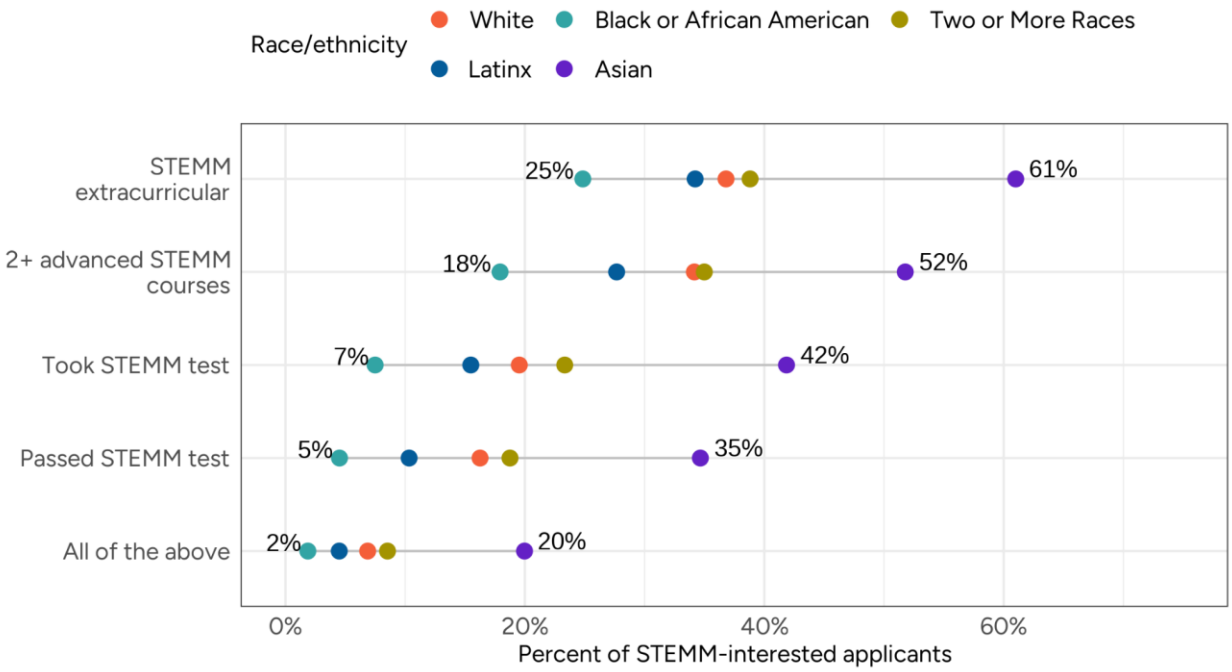


Figure 4B. Reported STEMM experiences within demographic groups
Among STEMM-interested domestic applicants planning to enroll in AY 2017-18



Unlike our exploration of STEMM-interests, Figure 4 shows consistent disparities between historically underrepresented groups in STEMM and their peers, particularly for first-generation, below-median income ZIP code, and Black or African American applicants, and to a lesser extent, Latinx applicants.[10]

Applicant enrollment and degree outcomes

Next, we follow these same applicants over the next six years, assessing which applicants enroll at a four-year institution in Fall 2017 as intended, and which of those enrolled ultimately earned a Bachelor's degree within six years. Importantly, this focus on *overall* Bachelor's degree attainment thus excludes discussion of degrees from two-year institutions, and it also precludes analyzing trends by more granular institutional characteristics; we recognize these are important aspects of the STEMM pipeline and hope to analyze them with commensurate nuance in future work.

[10] For additional data on patterns of advanced STEM coursetaking in high school, please see the National Science Foundation's Elementary and Secondary STEM Education report.

All applicants

In this section, we compare the post-application outcomes of the 578,719 / (74%) applicants who expressed interest in either STEMM only or non-STEMM only for clarity of reporting. We assign each applicant to one and only one outcome category, defined below.

- **Never enrolled:** Applicant has no enrollment records at a four-year institution at the undergraduate level between Fall 2017 and Fall 2023.[11]

- **Late enroll**: First enrollment record at a four-year institution is later than their initially planned enrollment term (Fall 2017).[12] In order to estimate six-year graduation rates from the point of enrollment, we do not include these applicants in our degree outcomes analysis (as our NSC records were pulled too early to observe six-year graduation for these late enrollees).

Applicants who have an enrollment record in a four-year institution in Fall 2017 have three possible outcome categories.

- **No Bachelor's degree:** Applicant has not earned a bachelor's degree in any field by Fall 2023, six years later. In this research brief, we do not track degrees at the Associate's level or at two-year institutions.

- **Switch degree:** Applicant earned a bachelor's degree in the opposite (STEMM or non-STEMM) category relative to their application interest.

- **Persist degree**: Applicant earned a bachelor's degree in the area they expressed interest in at application – STEMM for STEMM-interested applicants, and non-STEMM for non-STEMM-only applicants.

An analysis of outcomes for the 208,066 applicants interested in both STEMM and non-STEMM subjects is available in Appendix B. Generally speaking, outcomes for applicants interested in both are similar to their same demographic group peers interested in STEMM only, although with higher rates of earning degrees in non-STEMM fields and commensurately lower rates of earning degrees in STEMM.

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[11] We follow 2018 Carnegie Classifications to define enrollments at "4-year" institutions, incorporating information from IPEDS for certain institutions lacking Carnegie Classification, aligning with NSC's institutional sector classification methodology. As mentioned previously, some of applicants without enrollment records may in reality be enrolled outside NSC's record coverage or have their records blocked.

[12] We define "Fall 2017" as any enrollment term which meets the following criteria used by NSC in their Current Term Enrollment Estimates: (a) began between August 15 and October 31, inclusive or, (b) ended between September 15 and November 30, inclusive or (c)began before August 15 and ended after November 30.

Figure 5 shows post-application outcomes for applicants disaggregated by legal sex and interest in STEMM. Just under half of STEMM-interested applicants, male or female, had earned a bachelor's degree in STEMM by the end of six years, as shown in the far right bar of the first two rows. STEMM-interested female applicants have slightly higher rates of switching focuses and earning a degree in a non-STEMM subject (18% of female applicants vs 14% of male applicants), while male applicants have commensurately higher rates of having earned no degree (17% of male applicants vs 13% of female applicants).

Shifting our attention to applicants only interested in non-STEMM subjects at application, in the last two paired bars, we can see female applicants have higher degree persistence rates, with 58% earning a degree in a non-STEMM field, compared to 52% of male non-STEMM interested applicants. Male students also have a commensurately higher rate, as with STEMM, of not having any degree at 18% versus 13%.

Figure 5. Outcomes by applicant legal sex and interests at application
Among 578,719 domestic applicants planning to enroll in AY 2017-18

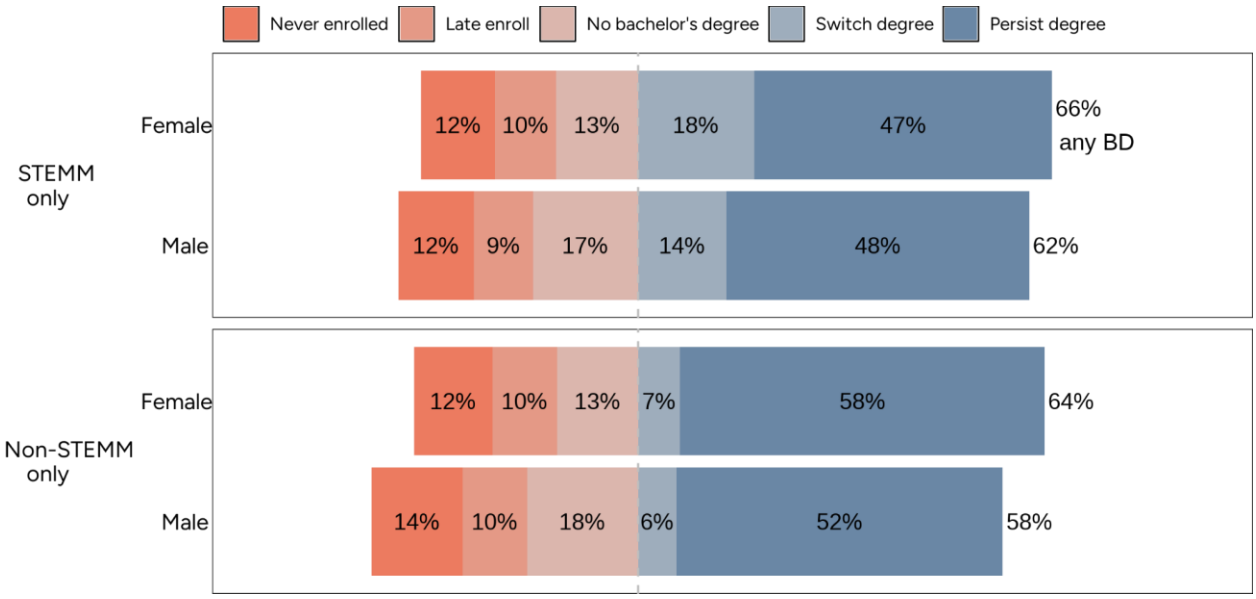
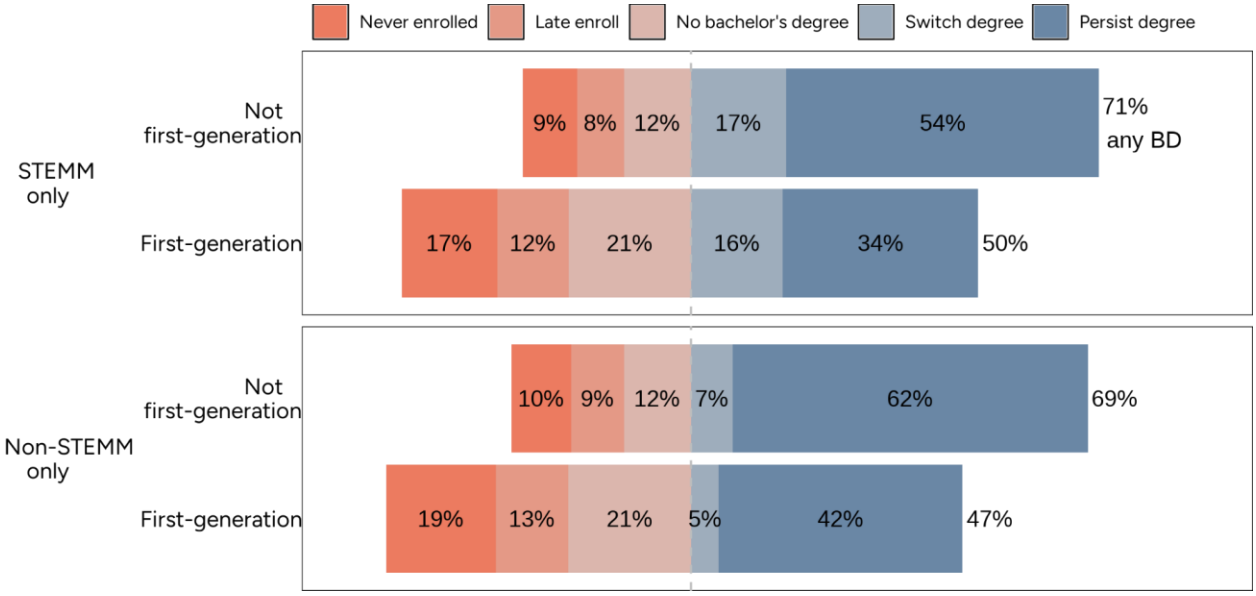


