Online Appendix

STEM Summer Programs for Underrepresented Youth Increase STEM Degrees

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Appendix A: Randomization and data details

This appendix describes the application and randomization process in more detail. It also includes more information on the surveys and other outcomes, as well as additional tables and figures.

A.1 Randomization details

Below, we describe the details of the randomization process for each cohort. See Figures 2a through 2c for a general overview of the randomization design and the number of applicants allocated to program spots. Randomization processes were slightly different across years, reflecting different operational preferences and leadership over time. Key participants in the selection process are staff in the HI admissions offices. Typically, these employees work to recruit and select the freshman class at the HI; each year they also help winnow the large pool of applications to the summer program from about 2,000 to about 700. Program selection committees also evaluate applications. They consist of program affiliates—alumni, program staff, community members, and professors who participate in the selection process after the admissions office conducts its initial sort. Prior to randomization years, the applicants who scored highest on selection committee ratings were generally admitted to the program, alongside operational criteria (for example, gender balance or the need to admit students from certain locations to maintain regional representation). During randomization, selection committee ratings, alongside admissions office ratings, as well as regional priority criteria and gender, were used to allocate students to blocks for random assignment.

The number of students admitted to each of the programs varies over time. This reflects different operational constraints each year, as well as an increasing willingness on the part of the program staff to offer a few extra seats in the six-week program to account for the small number of students who declined offers each year. Each year a few applicants received "certainty spots" where admission to a program was guaranteed for program operational reasons. These students are excluded from the impact analysis.

A.1.1 Cohort 1 (2014) randomization details

The research team randomized admission to the summer programs with a block randomization design, with applicants assigned to three blocks and then randomized within blocks. The assignment process proceeded in the following steps during winter and spring of 2014:

1. The HI admissions office selected 674 applicants to move on to the program selection committee.

2. The program leadership separated the remaining applicants into regional groupings with about 30 applicants in each group. Each regional group was reviewed by a selection committee of two or three people, and the applicants were rank ordered within their group.

3. The HI admissions office reread the applications and assessed each applicant for their ability to complete the six-week program. Each applicant was tagged with a numeric variable representing a rating of yes, no, or maybe.

4. The research team combined the selection committee ranking and the HI admissions office vote into a weighted rank that program staff approved of because it supported the regional balance they wished to maintain in their programs.

5. Students were randomized to programs within randomization blocks defined by these rankings, for a total of three blocks. Top-ranked students were randomized between the six-week program and the one-week program. The group with the next highest rankings was randomized between the one-week program and the online program, and the final group was randomized between the online program and a control group. Block cutoffs were chosen to ensure appropriate program size.

    - Because there were fewer female applicants than male applicants and the program office wanted gender balance in its programs, we used gender as a stratum within the block randomization. Thus, there were different rankings cutoffs for male and female applicants.

6. Program staff reserved 19 spots in the six-week programs as "certainty" spots, which program staff chose to use to ensure representation from urban areas. The certainty spots were filled by taking the highest-ranked candidates from priority urban areas.

A.1.2 Cohort 2 (2015) randomization details

A staff member of the institutional research office of the HI randomized admission to the summer programs with a block randomization design, with applicants assigned to two blocks and then randomized within blocks. We highlight a few major differences from the 2014 randomization here, which were applied to the 2015 and 2016 randomization processes. The research team did not directly conduct the randomization; instead, a member of the HI institutional research office did. This was at the request of the Institutional Review Board. Additionally, the process with the admissions office and selection committee was streamlined, so that the admissions office scored applications before they were passed to the selection committees rather than the iterative process used in 2014. The admissions office and the selection committees offered more detailed ranking variables than in 2014. There were fewer certainty spots. Most importantly, the number of randomization blocks was reduced from three to two, making comparisons across blocks more plausible. This was to simplify operations and strengthen the research design. While full randomization would have been ideal, the outreach office was concerned that the most qualified candidates might have received no program and that relatively less qualified candidates might have received more intensive interventions.

The assignment process proceeded in the following steps during spring 2015:

1. The HI admissions office selected 701 applicants to move on to the program selection committee. At this time, they gave a yes/no recommendation for admission to the six-week program, and supplied a personal and academic rating score.

2. The program leadership separated the remaining applicants into regional groupings with about 30 applicants in each group. Each regional group was reviewed by a selection committee of two people, and the applications received several scores, including a yes/maybe/no recommendation for the six-week program, an academic score, a personal score, and a "top 5" indicator (for applicants considered one of the top 5 reviewed by each reviewer). Each selection committee also selected a top 5 jointly.

3. The HI institutional research staff member, in consultation with the research team, combined the selection committee rankings and the HI admissions office rankings into a weighted rank.

The weighted rank also included priorities for students from certain states or territories; this was to ensure representation from across the United States in the program.

4. Students were randomized to programs within randomization blocks defined by these rankings, for a total of two blocks. Top-ranked students were randomized between the six-week program, the one-week program, and the online program. The next group was randomized between the online program and a control group. Block cutoffs were chosen to ensure appropriate program size.

    - Because there were fewer female applicants than male applicants and the program office wanted gender balance in its programs, we used gender as a stratum within the block randomization. Thus, there were different rankings cutoffs for male and female applicants.
    - Program staff imposed a math standardized test score for eligibility for Block 1. An applicant needed to score above one of the following cutoffs to be eligible for Block 1:
        - SAT: 550
        - PSAT: 55
        - ACT: 24
        - PLAN: 24
        - A small number of applicants were shifted from Block 1 to Block 2 due to not meeting the test score criteria. Applicants who were missing scores were allowed to be placed in Block 1.

5. Four students were offered seats in the six-week program in certainty spots.

6. The HI institutional research staff member ran many randomization scenarios: about 50 scenarios that met the program staff geographical preferences and demonstrated covariate balance were offered to the program staff as potential final randomization scenarios. The research team suggested a scenario that demonstrated covariate balance and the program staff agreed to that scenario.

A.1.3 Cohort 3 (2016) randomization details

A staff member of the institutional research office of the HI randomized admission to the summer programs with a block randomization design, with applicants assigned to two blocks and then randomized within blocks. The changes from the 2014 to the 2015 randomization process remained in place, with minor alterations noted below. The assignment process proceeded in the following steps during spring 2016:

1. The HI admissions office selected 749 applicants to move on to the program selection committee. At this time, they gave a yes/no recommendation for admission to the six-week program and supplied a personal and academic rating score.

2. The program leadership separated the remaining applicants into regional groupings with about 30 applicants in each group. Each regional group was reviewed by a selection committee of two people, and the applications received several scores, including a yes/no recommendation for the six-week program, an academic score, a personal score, and a top 5 indicator (for

applicants considered one of the top 5 reviewed by each reviewer). Each selection committee also selected a top 5 jointly.

3. The HI institutional research staff member, in consultation with the research team, combined the selection committee rankings and the HI admissions office rankings into a weighted rank. The weighted rank also included priorities for students from certain states or territories; this was to ensure representation from across the United States in the program.

4. Students were randomized to programs within randomization blocks defined by these rankings, for a total of two blocks. Top ranked students were randomized between the six-week program, the one-week program, and the online program. The next group was randomized between the online program and a control group. Block cutoffs were chosen to ensure appropriate program size.

    - Because there were fewer female applicants than male applicants and the program office wanted gender balance in its programs, we used gender as a stratum within the block randomization. Thus, there were different rankings cutoffs for male and female applicants.
    - Program staff imposed a math standardized test score for eligibility for Block 1. An applicant needed to score above one of the following cutoffs to be eligible for Block 1:
        - SAT: 550
        - Old PSAT: 55
        - New PSAT: 525
        - ACT: 24
        - PLAN: 24
        - ASPIRE: 432
        - All applicants who submitted test scores met the cutoffs. Applicants who were missing scores were allowed to be placed in Block 1.

5. Program staff reserved one spot in Block 1, which program staff chose to use to ensure an applicant who participated in prior programs for middle and high schoolers sponsored by the program office received a spot in one of the programs. This student was randomly assigned to the online program. (Other students also participated in the prior program; however, the rest of them received rating scores high enough that they were all in Block 1 without intervention.) Two other students received a certainty spot in the six-week program and three in the one-week program due to programmatic considerations.

6. The HI institutional research staff member ran many randomization scenarios: about 50 scenarios that met the program staff geographical preferences and demonstrated covariate balance were offered to the program staff as potential final randomization scenarios. The research team suggested a scenario that demonstrated covariate balance and the program staff agreed to that scenario.

A.1.4 Covariate balance

Table A.1 summarizes Tables A.14 through A.16 (shown later in this appendix) and reports the p-values from joint hypothesis tests of equality of coefficients within randomization blocks, for each

randomization block by cohort. The generally high p-values show that randomization produced treatment and control groups that were very similar in terms of demographic characteristics. This is not surprising, of course, because the randomization process included criteria for covariate balance. We do not expect student characteristics to be similar across blocks, as by definition blocks are defined by applicant characteristics.

Table A.1: Covariate Balance: Summary of P-Values for Joint Hypothesis Tests of Strata-Adjusted Mean Differences

	6-Week vs. 1-Week (1)	6-Week vs. Online (2)	1-Week vs. Online (3)	Online vs. Control (4)
2014 Cohort	0.980	-	0.943	0.421
2015 Cohort	0.844	0.934	0.987	0.498
2016 Cohort	0.924	0.218	0.563	0.891

Notes: This table shows p-values for test of joint-significance of strata-adjusted within-block mean comparisons for baseline covariates: race/ethnicity, free and reduced-price lunch status, and standardized math score and GPA. See Online Tables A.14 through A.16 for details and sample sizes.

A.1.5 Take-up

Most students assigned to a program ultimately participated in the program. Program staff generally did not permit students to switch programs, in the few cases this occurred, we consider the switchers "certainty spots" who are dropped from the analysis. Across program years, 87 percent of students assigned to the six-week program ultimately participated; 85 percent of students assigned to the one-week program, and 77 percent of student assigned to the online program participated (Online Appendix Table A.2). No students in the control group were permitted to attend the program.

Table A.2: Program Attendance by Program Assignment

	6-Week (1)	1-Week (2)	Online (3)	Control (4)	All (5)
Attended 6-Week	0.87	0.00	0.00	0.00	0.10
Attended 1-Week	0.01	0.85	0.00	0.00	0.13
Attended online	0.00	0.00	0.77	0.00	0.18
Did not attend a program	0.00	0.00	0.00	1.00	0.51
N	231	308	472	1073	2084

Notes: This table displays program-takeup rates. Columns 1 through 4 show the share of applicants who attended a program, according to the program office, by the program they were assigned to. Column 5 shows takeup across the entire sample.

A.1.6 Validating the Experiment

In Section 5.5, we detail several exercises that we conduct to show that our modified random assignment structure generates valid causal estimates of an offer to each of the STEM summer programs. Below, we also discuss whether heterogeneous treatment effects in the context of modified random assignment present a threat to validity. The figures and tables associated with both these analyses are displayed here.

A.1.6.1 Heterogeneous treatment effects

Having shown in Section 5.5 that the blocking strategy accounts for selection bias, the second major threat to the validity of the evidence here is that program effects are driven by heterogeneous treatment effects. If our findings are driven by, for example, the highest rated students, this might imply that our estimates based on a linear functional form are not a good estimate of program effectiveness, as we do not have similarly rated students in the control group to compare to. Below, we present several ways to consider this possibility.

Our first strategy to determine if differential response by highly-rated students accounts for our findings comes from cross-block comparisons. We take advantage of the fact that the online program is assigned in both the higher-rated Block 1 and the lower-rated Block 2. We then compare each of the two online groups to the control group separately, controlling for the rating variable and removing the block-specific randomization strata and substituting alternative strata that include cohort, gender, and location. If the block-inclusive strata fully capture the differences between the two groups (as we show above)—and there are not heterogeneous treatment effects—we would expect estimates of each online group to be identical to each other, and to the main estimates. Alternatively, if heterogeneous treatment effects are driving our findings, we would expect the estimates for the online group across blocks to differ, for example, if higher-rated applicants benefited more from the program, then the estimates for Block 1 online vs. control should be larger than those for Block 2 vs. control.

Online Appendix Tables A.7 and A.8 show the estimates for outcomes at all institutions and the HI from this strategy. Panel A reproduces the main estimation results for the online group for reference. Panel B compares the online group in Block 1 (the higher-rated group) to the control group in Block 2 (the lower-rated group), controlling for rating variable, and Panel C compares the within Block 2 (the lower-rated group) difference between online and control. Note that the two estimates in Panels B and C will not average out to the exact estimate in Panel A, as we control for a slightly different set of covariates intentionally. For program effects at all and elite colleges (Online Appendix Table A.8), estimates from Panels B and C are broadly similar to each other, though there are some differences. However, those differences, if anything, point *against* highly rated students benefiting more from the program. For example, the online impact in Block 1 indicates a *lower* likelihood of attending an elite institution, whereas the online program effect in Block 2 is a positive 9 percentage points for attending elite institutions. Estimates of treatment effects at the HI from Panels B and C are very similar to each other, and to the main estimate (Online Appendix Table A.8). Panel D in both tables shows the difference between the two estimates—none of which is statistically significant. We take this as evidence that—for the one program where we observe students in both rating variable groups—there is no evidence that our positive impacts are driven by higher-rated students responding to programs to a greater extent.

Online Appendix Tables A.9 and A.10 display two more ways we consider the possibility of

heterogeneous response for highly rated students both at all institutions and the HI. We reweight our estimates by the inverse of the rating variable (adjusted so there are no negative values) in Panel B of these tables. This effectively increases the contribution of lower-ranked students and decreases the contribution of higher-ranked students in comparison to the main estimates (Panel A). If our findings were driven by heterogeneous treatment effects by rating, this re-weighting scheme would de-emphasize those differences, changing our results. However, the estimates in Panel B are quite similar showing little evidence that heterogeneity by rating variable is driving the results. In Panel C, we truncate the control group, removing the relatively lower-rated half of the control group. If treatment effects differ by rating, we would expect this comparison group to yield different findings.[21] The results are of smaller magnitude, but overall, the findings are generally similar to the main results.

In Online Appendix Tables A.11 and A.12, we also consider heterogeneous treatment effects within Block 1 in the 2015 and 2016 cohorts at all institutions and at the HI, respectively.[22] Within Block 1, all students are relatively high rated, and there is no control group. Thus, having shown above that treatment effects are constant for the online program, we use this as a comparison group and split the sample between the highest-rated students and the lower-rated students.