Figure 6 shows larger differences in degree persistence by first-generation status than we observed for applicant sex. First-generation applicants are much less likely to persist in their field of interest, for both STEMM and non-STEMM interested applicants, with a 20-percentage point gap in degree persistence rates. These differences are primarily driven by both lower rates of timely enrollment, and lower rates of earning a degree in any field if enrolled. In other words, these differences do not seem to be driven by higher rates of first-generation students switching out of STEMM fields. About 21% of first-generation applicants enroll but have not earned a

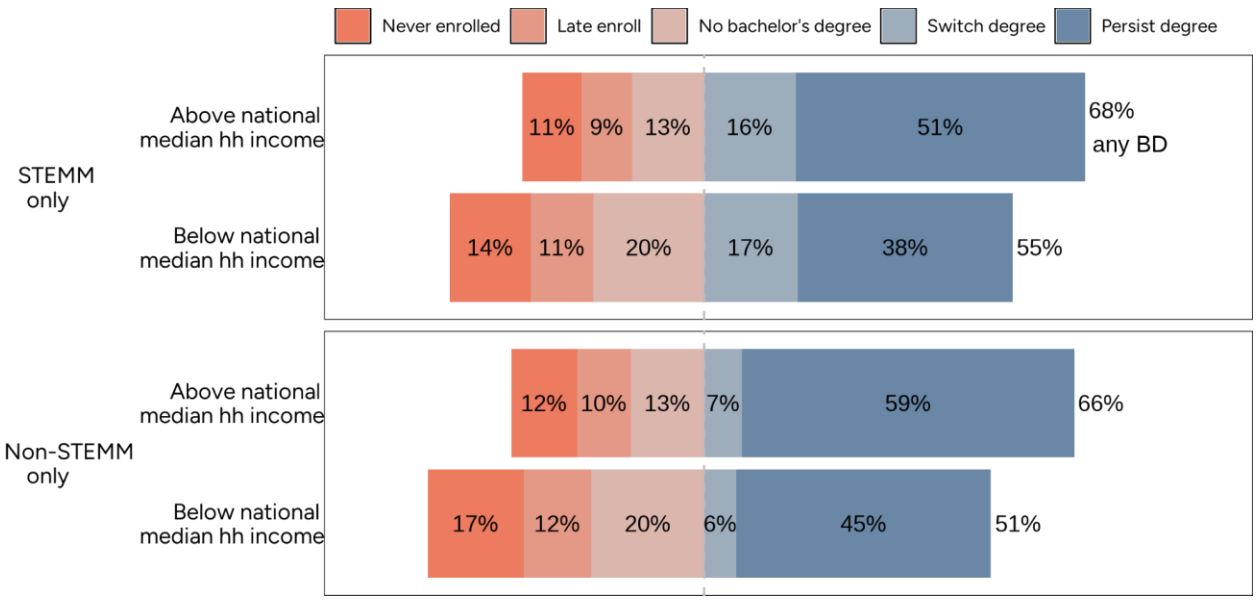
degree in any subject, compared to about 12% of non-first generation applicants, regardless of interests at application.

Figure 6. Outcomes by STEMM-interest at application and first-generation status
Among 578,719 domestic applicants planning to enroll in AY 2017-18



In Figure 7, differences by applicant ZIP code being above or below the median household income follow a similar pattern to first-generation differences, although the size of the gap between above and below median income ZIP codes is less pronounced than that between first-generation status, with a 13 percentage point difference in degree persistence rates.

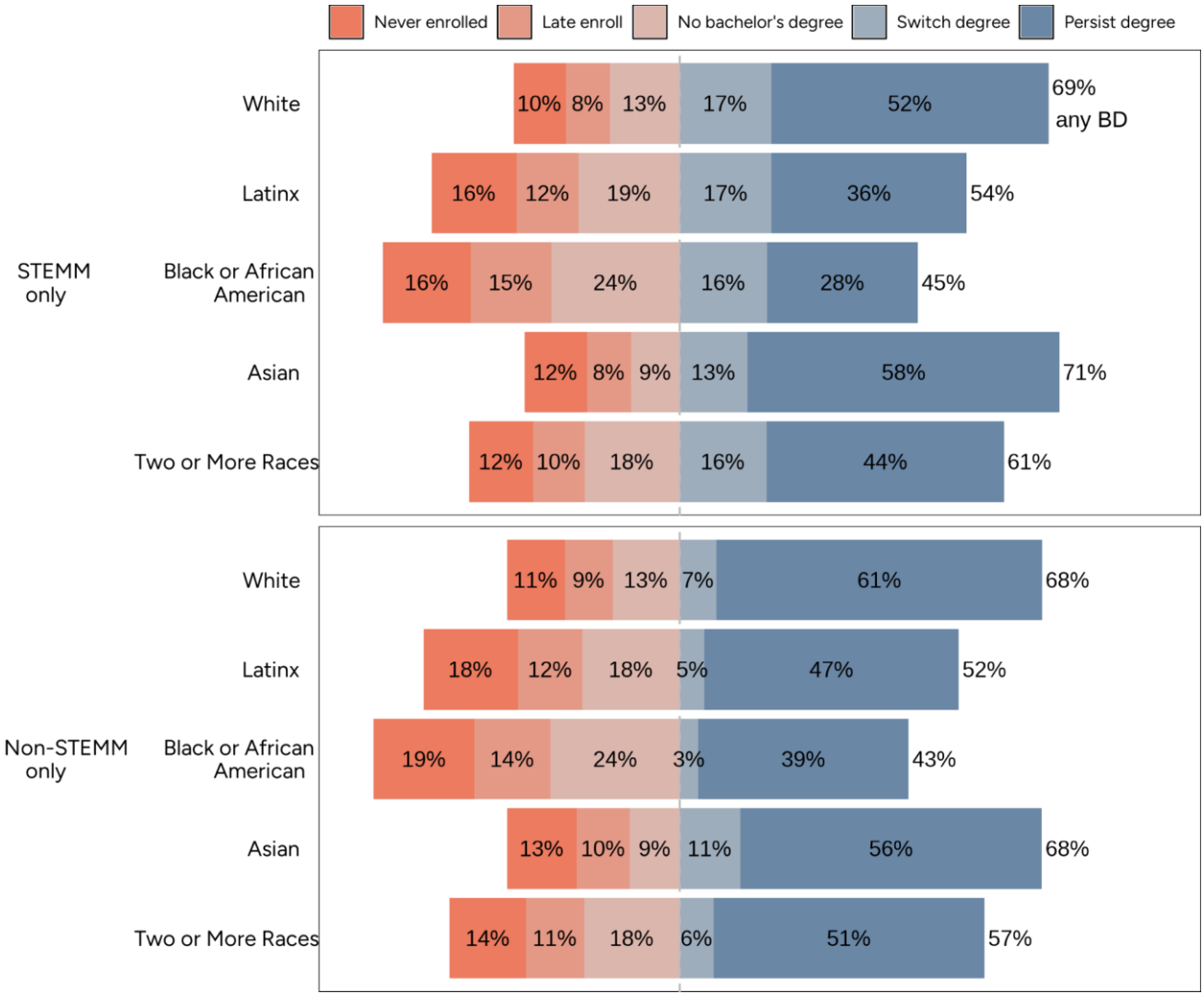
Figure 7. Outcomes by STEMM-interest at application and applicant's ZIP code
Among 578,719 domestic applicants planning to enroll in AY 2017-18



Finally, Figure 8 shows outcomes by applicant race/ethnicity. Focusing on applicants interested in STEMM, we can see a 30 percentage point difference between the percent of Asian applicants who persist and earn a degree in STEMM (58%) and Black or African American applicants (28%). Rates of switching into non-STEMM are consistently about 16%-17% for almost every race/ethnicity group. Instead, degree persistence differences among STEMM-interested applicants arise from higher rates of not earning a degree in any field within six years and enrolling either late or not at all.

Comparing applicants interested in non-STEMM fields to their same race/ethnicity peers in STEMM, non-STEMM applicants have higher rates of persistence. For example, 52% of white applicants in STEMM earn a degree in STEMM, compared to the 61% degree persistence rate of white applicants interested in non-STEMM subjects. Yet these higher degree persistence rates compared to STEMM are generally the result of lower rates of switching – while 17% of white STEMM applicants switch out of STEMM, just 7% of non-STEMM applicants switch into STEMM. Comparing within applicants interested in non-STEMM across race/ethnicity, substantial gaps in enrolling on time and earning a degree in any subject are similar to those observed within STEMM. Regardless of interests at application, Latinx and African American applicants are less likely to enroll on time and earn a degree in any subject.

Figure 8. Outcomes by STEMM-interest at application and applicant race/ethnicity
Among 578,719 domestic applicants planning to enroll in AY 2017-18



"Top quartile" applicants

Many of the patterns we show above reveal that the majority of demographic differences in STEMM degree persistence seem driven by overall enrollment and degree completion issues. But what if we focus instead on students who are particularly well-prepared for college success? Would we still observe similar disparities in the enrollment and degree persistence pipeline?

In this section, we consider the subset of applicants whose application data suggests a strong readiness for college coursework. Our rough approximation relies on an applicant meeting at least one of two criteria: reporting SAT/ACT test scores

in the top quartile of all test-takers for the 2016-2017 test cycle (based on national percentile cut points), and/or GPAs in the top quartile of all Common App GPAs submitted in the 2016-2017 application season.[13]

Figure 9 shows the percent of applicants in each demographic group who met this threshold. Note that more than a quarter of applicants meet this threshold and that this percent differs across demographic groups, reflecting both that Common App applications in this cycle do not represent the full college applicant population and also that GPA and standardized test scores reflect broader inequalities in the U.S. education system.