First, for comparison purposes, Panel A shows the treatment estimates limited to the 2015 and 2016 cohorts, and Panel B shows these estimates limited only to Block 1, where the comparison group is the online treatment. Panel C shows a version of the estimates where there are separate treatment indicators for the top-rated students in the six- and one-week programs and the bottom-rated students in the six- and one-week program. The strata are adjusted to include an indicator variable for being a higher-rated student (within this highly rated group). The program variables can then be interpreted as the treatment effect for students of each type.

Impacts are very similar for relatively higher and relatively lower-rated students for the six-week program at the HI (online Appendix Table A.12). The only variable that looks different is the application to the HI variable, likely because the comparison means differ by rating variable. Thus the larger impact for the lower-rated group essentially brings both groups to the same level of application. When it comes to impacts on enrollment and graduation, treatment effects are consistently similar for both groups. However, when looking at graduation outcomes at larger groups of institutions, or STEM degree impacts, treatment effects are larger for the higher-rated group in the six-week program, though only the difference in overall graduation is statistically significant.

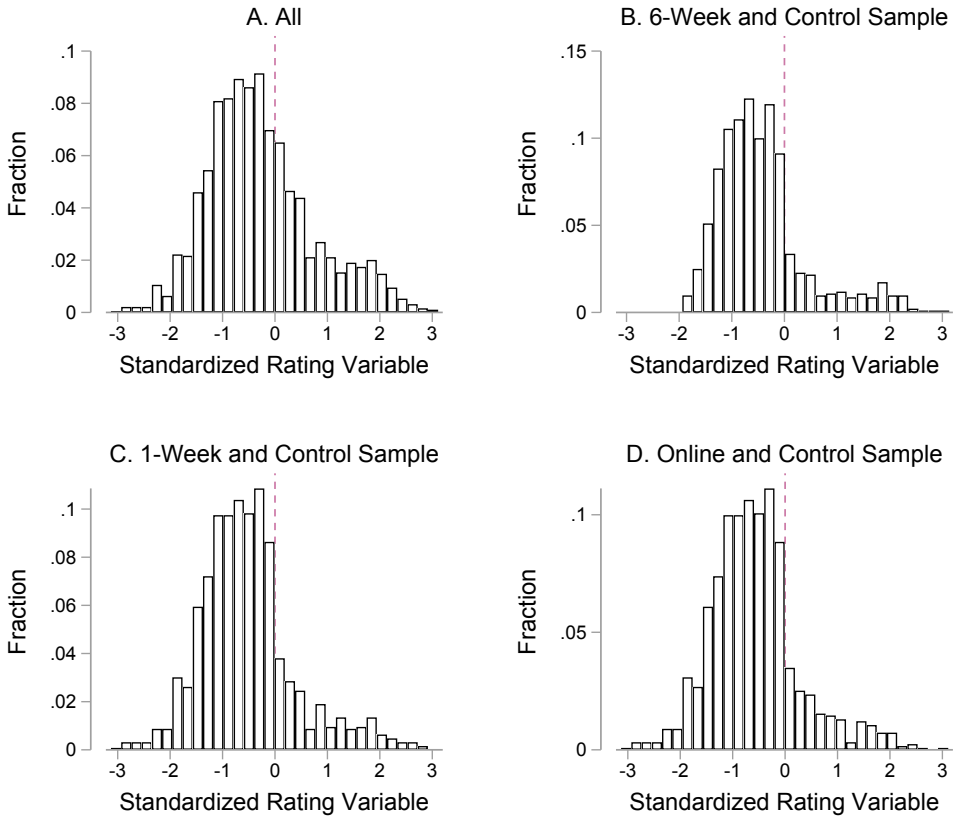
This pattern is reversed for the one-week program. At all institutions, the one-week program has similar impacts for both higher- and lower-rated students, with perhaps larger impacts at elite institutions for lower rated students. But at the HI, relatively higher-rated students admitted to the one-week program are more likely to be accepted at, attend, and graduate from the HI, compared to lower-rated students. The difference is only statistically significant for the attendance

[21] This strategy is reminiscent of a regression discontinuity. Given that we have the rating variable that fully determines whether a student is assigned to Block 1 (and guaranteed offer of a program) and Block 2 (with some probability of a control group), a natural extension would be to re-estimate program effects using a regression discontinuity approach. We do not do so, however, because our program assignment structure necessarily means that the conditional expectation function does not move smoothly across the assignment threshold, violating the assumptions that underlie regression discontinuity estimation. Online Appendix Figure A.1 shows the distribution of the rating variable over the threshold for the cases that would be relevant to regression discontinuity estimation for each program (Panels B through D).

[22] These are these years during which treatment assignment for higher-rated applicants occurs within one large block.

in year one, and, given small sample sizes and relatively smaller treatment effects for the one-week program, few estimates are statistically significant. Overall, we take this group of findings to mean that while there may be heterogeneous treatment effects for some programs for some outcomes, there is no consistent pattern where only higher-rated or only lower-rated students benefit from the program. Thus our exploration of selection bias and heterogeneous treatment effects supports our use of estimates from Equation 1 throughout our analysis.

Figure A.1: Distribution of Rating Scores



Notes: This figure displays the standardized rating score. The score is centered at the break between Blocks 1 and 2, and is standardized within cohort and gender. Panel A includes all students in the sample who meet the test score cutoff. Panels B through D show the relevant samples for a proposed regression discontinuity analysis. Panel B shows the six-week program (to the right of 0) and the control group (to the left of 0), but omits the 2014 cohort (which had a different blocking structure). Panel C shows the one-week program (to the right of 0) and the control group (to the left of 0). Panel D shows the online program (to the right of 0) and the control group (to the left of 0), omitting students assigned to the online program with rating scores below zero.

Table A.3: Alternative Design Controls

	Attended 4-Year in Y1 (1)	Attended Barron's Most Comp. in Y1 (2)	Graduated 4-Year by Y4 (3)	Graduated Barron's Most Comp. by Y4 (4)	STEM Degree by Y4 (5)
(A) Biased Estimate (No Blocks)					
6-Week	0.023	0.194***	0.045	0.132***	0.126***
	(0.024)	(0.034)	(0.036)	(0.036)	(0.036)
1-Week	0.034	0.167***	0.062+	0.118***	0.101***
	(0.021)	(0.033)	(0.033)	(0.033)	(0.033)
Online	0.014	0.097***	0.001	0.043	0.021
	(0.018)	(0.028)	(0.028)	(0.027)	(0.027)
(B) Main Specification					
6-Week	0.038	0.172***	0.082	0.115+	0.144*
	(0.041)	(0.059)	(0.061)	(0.060)	(0.060)
1-Week	0.042	0.136*	0.080	0.099+	0.107+
	(0.037)	(0.056)	(0.057)	(0.056)	(0.056)
Online	0.020	0.095***	0.016	0.046	0.031
	(0.024)	(0.036)	(0.036)	(0.035)	(0.035)
(C)Main Spec + Control for Rating					
6-Week	0.038	0.167***	0.082	0.112+	0.143*
	(0.041)	(0.059)	(0.061)	(0.060)	(0.061)
1-Week	0.042	0.128*	0.080	0.095+	0.105+
	(0.037)	(0.056)	(0.057)	(0.056)	(0.057)
Online	0.020	0.089*	0.017	0.044	0.030
	(0.024)	(0.035)	(0.036)	(0.035)	(0.035)
(D) Control for Rating, No Blocks					
6-Week	0.037	0.074+	0.059	0.077+	0.101*
	(0.030)	(0.043)	(0.045)	(0.045)	(0.045)
1-Week	0.047+	0.052	0.076+	0.065	0.077+
	(0.027)	(0.041)	(0.042)	(0.042)	(0.042)
Online	0.020	0.046	0.007	0.020	0.011
	(0.020)	(0.030)	(0.030)	(0.029)	(0.029)

Notes: The notes for this table are the same as the notes for Table B.1 for Panel B. Panel A removes blocks from the main estimate, reflecting a biased estimate of program effects. Panel C add a control for the rating variable to Panel B. Panel D removes blocks but retains the control for rating variable. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084.