[13] Alternative specifications using either SAT or ACT "college-ready" benchmark scores reveal similar results. For more on these alternative benchmarks see Benchmarks – SAT Suite | College Board or ACT Scores for Higher Education Professionals

Figure 9A. Percent of applicants in "Top Quartile" threshold for legal sex and first-generation status

Among 578,719 domestic applicants planning to enroll in AY 2017-18

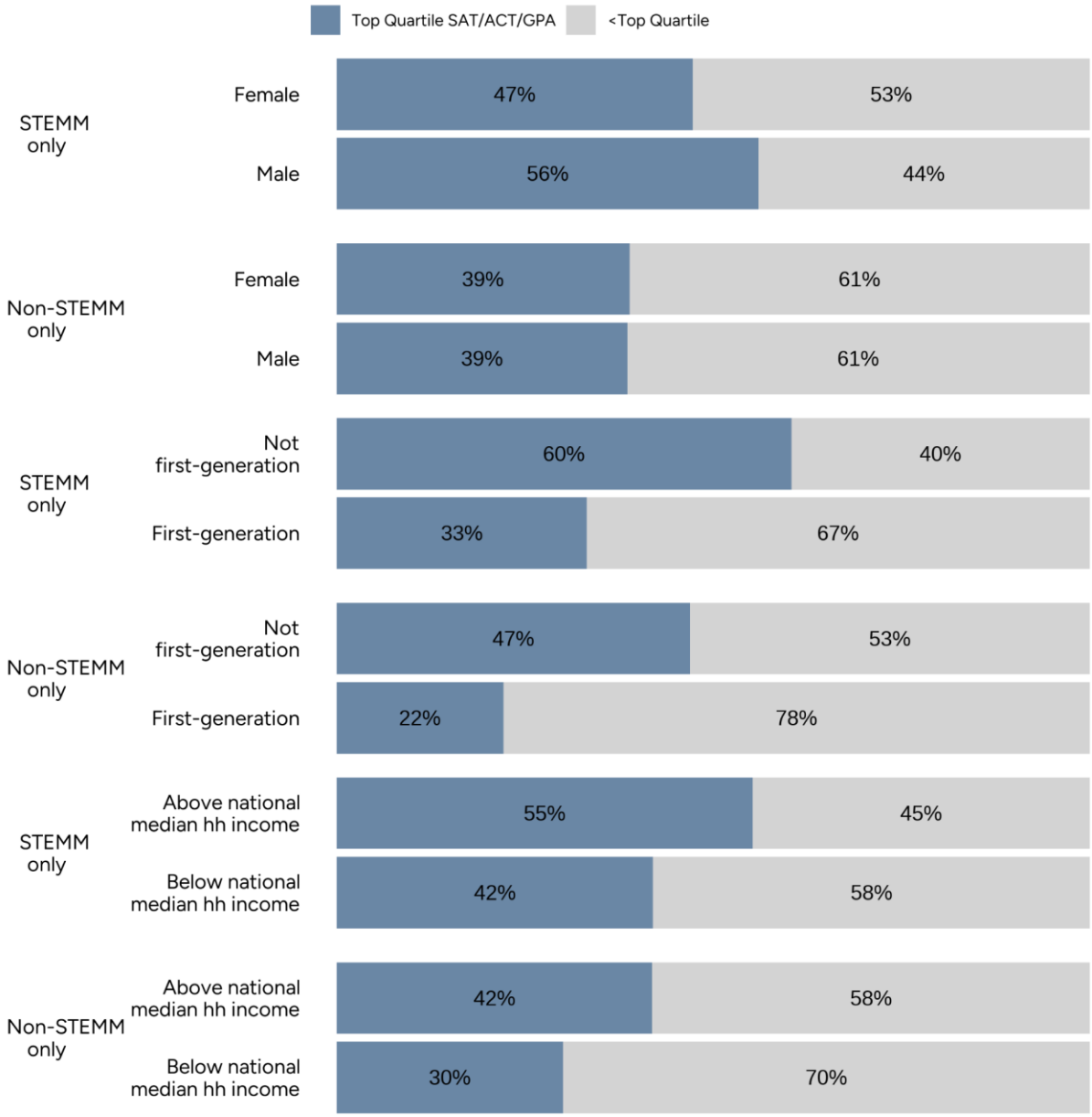
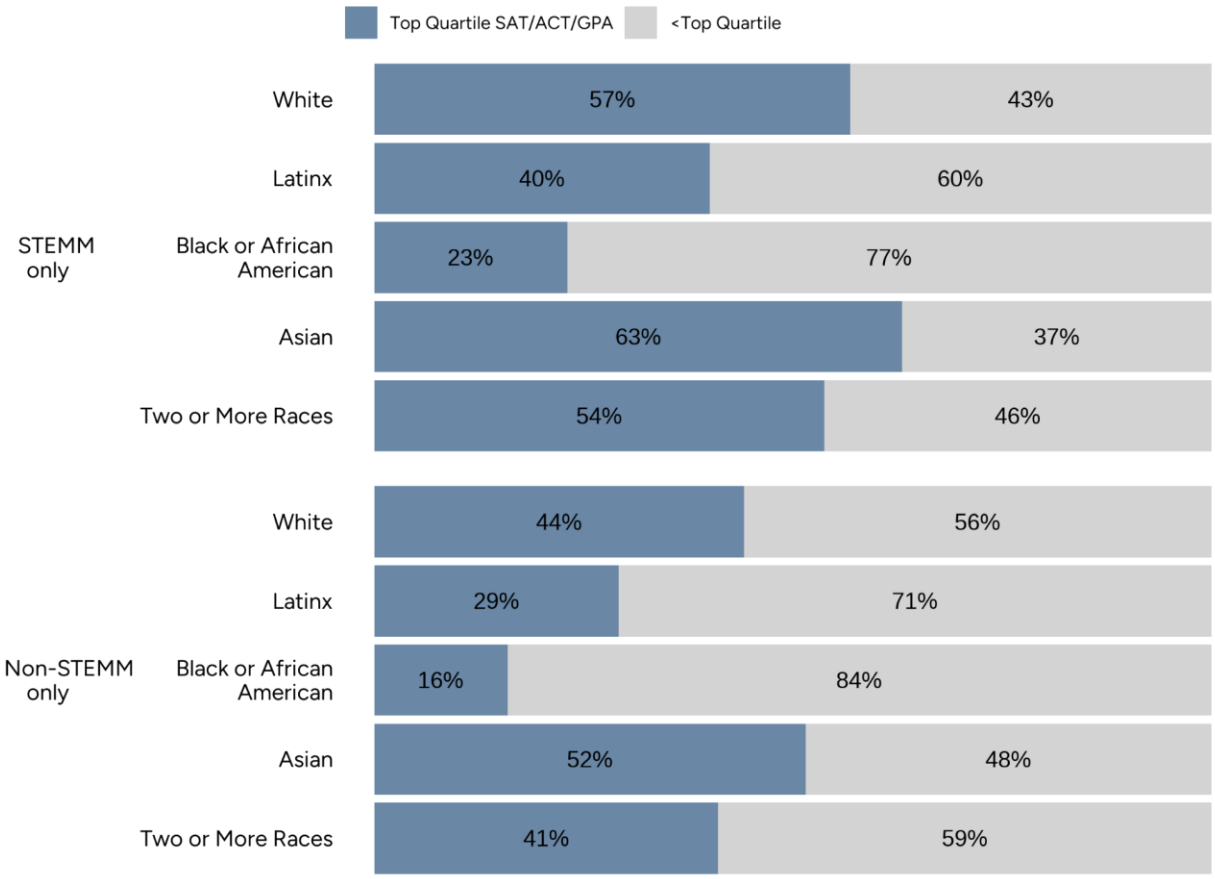


Figure 9B. Percent of applicants in "Top Quartile" threshold for student race/ethnicity groupings

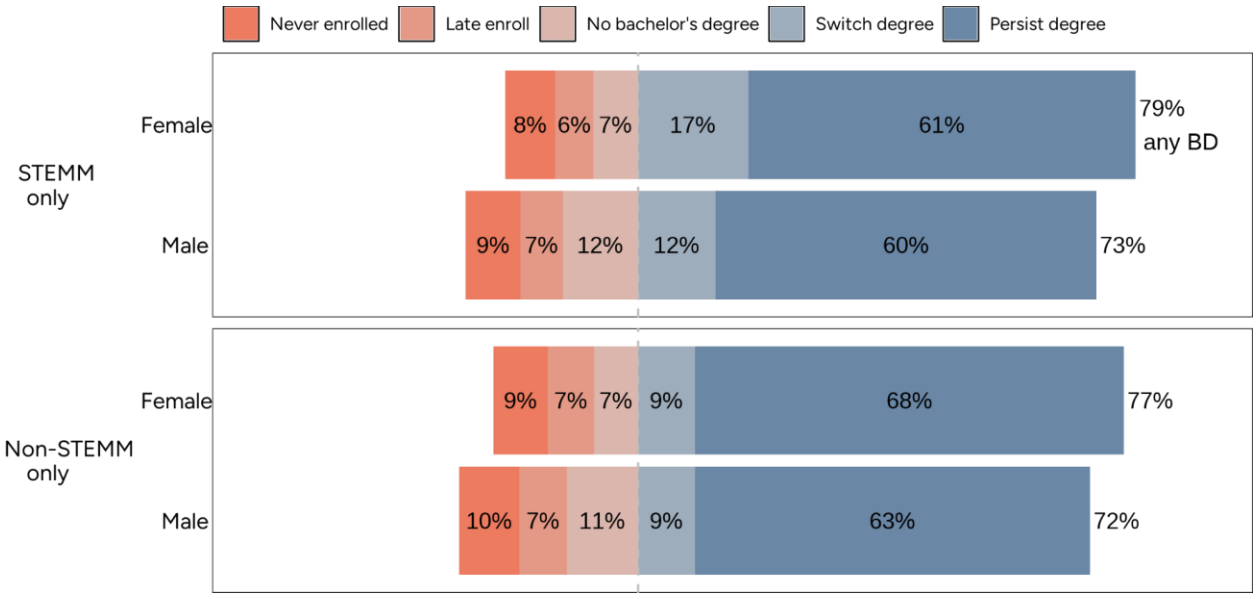
Among 578,719 domestic applicants planning to enroll in AY 2017-18



Figures 10-13 show outcomes restricted to top quartile applicants. Restricting analyses to this subset reduces the size of differences in enrolling on-time or at all to just one to three percentage points, across demographic groups, making differences in switching or earning any degree more salient.

For example, in Figure 10, male and female applicants both persist in STEMM at rates of about 60%. However female applicants have higher rates of switching subjects (17%) and male applicants have higher rates of earning no degree (12%), leaving male applicants with a lower overall degree rate (73% in comparison to 79% for female students). Non-STEMM differences by sex follow similar patterns, though female persistence in non-STEMM is notably high at 68%.

Figure 10. Outcomes by STEMM-interest at application and applicant sex
Among 250,496 "top quartile" domestic applicants planning to enroll in AY 2017-18



First-generation applicants have lower rates of degree persistence in both STEMM and non-STEMM, by about 8-9 percentage points, most of which arises from rates of earning no degree (~14% for first-generation, ~8% for not-first generation). First-generation applicants are also slightly more likely to switch out of STEMM in the STEMM-only group (16% versus 14% of continuing-generation applicants).

Figure 11. Outcomes by STEMM-interest at application and applicant first-generation status

Among 250,496 "top quartile" domestic applicants planning to enroll in AY 2017-18

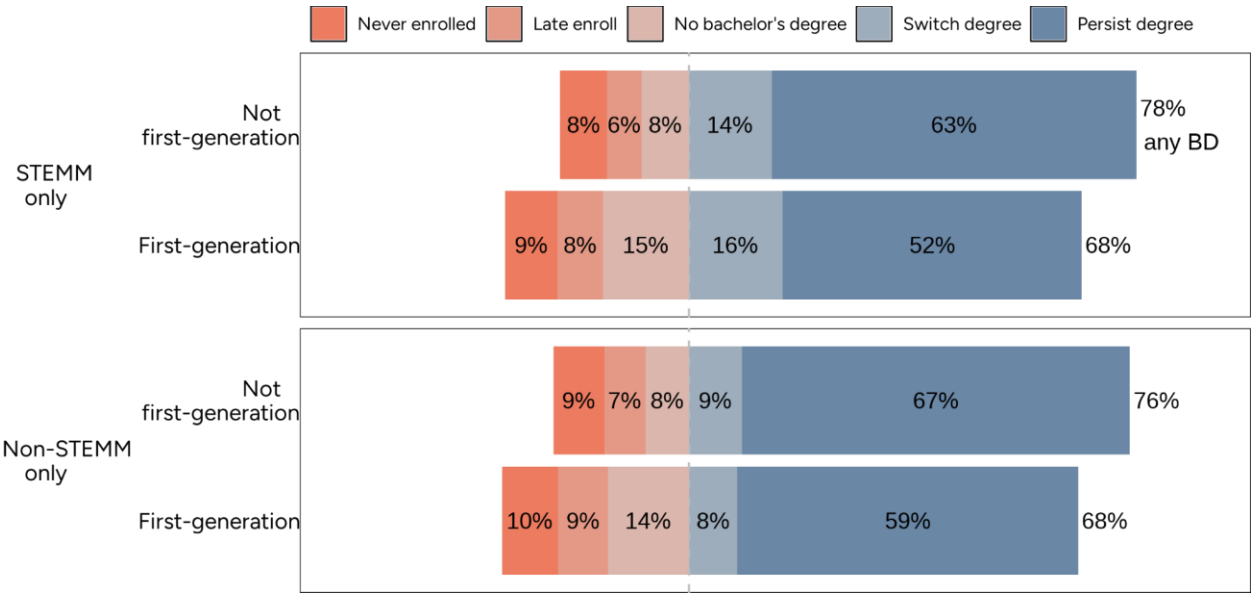
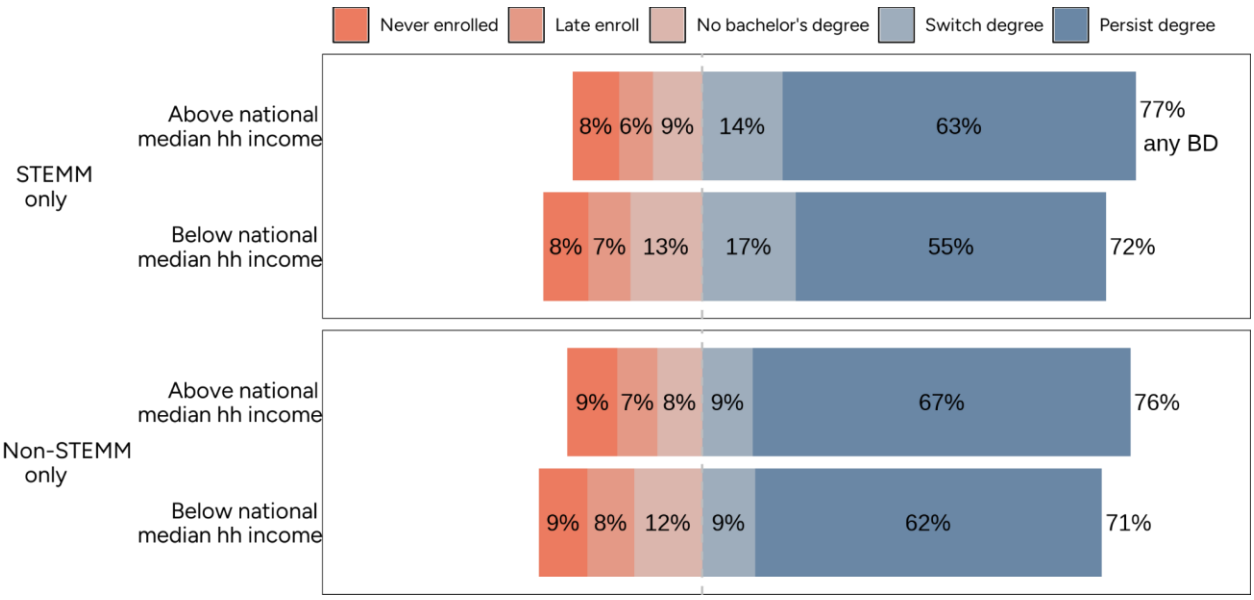


Figure 12. Outcomes by STEMM-interest at application and applicant ZIP code

Among 250,496 "top quartile" domestic applicants planning to enroll in AY 2017-18



Differences between above and below median household income ZIP code applicants grow quite small for "top quartile" applicants. Sixty-three percent of above median household income ZIP code STEMM aspirants earn a STEMM degree, just eight percentage points higher than the 55% of below median income ZIP code who earn a STEMM degree. The three percentage point higher rate of switching out

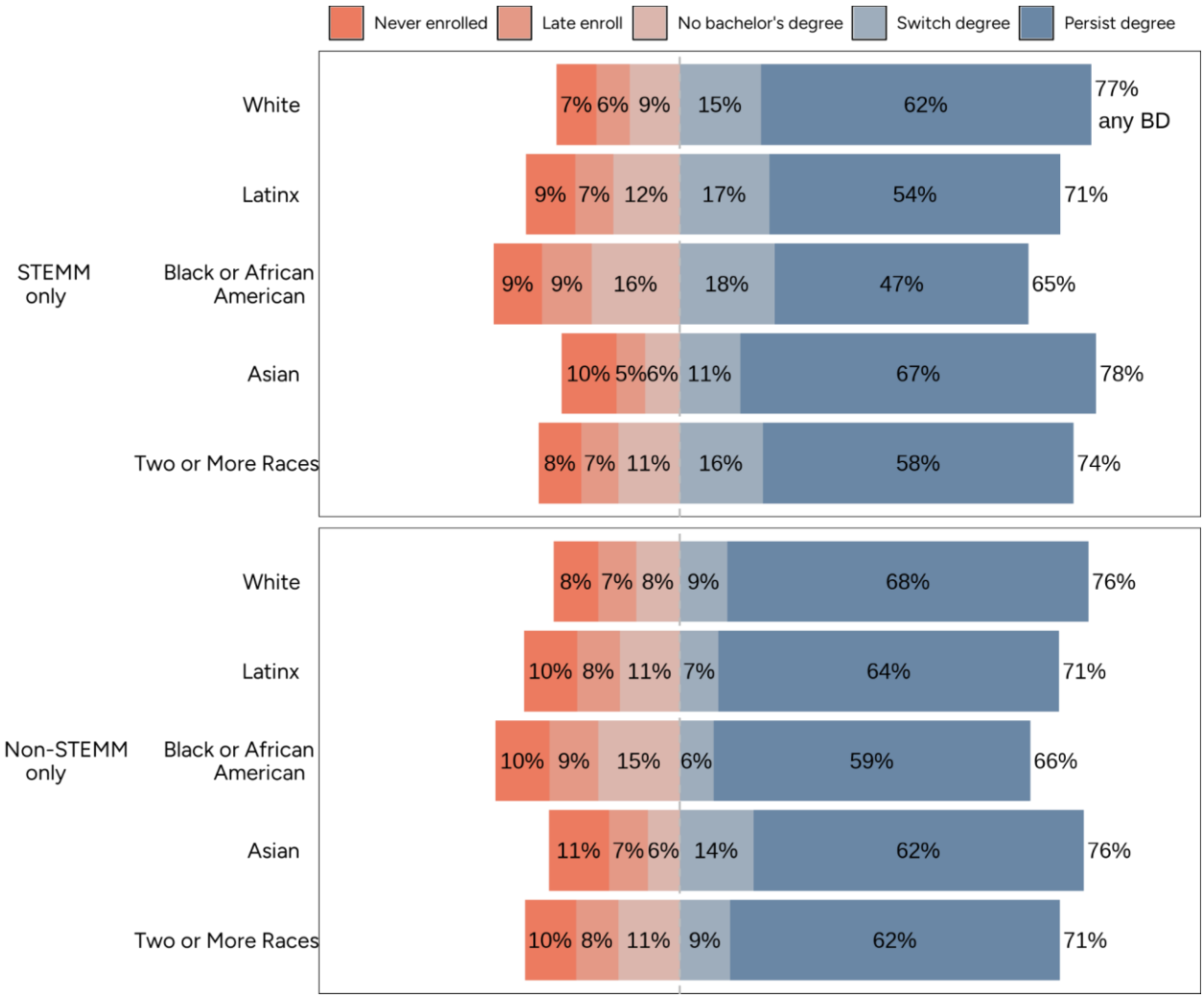
of STEMM for below median household income ZIP code applicants makes up almost half of this eight percentage point difference. For non-STEMM aspirants, differences in persistence are even smaller, and rates switching are identical between above and below median household income applicants.