Table A.4: Alternative Design Controls, HI Outcomes

	Applied to HI (1)	Accepted to HI (2)	Attended HI First Year (3)	Attended HI Fourth Year (4)	Graduated HI Within 4 Years (5)
(A) Biased Estimate (No Blocks)					
6-Week	0.450***	0.316***	0.218***	0.217***	0.201***
	(0.031)	(0.032)	(0.031)	(0.031)	(0.029)
1-Week	0.381***	0.207***	0.096***	0.092***	0.091***
	(0.030)	(0.027)	(0.023)	(0.022)	(0.021)
Online	0.334***	0.128***	0.052***	0.054***	0.049***
	(0.026)	(0.020)	(0.017)	(0.017)	(0.016)
(B) Main Specification					
6-Week	0.464***	0.207***	0.169***	0.178***	0.146***
	(0.057)	(0.051)	(0.046)	(0.045)	(0.043)
1-Week	0.398***	0.105*	0.053	0.059	0.040
	(0.054)	(0.046)	(0.039)	(0.039)	(0.036)
Online	0.352***	0.088***	0.038+	0.047*	0.033+
	(0.034)	(0.024)	(0.021)	(0.020)	(0.018)
(C)Main Spec + Control for Rating					
6-Week	0.462***	0.203***	0.167***	0.176***	0.144***
	(0.057)	(0.051)	(0.046)	(0.045)	(0.042)
1-Week	0.395***	0.099*	0.049	0.056	0.037
	(0.054)	(0.045)	(0.039)	(0.038)	(0.036)
Online	0.350***	0.084***	0.035+	0.045*	0.030+
	(0.034)	(0.024)	(0.020)	(0.020)	(0.018)
(D) Control for Rating, No Blocks					
6-Week	0.416***	0.198***	0.142***	0.154***	0.133***
	(0.041)	(0.038)	(0.036)	(0.035)	(0.033)
1-Week	0.348***	0.093***	0.023	0.031	0.025
	(0.039)	(0.033)	(0.028)	(0.028)	(0.026)
Online	0.320***	0.078***	0.019	0.027	0.020
	(0.029)	(0.020)	(0.018)	(0.018)	(0.016)

Notes: The notes for this table are the same as the notes for Table B.1 for Panel B. Panel A removes blocks from the main estimate, reflecting a biased estimate of program effects. Panel C add a control for the rating variable to Panel B. Panel D removes blocks but retains the control for rating variable. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084.

Table A.5: The Impact of Assignment to STEM Summer Programs on Key Outcomes, Alternative Specifications

	Attended 4-Year in Y1 (1)	Attended Barron's Most Comp. in Y1 (2)	Graduated 4-Year by Y4 (3)	Graduated Barron's Most Comp. by Y4 (4)	STEM Degree by Y4 (5)
(A) No baseline controls					
6-Week	0.038	0.177*	0.082	0.114	0.142*
	(0.025)	(0.073)	(0.056)	(0.068)	(0.061)
1-Week	0.042	0.133*	0.080	0.095	0.107
	(0.031)	(0.063)	(0.061)	(0.069)	(0.064)
Online	0.021	0.098*	0.021	0.049	0.037
	(0.015)	(0.037)	(0.031)	(0.039)	(0.031)
Control Mean	0.867	0.494	0.532	0.368	0.350
(B) Excluding 2014					
6-Week	0.031	0.140+	0.070	0.114+	0.131*
	(0.023)	(0.069)	(0.054)	(0.062)	(0.057)
1-Week	0.066+	0.128+	0.052	0.094	0.070
	(0.036)	(0.063)	(0.071)	(0.063)	(0.061)
Online	0.010	0.054	-0.020	0.004	-0.010
	(0.020)	(0.037)	(0.034)	(0.044)	(0.031)
Control Mean	0.872	0.517	0.532	0.367	0.349
(C) Excluding 2015					
6-Week	0.004	0.139	0.062	0.080	0.110
	(0.032)	(0.088)	(0.069)	(0.082)	(0.069)
1-Week	-0.012	0.066	0.059	0.053	0.115
	(0.038)	(0.079)	(0.058)	(0.083)	(0.077)
Online	0.010	0.087+	0.018	0.050	0.053*
	(0.020)	(0.049)	(0.026)	(0.045)	(0.022)
Control Mean	0.878	0.502	0.525	0.364	0.352
(D) Excluding 2016					
6-Week	0.075+	0.233***	0.094+	0.127	0.180*
	(0.037)	(0.081)	(0.050)	(0.084)	(0.075)
1-Week	0.064	0.201***	0.105	0.126	0.122
	(0.040)	(0.069)	(0.071)	(0.087)	(0.078)
Online	0.037+	0.139***	0.046	0.078	0.049
	(0.021)	(0.032)	(0.034)	(0.048)	(0.035)
Control Mean	0.850	0.460	0.542	0.375	0.350

Notes: This table shows alternative specifications to main specification. Panel A (N = 2,084) omits control variables but retains randomization strata. Panels B (N = 1,450), C (N = 1,383), and D (N = 1,335) omit each cohort in turn. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).

Table A.6: The Impact of Assignment to STEM Summer Programs on Key HI Outcomes, Alternative Specifications

	Applied to HI (1)	Accepted to HI (2)	Attended HI First Year (3)	Attended HI Fourth Year (4)	Graduated HI Within 4 Years (5)
(A) No baseline controls					
6-Week	0.457***	0.212***	0.171***	0.179***	0.145***
	(0.053)	(0.048)	(0.045)	(0.047)	(0.038)
1-Week	0.396***	0.103*	0.051	0.057	0.038
	(0.055)	(0.044)	(0.038)	(0.040)	(0.037)
Online	0.354***	0.092***	0.039+	0.048*	0.034
	(0.025)	(0.029)	(0.021)	(0.021)	(0.020)
Control Mean	0.312	0.106	0.080	0.070	0.065
(B) Excluding 2014					
6-Week	0.505***	0.217***	0.167***	0.182***	0.153***
	(0.056)	(0.052)	(0.048)	(0.053)	(0.043)
1-Week	0.461***	0.137*	0.100+	0.100+	0.071
	(0.063)	(0.057)	(0.049)	(0.052)	(0.048)
Online	0.372***	0.099*	0.052+	0.062*	0.039
	(0.029)	(0.039)	(0.027)	(0.029)	(0.028)
Control Mean	0.282	0.094	0.072	0.064	0.054
(C) Excluding 2015					
6-Week	0.438***	0.257***	0.219***	0.231***	0.166***
	(0.060)	(0.038)	(0.051)	(0.057)	(0.036)
1-Week	0.381***	0.123*	0.030	0.054	0.024
	(0.073)	(0.044)	(0.034)	(0.038)	(0.034)
Online	0.331***	0.104***	0.041*	0.053*	0.031*
	(0.018)	(0.023)	(0.017)	(0.019)	(0.011)
Control Mean	0.327	0.095	0.077	0.063	0.060
(D) Excluding 2016					
6-Week	0.435***	0.142*	0.127*	0.123*	0.117*
	(0.066)	(0.052)	(0.048)	(0.044)	(0.049)
1-Week	0.351***	0.047	0.027	0.022	0.021
	(0.059)	(0.050)	(0.048)	(0.049)	(0.048)
Online	0.353***	0.059+	0.019	0.025	0.026
	(0.033)	(0.034)	(0.026)	(0.027)	(0.026)
Control Mean	0.331	0.131	0.093	0.084	0.081

Notes: This table shows alternative specifications to main specification. Panel A (N = 2,084) omits control variables but retains randomization strata. Panels B (N = 1,450), C (N = 1,383), and D (N = 1,335) omit each cohort in turn. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).

Table A.7: Comparison of Key Outcomes Between Online and Control Conditions

	Attended 4-Year in Y1 (1)	Attended Barron's Most Comp. in Y1 (2)	Graduated 4-Year by Y4 (3)	Graduated Barron's Most Comp. by Y4 (4)	STEM Degree by Y4 (5)
(A) Main Specification (N = 2,084)					
Online	0.020	0.095*	0.016	0.046	0.031
	(0.015)	(0.035)	(0.027)	(0.039)	(0.027)
(B) Block 1 Online vs. Block 2 Control (N = 1,327)					
Online	0.051	-0.024	0.029	0.000	-0.008
	(0.032)	(0.051)	(0.053)	(0.063)	(0.059)
(C) Block 2 Online vs. Block 2 Control (N = 1,291)					
Online	0.021	0.091*	0.016	0.044	0.031
	(0.016)	(0.037)	(0.029)	(0.041)	(0.028)
(D) Block 1 Online vs. Block 2 Online (N = 472)					
Block 1 Online	0.062	-0.109	0.105	0.014	0.073
	(0.047)	(0.091)	(0.069)	(0.067)	(0.055)

Notes: Panel A repeats the main specification as a reference. Panels B, C, and D show alternative comparisons for the online program by block to assess the efficacy of the estimation strategy. All regressions in B, C and D control for alternative strata constructed using gender, geographic location, meeting a minimum test score threshold and cohort, as well as a vector of characteristics including program admissions committee rating variable, GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. These alternative strata do not include the block variables to permit comparisons across blocks. The sample includes STEM summer program applicants who applied in 2014, 2015 and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).

Table A.8: Comparison of Key HI Outcomes Between Online and Control Conditions

	Applied to HI (1)	Accepted to HI (2)	Attended HI First Year (3)	Attended HI Fourth Year (4)	Graduated HI Within 4 Years (5)
(A) Main Specification (N = 2,084)					
Online	0.352***	0.088***	0.038+	0.047*	0.033+
	(0.024)	(0.028)	(0.020)	(0.022)	(0.019)
(B) Block 1 Online vs. Block 2 Control (N = 1,327)					
Online	0.235***	0.096***	0.020	0.027	0.031
	(0.065)	(0.025)	(0.023)	(0.027)	(0.018)
(C) Block 2 Online vs. Block 2 Control (N = 1,291)					
Online	0.350***	0.088***	0.037+	0.046*	0.032
	(0.024)	(0.027)	(0.020)	(0.021)	(0.019)
(D) Block 1 Online vs. Block 2 Online (N = 472)					
Block 1 Online	-0.053	-0.035	-0.012	-0.010	-0.000
	(0.077)	(0.060)	(0.050)	(0.057)	(0.050)

Notes: Panel A repeats the main specification as a reference. Panels B, C, and D show alternative comparisons for the online program by block to assess the efficacy of the estimation strategy. All regressions in B, C and D control for alternative strata constructed using gender, geographic location, meeting a minimum test score threshold and cohort, as well as a vector of characteristics including program admissions committee rating variable, GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. These alternative strata do not include the block variables to permit comparisons across blocks. The sample includes STEM summer program applicants who applied in 2014, 2015 and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).

Table A.9: The Impact of Assignment to STEM Summer Programs on Key Outcomes, Alternative Estimates

	Attended 4-Year in Y1 (1)	Attended Barron's Most Comp. in Y1 (2)	Graduated 4-Year by Y4 (3)	Graduated Barron's Most Comp. by Y4 (4)	STEM Degree by Y4 (5)
(A) Main Specification (Unweighted)					
6-Week	0.038	0.172*	0.082+	0.115+	0.144*
	(0.025)	(0.065)	(0.048)	(0.061)	(0.056)
1-Week	0.042	0.136*	0.080	0.099	0.107+
	(0.031)	(0.060)	(0.056)	(0.066)	(0.059)
Online	0.020	0.095*	0.016	0.046	0.031
	(0.015)	(0.035)	(0.027)	(0.039)	(0.027)
Control Mean	0.867	0.494	0.532	0.368	0.350
(B) Inverse Rating Weighted					
6-Week	0.034	0.176***	0.077	0.108+	0.148*
	(0.041)	(0.061)	(0.062)	(0.061)	(0.061)
1-Week	0.040	0.140*	0.077	0.095+	0.109+
	(0.037)	(0.057)	(0.058)	(0.057)	(0.058)
Online	0.021	0.096***	0.020	0.046	0.038
	(0.024)	(0.037)	(0.037)	(0.035)	(0.036)
Control Mean	0.870	0.474	0.528	0.354	0.346
(C) Vs. Highest Rated Controls					
6-Week	0.021	0.125*	0.044	0.084	0.089
	(0.043)	(0.062)	(0.064)	(0.062)	(0.063)
1-Week	0.024	0.092	0.044	0.070	0.053
	(0.040)	(0.058)	(0.060)	(0.058)	(0.059)
Online	0.002	0.050	-0.020	0.017	-0.023
	(0.027)	(0.039)	(0.040)	(0.039)	(0.039)
Control Mean	0.880	0.561	0.581	0.425	0.409

Notes: The notes for this table are the same as the notes for Table B.1 for Panel A. Panel B modifies the main specification to weight the regression with weights inverse to the rating variable used to assign applicants to blocks (N = 2,084). Panel C limits control group members to those in the top half of control group ratings (N = 1,544). Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).