Differences in degree persistence by race/ethnicity for top quartile applicants are smaller than in the all-applicant pool. Black or African American STEMM-interested applicants are still less likely to persist, about 20 percentage points less than Asian applicants (47% vs 67%) and 15 percentage points less than White applicants (62%). Rates of switching do contribute a few percentage points to this disparity, with 18% of Black or African American and 17% of Latinx applicants switching out of STEMM, in comparison to 15% of White applicants and just 11% of Asian. That said, differences for STEMM-interested applicants are still largely driven by higher rates of earning no degree for Black or African American applicants (16%) and Latinx (12%) in comparison to 9% of White applicants and 6% of Asian applicants.

Differences in degree persistence rates by race/ethnicity are slightly less pronounced for non-STEMM applicants. The difference in degree persistence between Black and African American applicants and White applicants is 10 percentage points, and the difference between Hispanic/Latinx and White applicants is just 4 percentage points. Asian applicants have lower rates of degree persistence than several other groups, though note that this gap is driven by uniquely higher rates of switching into STEMM (14%).

Figure 13. Outcomes by STEMM-interest at application and applicant race/ethnicity

Among 250,496 "top quartile" domestic applicants planning to enroll in AY 2017-18



We examine one additional subset of applicants: STEMM-interested applicants who are both "top quartile" and *also* took at least 2 advanced courses in a STEMM subject during their senior year, with results shown in Appendix C. While this analysis covers just a small percentage of the applicant pool, it allows us to see outcomes for applicants who should be well-prepared and well-committed to persist in STEMM. We find patterns are similar to the top quartile analyses, even as the persistence rates broadly increase. Rates of switching out of STEMM become slightly more salient for Black or African American and Latinx applicants in comparison to the general and top quartile analysis.

Degree fields within STEMM

While the above analyses explore differences in degree persistence for any STEMM degree across demographics, an important question remains: For those applicants who earned a degree in STEMM, did the fields of those degrees differ by demographic groups as well? Figure 16 shows the percent of STEMM degree earners with a degree in each field. For example, 32% of female STEMM degree earners earned a degree in Biology, compared to 18% of male STEMM degree earners. Note the individuals can earn degrees with multiple majors and minors, meaning percentages do not necessarily sum to 100% within a demographic group.

Figure 14A. STEMM degree fields by demographic groups
Among 198,201 STEMM degree earners by the end of AY 2023-2024

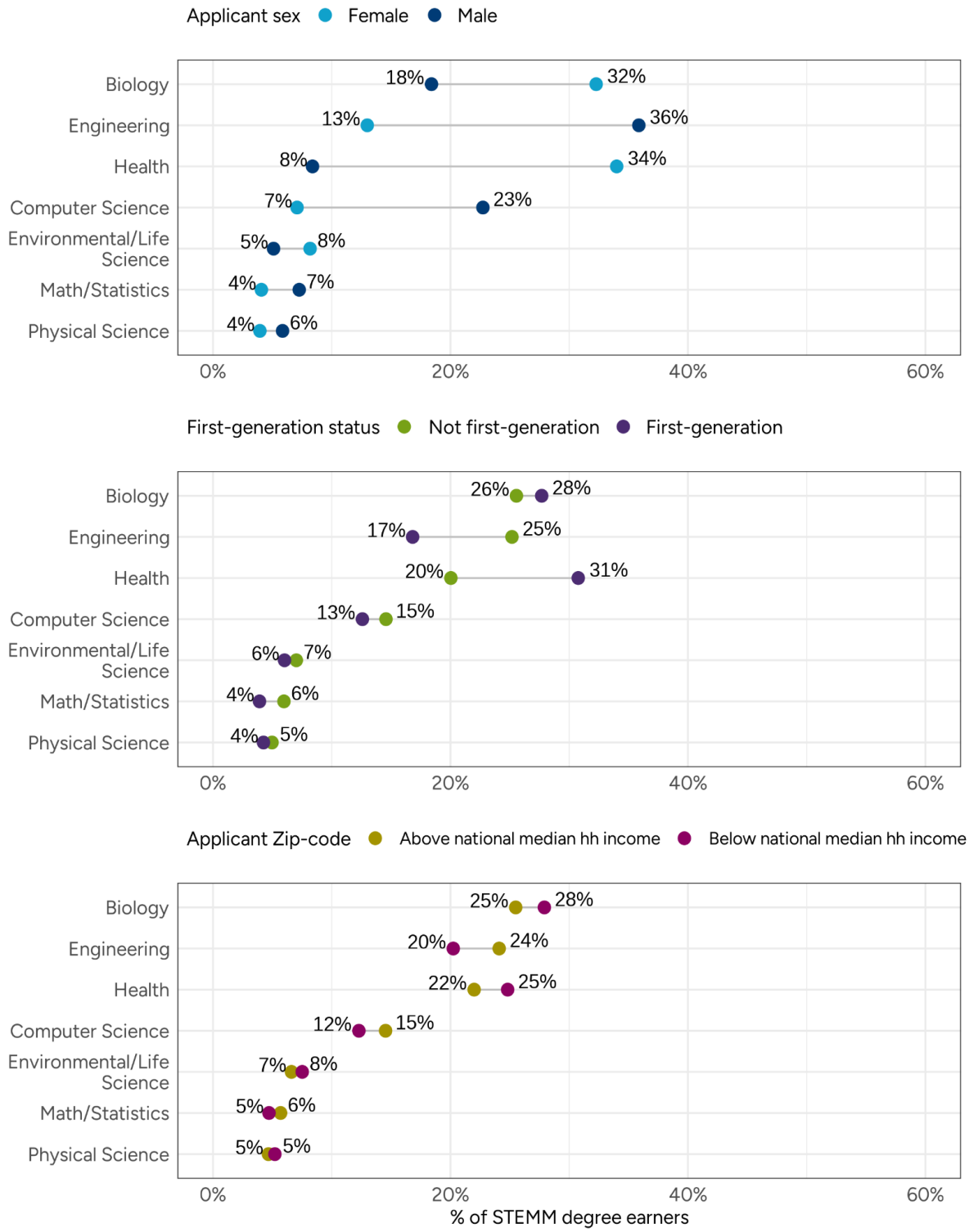
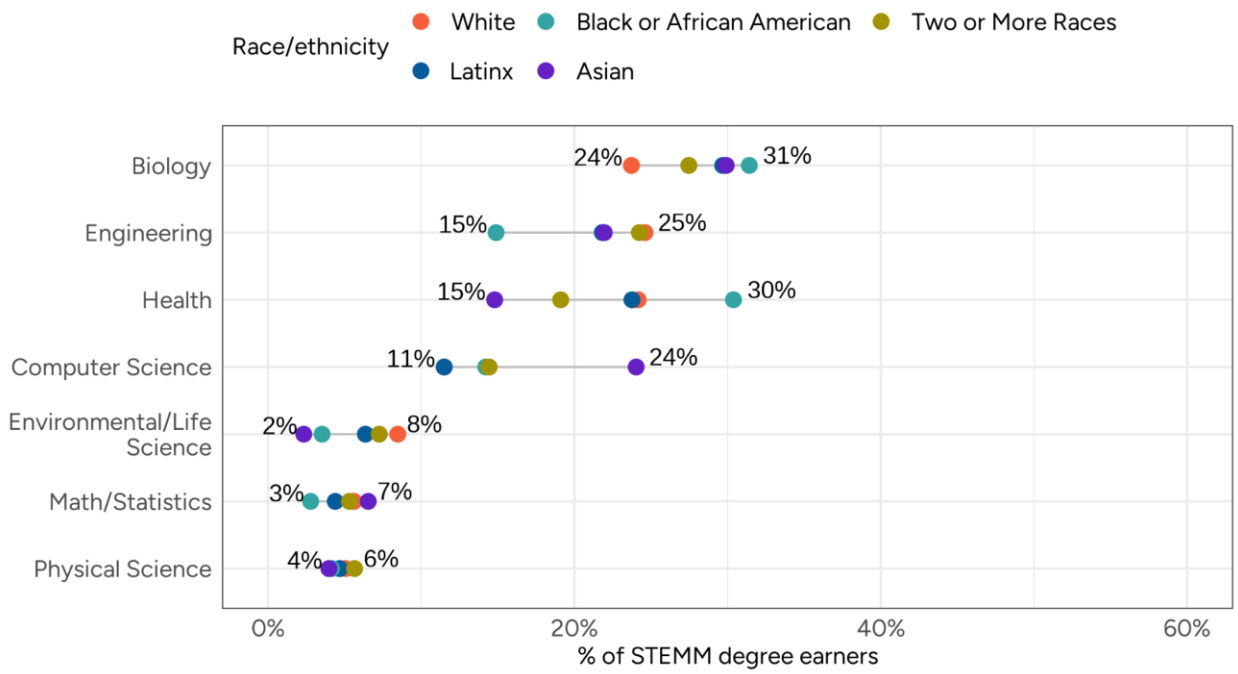


Figure 14B. STEMM degree fields by demographic groups
Among 198,201 STEMM degree earners by the end of AY 2023-2024



Patterns in degrees earned are for the most part aligned with patterns in STEMM fields of interest. We again see some large magnitude differences in degree fields by applicant legal sex, with about a third of female STEMM degree earners in Health or Biology, while a third of male STEMM degree earners studied Engineering. Differences by first-generation and race/ethnicity degree earners are smaller in magnitude and more variable. Similar to patterns in interest, underrepresented groups have higher rates of earning a degree in Health.

Conclusion

Taken together, our findings suggest that barriers to college access and success remain that disproportionately impact applicants in underrepresented groups, regardless of their fields of interest. Even high-achieving applicants from underrepresented groups are at higher risk of not completing a bachelor's degree in any field within six years. The story of who persists in STEMM is thus ultimately part of a broader narrative of who persists in college more generally.

To summarize our wide-ranging results, we highlight the key takeaways for each phase of the pipeline. At **application**, we observe lower rates of advanced STEMM courses and extracurriculars in high school for first-generation and minority

students.[14] Future research could further unpack the relationship between these pre-college activities and success, and explore whether these gaps are also true of pre-college non-STEMM opportunities, in the humanities and social sciences. Given that interest and aspirations are already quite high among underrepresented students, advocates of STEMM equity who work with high school students may want to consider increasing access to STEMM activities and coursework as a top priority. Ensuring every student has the opportunity to build skills and confidence in their interests can help them hit the ground running in college.