Table A.10: The Impact of Assignment to STEM Summer Programs on Key HI Outcomes, Alternative Estimates

	Applied to HI (1)	Accepted to HI (2)	Attended HI First Year (3)	Attended HI Fourth Year (4)	Graduated HI Within 4 Years (5)
(A) Main Specification (Unweighted)					
6-Week	0.038	0.172*	0.082+	0.115+	0.144*
	(0.025)	(0.065)	(0.048)	(0.061)	(0.056)
1-Week	0.042	0.136*	0.080	0.099	0.107+
	(0.031)	(0.060)	(0.056)	(0.066)	(0.059)
Online	0.020	0.095*	0.016	0.046	0.031
	(0.015)	(0.035)	(0.027)	(0.039)	(0.027)
Control Mean	0.867	0.494	0.532	0.368	0.350
(B) Inverse Rating Weighted					
6-Week	0.473***	0.196***	0.164***	0.172***	0.141***
	(0.058)	(0.050)	(0.045)	(0.044)	(0.041)
1-Week	0.408***	0.095*	0.044	0.051	0.033
	(0.055)	(0.045)	(0.038)	(0.037)	(0.035)
Online	0.355***	0.082***	0.034+	0.043*	0.029+
	(0.034)	(0.023)	(0.019)	(0.019)	(0.017)
Control Mean	0.307	0.088	0.069	0.061	0.055
(C) Vs. Highest Rated Controls					
6-Week	0.448***	0.193***	0.157***	0.168***	0.137***
	(0.059)	(0.052)	(0.047)	(0.047)	(0.044)
1-Week	0.380***	0.092+	0.041	0.050	0.032
	(0.057)	(0.047)	(0.041)	(0.040)	(0.038)
Online	0.333***	0.075***	0.026	0.037	0.024
	(0.038)	(0.027)	(0.023)	(0.023)	(0.020)
Control Mean	0.333	0.151	0.113	0.098	0.092

Notes: The notes for this table are the same as the notes for Table B.1 for Panel A. Panel B modifies the main specification to weight the regression with weights inverse to the rating variable used to assign applicants to blocks (N = 2,084). Panel C limits control group members to those in the top half of control group ratings (N = 1,544). Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).

Table A.11: Heterogeneous Treatment Effects

	Attended 4-Year in Y1 (1)	Attended Barron's Most Comp. in Y1 (2)	Graduated 4-Year by Y4 (3)	Graduated Barron's Most Comp. by Y4 (4)	STEM Degree by Y4 (5)
(A) Cohorts 2015 and 2016					
6-Week	0.031	0.140^{+}	0.070	0.114^{+}	0.131*
	(0.023)	(0.069)	(0.054)	(0.062)	(0.057)
1-Week	0.066^{+}	0.128^{+}	0.052	0.094	0.070
	(0.036)	(0.063)	(0.071)	(0.063)	(0.061)
Online	0.010	0.054	-0.020	0.004	-0.010
	(0.020)	(0.037)	(0.034)	(0.044)	(0.031)
Control Mean	0.872	0.517	0.532	0.367	0.349
(B) Within Block 1					
6-Week	0.018	0.079	0.082	0.102^{+}	0.141*
	(0.015)	(0.058)	(0.045)	(0.046)	(0.051)
1-Week	0.055	0.071	0.069	0.090^{+}	0.080
	(0.032)	(0.052)	(0.066)	(0.047)	(0.052)
Online Mean	0.870	0.604	0.509	0.399	0.340
(C) Within Block 1, by Rating					
6-Week * Higher Rated	0.035	0.062	0.184*	0.176*	0.226***
	(0.048)	(0.053)	(0.067)	(0.066)	(0.077)
6-Week * Lower Rated	-0.000	0.092	-0.006	0.033	0.078
	(0.034)	(0.073)	(0.065)	(0.063)	(0.082)
p (6-Week, Higher = Lower)	0.559	0.761	0.050	0.142	0.186
1-Week * Higher Rated	0.063	-0.001	0.103	0.066	0.110
	(0.064)	(0.077)	(0.108)	(0.092)	(0.075)
1-Week * Lower Rated	0.053^{+}	0.128^{+}	0.037	0.102***	0.042
	(0.028)	(0.073)	(0.057)	(0.013)	(0.060)
p (1-Week, Higher = Lower)	0.884	0.259	0.593	0.711	0.482
Online Mean, Higher Rated	0.838	0.702	0.470	0.432	0.340
Online Mean, Lower Rated	0.895	0.517	0.541	0.373	0.338

Notes: Panel A reports estimates with the same specification as those in Table B.1, limited to the 2015 and 2016 cohorts, which are the cohorts with all three programs in Block 1 (N = 1,450). Panel B limits the sample to Block 1, and applies the same specification, which means that program impacts are estimated in comparison to the online program (N = 504). Panel C splits the program assignment between higher-rated and lower-rated individuals, and modifies the strata to fully interact rating status with the previous strata (N = 504). Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).

Table A.12: Heterogeneous Treatment Effects, HI Outcomes

	Applied to HI (1)	Accepted to HI (2)	Attended HI First Year (3)	Attended HI Fourth Year (4)	Graduated HI Within 4 Years (5)
(A) Cohorts 2015 and 2016					
6-Week	0.505***	0.217***	0.167***	0.182***	0.153***
	(0.056)	(0.052)	(0.048)	(0.053)	(0.043)
1-Week	0.461***	0.137*	0.100+	0.100+	0.071
	(0.063)	(0.057)	(0.049)	(0.052)	(0.048)
Online	0.372***	0.099*	0.052+	0.062*	0.039
	(0.029)	(0.039)	(0.027)	(0.029)	(0.028)
Control Mean	0.282	0.094	0.072	0.064	0.054
(B) Within Block 1					
6-Week	0.144*	0.116***	0.119*	0.124*	0.118***
	(0.050)	(0.031)	(0.040)	(0.044)	(0.033)
1-Week	0.093	0.045	0.052	0.042	0.037
	(0.057)	(0.045)	(0.042)	(0.045)	(0.040)
Online Mean	0.624	0.261	0.154	0.147	0.125
(C) Within Block 1, by Rating					
6-Week * Higher Rated	0.076	0.108+	0.119*	0.125+	0.117***
	(0.052)	(0.054)	(0.056)	(0.063)	(0.041)
6-Week * Lower Rated	0.200*	0.136***	0.118*	0.119*	0.115***
	(0.079)	(0.046)	(0.046)	(0.045)	(0.037)
p (6-Week, Higher = Lower)	0.198	0.700	0.981	0.939	0.971
1-Week * Higher Rated	0.026	0.089	0.122*	0.102	0.083
	(0.048)	(0.059)	(0.054)	(0.062)	(0.059)
1-Week * Lower Rated	0.141	-0.003	-0.033	-0.032	-0.026
	(0.084)	(0.053)	(0.056)	(0.055)	(0.037)
p (1-Week, Higher = Lower)	0.256	0.259	0.058	0.116	0.125
Online Mean, Higher Rated	0.697	0.307	0.166	0.153	0.153
Online Mean, Lower Rated	0.562	0.212	0.147	0.147	0.105

Notes: Panel A reports estimates with the same specification as those in Table B.1, limited to the 2015 and 2016 cohorts, which are the cohorts with all three programs in Block 1 (N = 1,450). Panel B limits the sample to Block 1, and applies the same specification, which means that program impacts are estimated in comparison to the online program (N = 504). Panel C splits the program assignment between higher-rated and lower-rated individuals, and modifies the strata to fully interact rating status with the previous strata (N = 504). Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).

A.2 Data details

Data for this analysis come from four main sources: the program application, the HI institutional research office, the National Student Clearinghouse (NSC), and surveys fielded by the HI institu-

tional research office. We describe each data source in detail below, as well as attrition rates for outcomes.