We find the transition from applying to **enrolling** in four-year colleges results in disproportionate losses of applicants from underrepresented groups, STEMM and non-STEMM aspirants alike. These disparities are mostly erased for top quartile applicants. Improving general college-readiness and application support among aspirants from underrepresented groups presents another opportunity to potentially reduce attrition.

Once enrolled, we find many students, including those who show high achievement on their application, have not earned a **bachelor's degree** in any subject within six years. While our findings do not point to one solution to this broad challenge, there is a robust coalition of practitioners, policymakers, and researchers who have been working on this challenge for decades, with recommendations ranging from ensuring students can find clear curricular pathways to graduation, to holistic student support programs.[15]

Our work builds on earlier studies, which have consistently found disparities in persistence in STEMM fields for Black or African American, Latinx, and first-generation college students, as well as the pattern of higher rates of "switching" for female students in STEMM.[16] One prior analysis also finds some non-STEMM majors have attrition rates as high as STEMM majors, while another found graduation gaps in any field as significant issues for STEMM persistence. We caution that differences in sample specifications and STEMM definition limit direct comparisons. Still, our

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[14] The National Science Foundation's Elementary and Secondary STEM Education indicators, National Center for Education Statistics Stats in Brief report, and ACT Research's The Condition of STEM 2016 all explore STEMM interest and/or preparation prior to college and find similar patterns

[15] See Using Data Effectively to Drive Equitable Improvements in Postsecondary Student Success: A Playbook from the Department of Education for one recent overview.

[16] For a few national level descriptive analyses of STEMM persistence please see the following works: Chen, X. (2013), Eagan, K., Hurtado, S., Figueroa, T., & Hughes, B. E. (2014), Radunzel, J., Mattern, K., & Westrick, P. (2016), Riegle-Crumb, C., King, B., & Irizarry, Y. (2019). Note that each of these studies defines "STEM" in distinct ways, three out of the four cover college entrants in 2004, and all focus on students already enrolled in four-year institutions, rather than college applicants.

study is unique in finding both challenges in non-STEMM persistence and also minimal differences in switching out of STEMM by demographic groups relative to differences in not completing in any degree. The recentness of our cohort of interest, students entering college in 2017, also provides a novel contribution.

Our findings don't preclude major-specific challenges, instead raising the possibility of unique challenges along both STEMM and non-STEMM pathways. We also uncover quite wide differences in interests and degrees within STEMM fields, which may point toward discipline-specific barriers, particularly in popular fields like Engineering and Computer Science. We hope our findings inspire additional research unpacking these dynamics. Many college students struggle to afford supplies, get career-relevant experience, find mentors and feel a sense of belonging. We can imagine that these challenges may be different in type across majors, but feel similarly daunting in magnitude, whether a student is trying to find time in a lab or studio, volunteering as a research assistant or student-teacher alongside a part-time job, or networking in computer science or business.

Part of building diversity in STEMM may thus mean considering college access and success more broadly, and building a coalition with advocates in other disciplines. We conclude with a hope that these descriptive statistics capture some of the challenges today's college applicants are navigating, help advocates make the case for additional resources and research, and help funders and other conveners marshall resources around these persistent gaps in college readiness and completion.

Appendix

A. CIP code categories and frequencies

Table A1. Top 10 majors by number of degrees earned for non-STEMM and STEMM fields

STEMM field (this analysis)	CIP Code	CIP Title	Number of Applicants intended major	Number of Applicants earned Bachelor's degree
Non-STEMM	420101	Psychology, General.	165,184	27,967
	520201	Business Administration and Management, General.	128,102	24,106
	451001	Political Science and Government, General.	100,491	18,158
	520801	Finance, General.	58,455	15,655
	521401	Marketing/Marketing Management, General.	56,165	13,430
	520301	Accounting.	47,692	10,098
	230101	English Language and Literature, General.	53,674	9,849
	90101	Speech Communication and Rhetoric.	37,311	8,920
	450601	Economics, General.	78,166	8,771
	540101	History, General.	37,861	7,850
Biology	260101	Biology/Biological Sciences, General.	275,526	28,576
Health	513801	Registered Nursing/Registered Nurse.	97,772	16,076
Computer Science	110701	Computer Science.	112,013	13,647
Engineering	141901	Mechanical Engineering.	64,057	12,314
Math/Statistics	270101	Mathematics, General.	45,232	7,188

STEMM field (this analysis)	CIP Code	CIP Title	Number of Applicants intended major	Number of Applicants earned Bachelor's degree
Computer Science	110101	Computer and Information Sciences, General.	22,462	7,138
Biology	261501	Neuroscience.	43,943	5,654
Health	310505	Exercise Science and Kinesiology.	17,680	5,444
Physics	400501	Chemistry, General.	68,578	5,225
Engineering	140501	Bioengineering and Biomedical Engineering.	50,293	4,870

Table A2. Top 5 majors per STEMM field by number of degrees earned

STEMM field (this analysis)	NSF Science and Engineering Field	CIP Code	CIP Title	Number of Applicants intended major	Number of Applicants earned bachelor's degree
Biology	Biological and Biomedical Sciences	260101	Biology/Biological Sciences, General.	275,526	28,576
		261501	Neuroscience.	43,943	5,654
		260202	Biochemistry.	46,250	4,020
		260406	Cell/Cellular and Molecular Biology.	7,656	1,795
		260102	Biomedical Sciences, General.	7,675	1,670
Computer Science	Computer Science	110701	Computer Science.	112,013	13,647
		110101	Computer and Information Sciences, General.	22,462	7,138
		110401	Information Science/Studies.	2,699	2,220

STEMM field (this analysis)	NSF Science and Engineering Field	CIP Code	CIP Title	Number of Applicants intended major	Number of Applicants earned bachelor's degree
		110103	Information Technology.	3,298	1,857
		111003	Computer and Information Systems Security/Auditing/ Information Assurance.	1,436	745
Engineering	Engineering	141901	Mechanical Engineering.	64,057	12,314
		140501	Bioengineering and Biomedical Engineering.	50,293	4,870
		141001	Electrical and Electronics Engineering.	39,746	4,857
		140801	Civil Engineering, General.	20,743	4,406
		140701	Chemical Engineering.	24,363	4,221
Environmental /Life Science	Natural Resources and Conservation	30103	Environmental Studies.	18,404	3,521
		30104	Environmental Science.	16,814	2,613
	Life Sciences	10901	Animal Sciences, General.	6,377	1,617
	Geosciences,	400601	Geology/Earth Science, General.	5,176	1,215

STEMM field (this analysis)	NSF Science and Engineering Field	CIP Code	CIP Title	Number of Applicants intended major	Number of Applicants earned bachelor's degree
	Atmospheric, and Ocean Sciences	261302	Marine Biology and Biological Oceanography.	7,898	626
Health	Health Sciences	513801	Registered Nursing/Registered Nurse.	97,772	16,076
	Medical Residency/Fellowship Programs	310505	Exercise Science and Kinesiology.	17,680	5,444
	Medical Residency/Fellowship Programs	510000	Health Services/Allied Health/Health Sciences, General.	16,807	3,278
	Health Sciences	512201	Public Health, General.	8,846	3,087
	Medical Residency/Fellowship Programs	519999	Health Professions and Related Clinical Sciences, Other.	3,746	1,592
Math/ Statistics	Mathematics and Statistics	270101	Mathematics, General.	45,232	7,188
		270501	Statistics, General.	5,029	1,486
		270301	Applied Mathematics, General.	6,924	1,228
		270305	Financial Mathematics.	1,840	226

STEMM field (this analysis)	NSF Science and Engineering Field	CIP Code	CIP Title	Number of Applicants intended major	Number of Applicants earned bachelor's degree
		279999	Mathematics and Statistics, Other.	1,091	204
Physics	Physical Sciences	400501	Chemistry, General.	68,578	5,225
		400801	Physics, General.	35,517	3,403
		400201	Astronomy.	2,829	266
		400202	Astrophysics.	2,808	178
		400599	Chemistry, Other.	1,087	176

B. Enrollment and degree outcomes for applicants interested in both STEMM and non-STEMM fields

Figure B1A. Outcomes by applicant demographics for applicants interested in both STEMM and non-STEMM fields
Among 208,066 domestic applicants planning to enroll in AY 2017-18

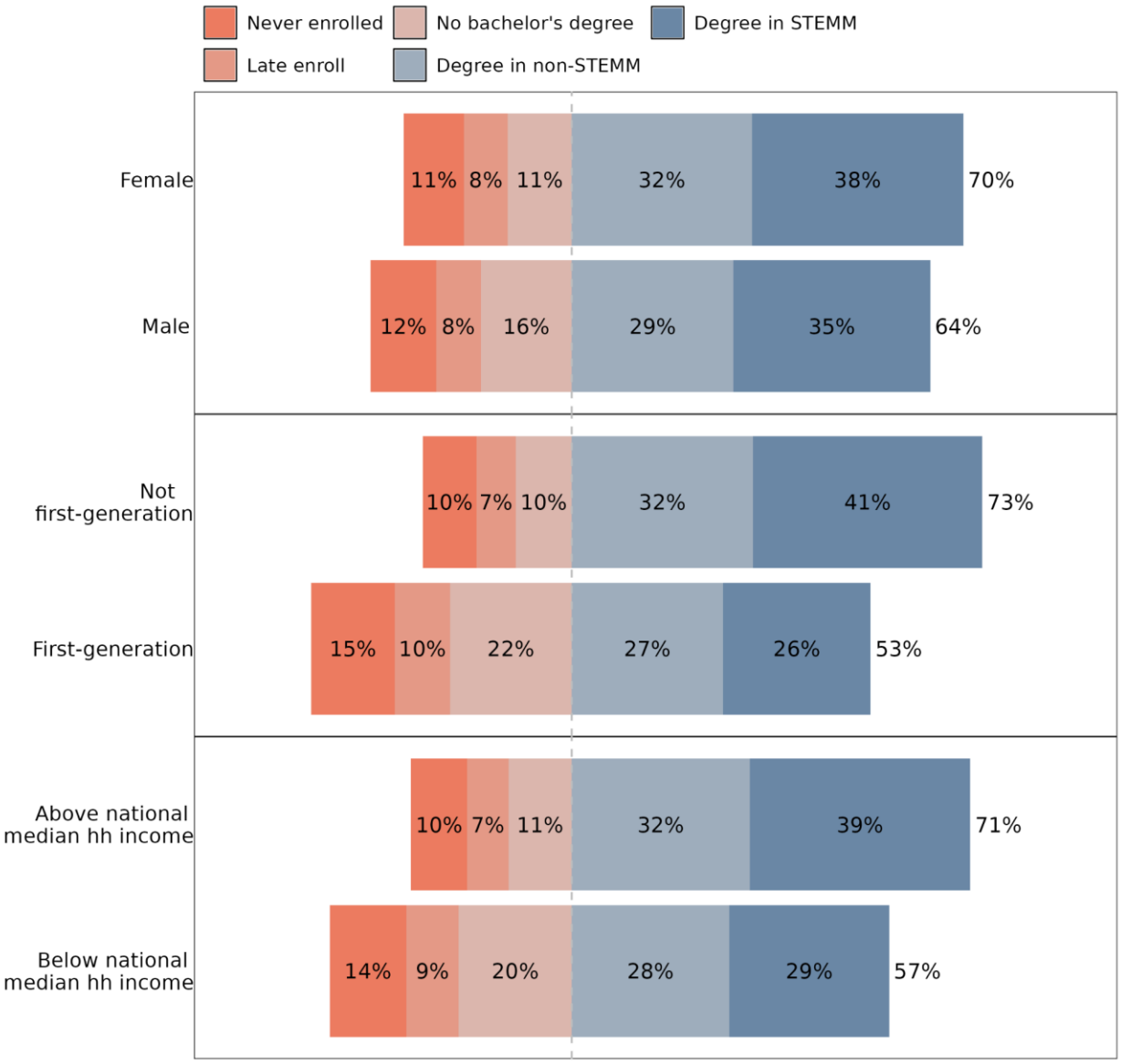

Never enrolled
Late enroll
No bachelor's degree
Degree in non-STEMM
Degree in STEMM
Female
11%
8%
11%
32%
38%
70%
Male
12%
8%
16%
29%
35%
64%
Not first-generation
10%
7%
10%
32%
41%
73%
First-generation
15%
10%
22%
27%
26%
53%
Above national median hh income
10%
7%
11%
32%
39%
71%
Below national median hh income
14%
9%
20%
28%
29%
57%

Figure B1B. Outcomes by applicant demographics for applicants interested in both STEMM and non-STEMM fields

Among 208,066 domestic applicants planning to enroll in AY 2017-18

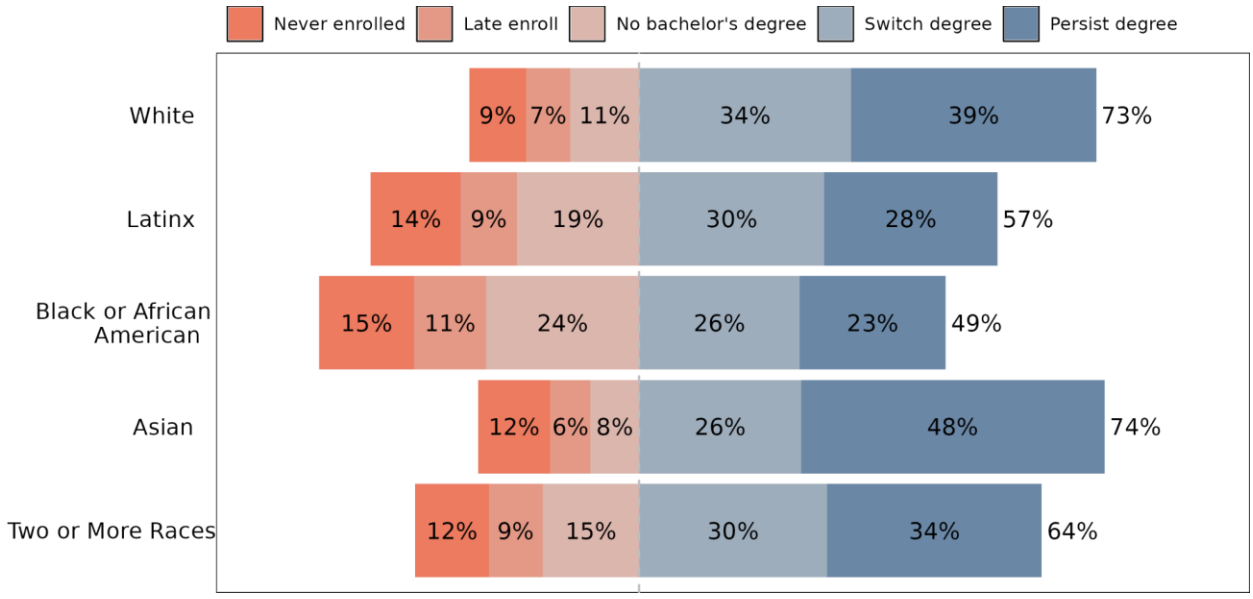


Figure B2. Percent of applicants in "Top Quartile" threshold or applicants interested in both STEMM and non-STEMM fields

Among 208,066 domestic applicants planning to enroll in AY 2017-18

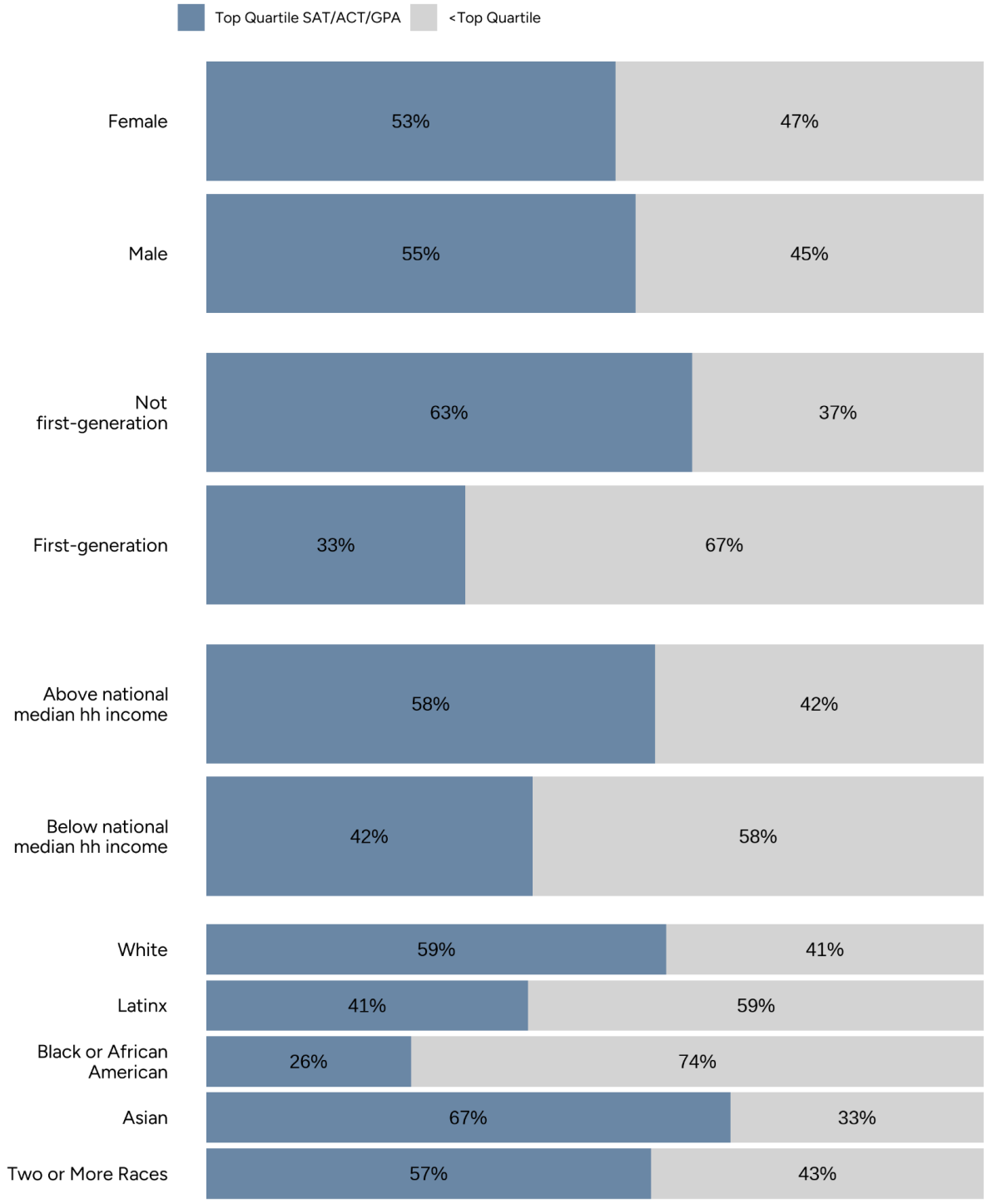


Figure B3A. Outcomes by applicant demographics for applicants interested in both STEMM and non-STEMM fields

Among 111,895 "top quartile" domestic applicants planning to enroll in AY 2017-18