A.2.1 Applications and baseline survey

Background information on applicants comes from the program application and a baseline survey. For Cohort 1, the baseline survey was a separate data collection; for subsequent cohorts, baseline survey measures were part of the application itself. Information about applicants from these sources includes demographic and academic information. Family background variables include parental education and demographics, and indicators for immediate family who are summer program or HI alumni. Applicants report income information and an indicator for whether they are eligible for the federal free or reduced price lunch program. High school performance measures such as GPA, standardized test scores, extracurricular activities, awards, essays, and letters of recommendation are also provided. All measures are self-reported, though students needed to submit to the program high school transcripts and official records of standardized test scores. Applicants also consented to participate in research surveys at this point; students who declined to participate were not included in follow-up outreach for additional surveys but are included in randomization. The program office also supplied information on who was offered each program and whether applicants accepted that offer.

A.2.2 HI internal records

The HI institutional research office provided information on program applicants' interactions with the HI, including application (early application), admission, enrollment, declared major (if enrolled), and graduation, including degree and graduation date. All applicants were sent to be matched to HI records; if an applicant does not match to HI data systems, we assume a zero value on indicator variables for each of the outcomes described. These data were last updated in June 2021.

A.2.3 NSC

The HI institutional research office sent applicants' personal information from the application (excluding students known to be enrolled in HI) to the NSC for matching. The NSC returns records that include information on enrolled college and dates of enrollment. The NSC also reports graduation and degree fields; we observe four-year graduation for all cohorts, five-year graduation for the first two cohorts (2014 and 2015), and six-year graduation for the first cohort (2014). We match the college information to the federal Integrated Post-secondary Education Data System as well as other sources for information on college characteristics. All applicants were sent to be matched to the NSC or included in the HI records; if an applicant does not match to the HI or any NSC college, we assume a zero value on indicator variables for enrollment. The NSC has almost complete coverage of colleges and universities in the relevant time period, especially the highly ranked institutions that the applicant sample tends to enroll in. These data were last updated in June 2021.

A.2.4 Surveys

The HI surveyed applicants in the fall shortly after program completion (or equivalent for the control group), in May of their senior year in high school, and in the spring of sophomore year in college. Periodic shorter surveys collected information on college enrollment and choice of major. The shorter surveys were not fielded to students attending HI, as HI provided data on attendance and major. Students received $25 Amazon gift cards if they responded to longer-length surveys and $10 gift cards for short surveys, regardless of their treatment status. We discuss the surveys in more detail in Online Appendix C.

A.2.5 Attrition and response rates

Follow-up information on college enrollment exists from either the HI or the NSC for almost all applicants; those without such information we assume did not enroll in college and instead worked or joined the military. Almost all of the high-achieving students in this experiment immediately enrolled in college after on-time college graduation. Table A.13 shows a follow-up rate of 100 percent for college information, because all students' information was sent to the NSC and the HI for matching. However, survey responses were not as universal and declined over time. Unsurprisingly, those offered seats in the programs were more likely to respond to surveys than control group members. We describe the differential attrition in more detail below. Given large levels of differential attrition, we consider results using the survey data suggestive rather than conclusive. However, note that if those who complete surveys tend to be more motivated and have higher follow-through than those who do not complete surveys, if survey measures are biased, they are likely to underestimate program effects.

Table A.13: Survey Response and Data Availability Rates by Program Assignment

	6-Week (1)	1-Week (2)	Online (3)	Control (4)	All (5)
Pre-program survey	0.96	0.95	0.93	0.85	0.89
Senior year HS fall (post-program) survey	0.90	0.88	0.85	0.65	0.76
Senior year HS spring survey	0.81	0.81	0.78	0.57	0.68
First year college survey	0.49	0.55	0.62	0.49	0.53
Second year college spring survey	0.66	0.61	0.67	0.53	0.59
Included in HI/NSC data request	1.00	1.00	1.00	1.00	1.00
N	231	308	472	1073	2084

Notes: This table displays the response rates for follow-up surveys and for whether an applicant was included in the request for National Student Clearinghouse post-secondary data. Columns 1 through 4 show response rates by treatment assignment and column 5 shows response rates across the entire sample.

A.2.6 Covariate balance by cohort

Tables A.14 through A.16 show detailed covariate information and p-values for joint hypothesis tests, separately for each cohort. Because the block structure differs slightly by cohort, not all comparisons are possible in every case.

Table A.14: Covariate Balance: 2014 Cohort

	Covariate Means						Strata-adjusted Mean Differences		
	6-Week (Block 1) (1)	1-Week (Block 1) (2)	1-Week (Block 2) (3)	Online (Block 2) (4)	Online (Block 3) (5)	Control (Block 3) (6)	6-Week vs. 1-Week (7)	1-Week vs. Online (8)	Online vs. Control (9)
Black	0.377	0.355	0.383	0.329	0.324	0.362	0.026	0.042	-0.065
							(0.088)	(0.087)	(0.058)
Hispanic	0.410	0.419	0.383	0.457	0.510	0.477	-0.004	-0.055	0.050
							(0.091)	(0.087)	(0.062)
Native American	0.066	0.065	0.033	0.014	0.059	0.039	-0.002	0.019	0.024
							(0.044)	(0.028)	(0.031)
Asian	0.131	0.113	0.183	0.157	0.098	0.097	0.015	0.007	0.015
							(0.059)	(0.064)	(0.037)
White	0.016	0.048	0.017	0.043	0.010	0.025	-0.035	-0.013	-0.024
							(0.033)	(0.027)	(0.021)
Multiethnic	0.426	0.371	0.283	0.357	0.480	0.427	0.050	-0.071	0.079
							(0.090)	(0.084)	(0.062)
GPA	3.921	3.915	3.905	3.849	3.880	3.811	0.003	0.053	0.053*
							(0.027)	(0.062)	(0.023)
Free/reduced-price lunch	0.492	0.484	0.367	0.329	0.314	0.301	0.003	0.037	-0.004
							(0.091)	(0.086)	(0.058)
Standardized math score	2.200	2.326	2.044	2.167	1.934	1.870	-0.113	-0.098	0.195*
							(0.157)	(0.137)	(0.096)
Female	0.508	0.484	0.517	0.486	0.520	0.154	0.000	0.000	0.000
							(0.000)	(0.000)	(0.000)
First-generation college	0.213	0.258	0.250	0.200	0.147	0.136	-0.046	0.036	0.023
							(0.077)	(0.076)	(0.045)
						p-value	0.980	0.943	0.421
Observations	61	62	60	70	102	279	123	130	381

Notes: This table shows means for baseline characteristics and outcomes. Columns 1 through 6 shows the proportion of students assigned to each program with a given characteristic. Columns 7 through 9 report coefficients from regressions of the student characteristics on assignment to each program, including controls for randomization strata (+ p<0.10). N=634.