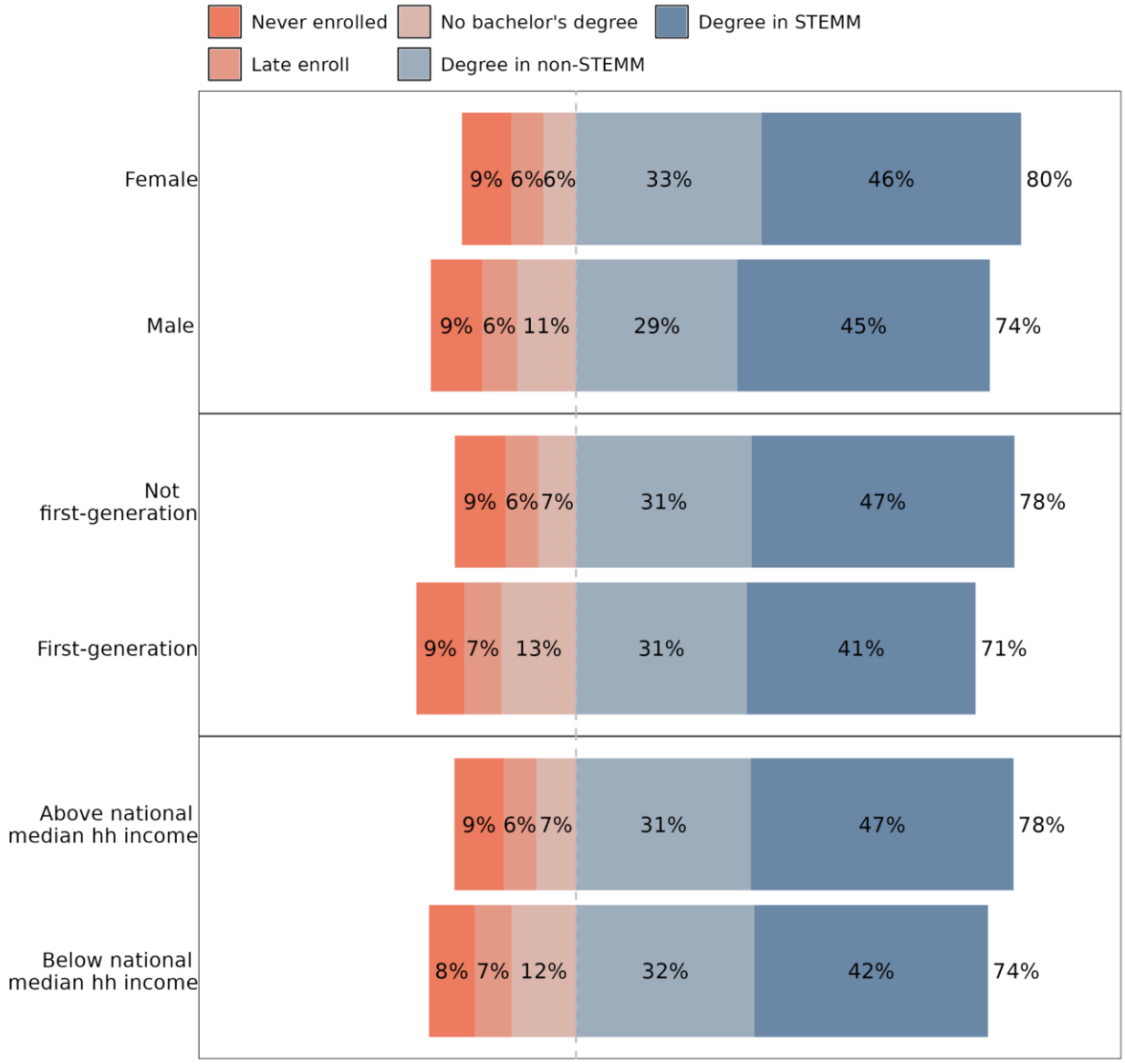
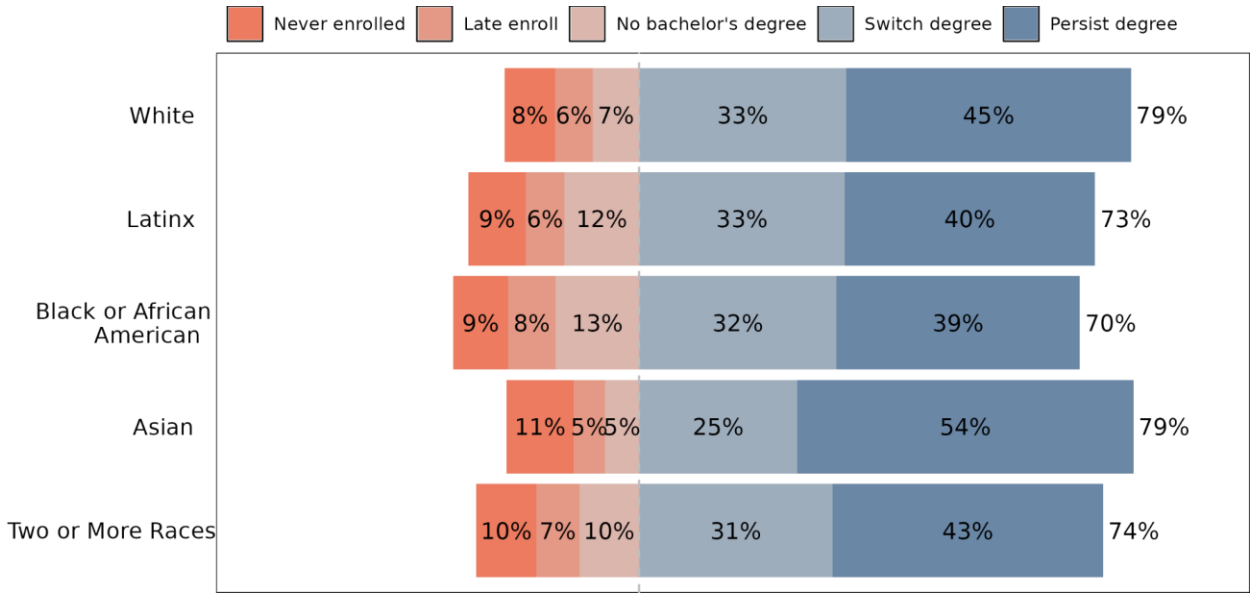


Figure B3B. Outcomes by applicant demographics for applicants interested in both STEMM and non-STEMM fields
Among 111,895 "top quartile" domestic applicants planning to enroll in AY 2017-18



C. "Top quartile" applicants with advanced STEMM coursework

Figure C1. Outcomes by STEMM-interest at application and applicant legal sex
Among 53,967 "top quartile" domestic applicants planning to enroll in AY 2017-18 who had taken 2+ advanced STEMM courses their senior year

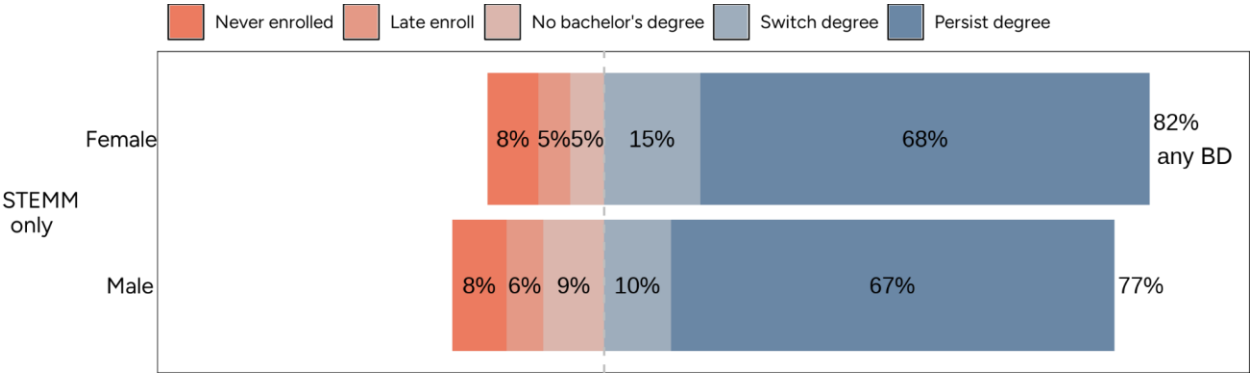


Figure C2. Outcomes by STEMM-interest at application and applicant first-generation status
Among 53,967 "top quartile" domestic applicants planning to enroll in AY 2017-18 who had taken 2+ advanced STEMM courses their senior year

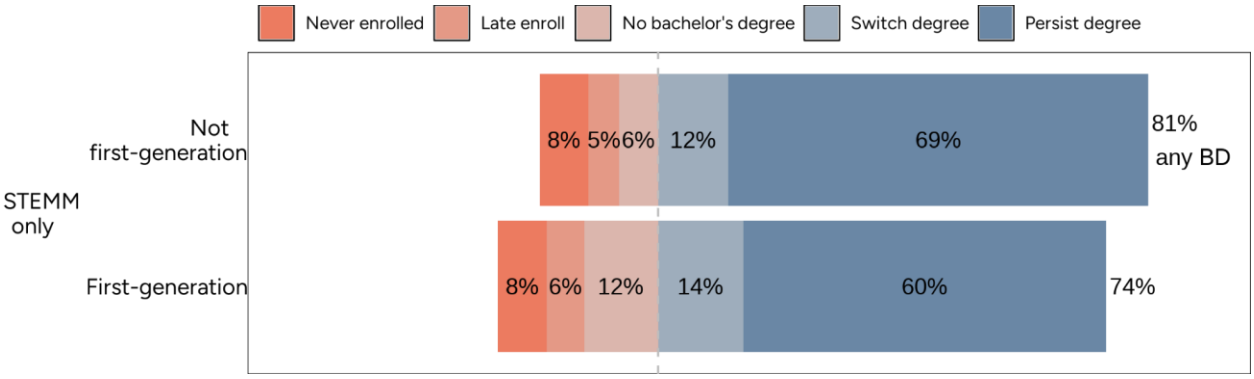


Figure C3. Outcomes by STEMM-interest at application and applicant ZIP code
Among 53,967 "top quartile" domestic applicants planning to enroll in AY 2017-18 who had taken 2+ advanced STEMM courses their senior year

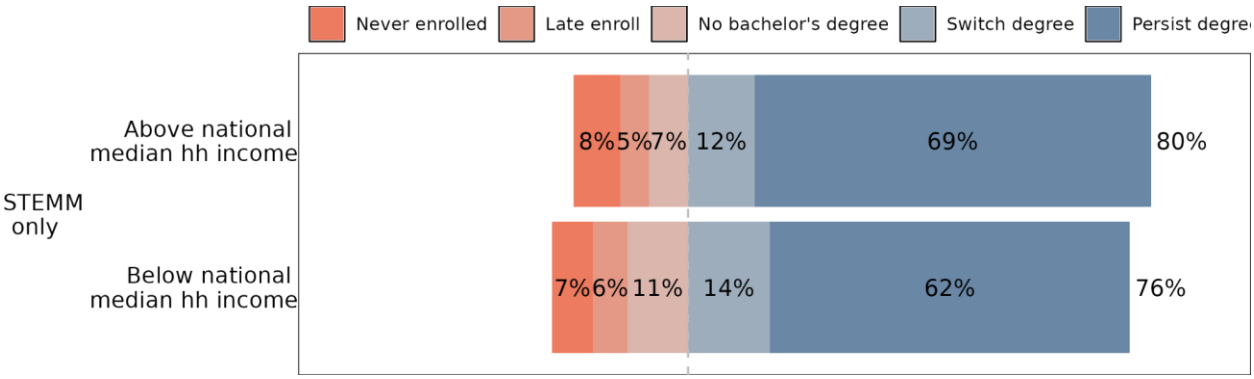


Figure C4. Outcomes by STEMM-interest at application and applicant race/ethnicity

Among 53,967 "top quartile" domestic applicants planning to enroll in AY 2017-18 who had taken 2+ advanced STEMM courses their senior year