Table A.15: Covariate Balance: 2015 Cohort

	Covariate Means					Strata-adjusted Mean Differences			
	6-Week (Block 1) (1)	1-Week (Block 1) (2)	Online (Block 1) (3)	Online (Block 2) (4)	Control (Block 2) (5)	6-Week vs. 1-Week (6)	6-Week vs. Online (7)	1-Week vs. Online (8)	Online vs. Control (9)
Black	0.425	0.364	0.419	0.408	0.335	0.067	0.053	-0.027	0.076
						(0.073)	(0.081)	(0.070)	(0.058)
Hispanic	0.388	0.391	0.365	0.368	0.418	-0.026	-0.004	-0.006	-0.055
						(0.068)	(0.077)	(0.064)	(0.058)
Native American	0.075	0.055	0.054	0.039	0.042	0.024	0.015	-0.002	-0.008
						(0.038)	(0.046)	(0.033)	(0.023)
Asian	0.087	0.145	0.122	0.132	0.163	-0.046	-0.049	0.024	-0.022
						(0.048)	(0.053)	(0.051)	(0.044)
White	0.025	0.045	0.041	0.053	0.042	-0.018	-0.015	0.010	0.010
						(0.027)	(0.030)	(0.029)	(0.028)
Multiethnic	0.300	0.318	0.284	0.250	0.274	-0.039	-0.009	0.015	-0.039
						(0.069)	(0.077)	(0.067)	(0.052)
GPA	3.896	3.862	3.912	3.851	3.807	0.033	-0.025	-0.050	0.030
						(0.042)	(0.024)	(0.040)	(0.027)
Free/reduced-price lunch	0.487	0.455	0.419	0.303	0.391	0.045	0.069	0.025	-0.076
						(0.077)	(0.084)	(0.074)	(0.058)
Standardized math score	2.215	2.304	2.251	1.799	1.939	-0.123	-0.071	0.055	-0.131
						(0.104)	(0.131)	(0.127)	(0.103)
Female	0.500	0.500	0.500	0.500	0.343	0.000	0.000	0.000	0.000
						(0.000)	(0.000)	(0.000)	(0.000)
First-generation college	0.188	0.209	0.162	0.118	0.205	-0.002	0.035	0.050	-0.078+
						(0.062)	(0.065)	(0.058)	(0.044)
					p-value	0.844	0.934	0.987	0.498
Observations	80	110	74	76	361	190	154	184	437

Notes: This table shows means for baseline characteristics and outcomes. Columns 1 through 5 shows the proportion of students assigned to each program with a given characteristic. Columns 6 through 9 report coefficients from regressions of the student characteristic on assignment to each program, including controls for randomization strata (+ $p<0.10$). N=701.

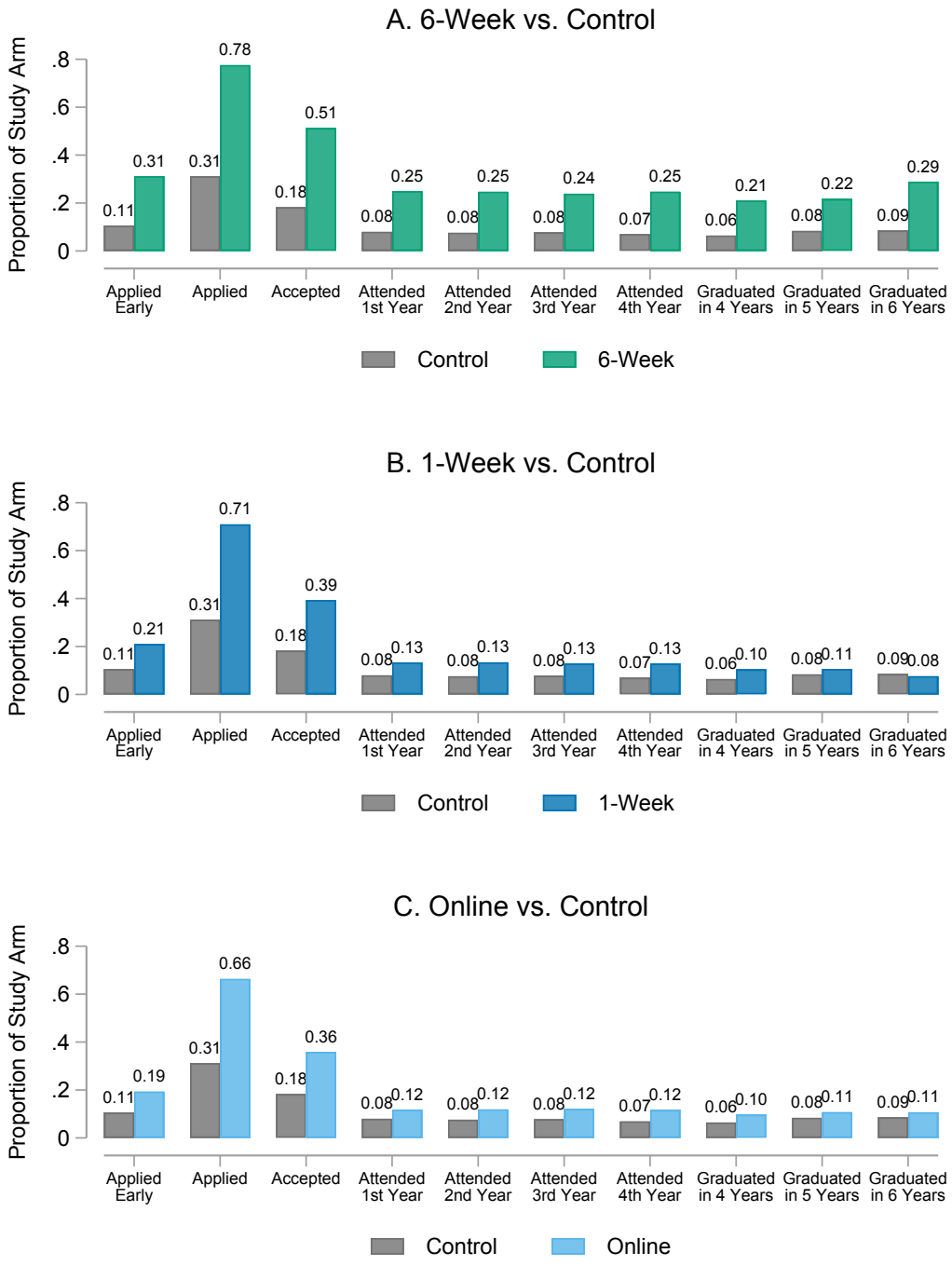
Table A.16: Covariate Balance: 2016 Cohort

	Covariate Means					Strata-adjusted Mean Differences			
	6-Week (Block 1) (1)	1-Week (Block 1) (2)	Online (Block 1) (3)	Online (Block 2) (4)	Control (Block 2) (5)	6-Week vs. 1-Week (6)	6-Week vs. Online (7)	1-Week vs. Online (8)	Online vs. Control (9)
Black	0.400	0.303	0.297	0.289	0.328	0.099	0.108	-0.000	-0.042
						(0.073)	(0.073)	(0.074)	(0.056)
Hispanic	0.422	0.461	0.432	0.434	0.434	-0.046	-0.001	0.056	-0.005
						(0.073)	(0.076)	(0.078)	(0.062)
Native American	0.033	0.053	0.041	0.039	0.042	-0.018	-0.013	0.005	0.001
						(0.031)	(0.029)	(0.033)	(0.024)
Asian	0.089	0.118	0.162	0.184	0.150	-0.030	-0.069	-0.044	0.033
						(0.049)	(0.052)	(0.057)	(0.048)
White	0.056	0.066	0.068	0.039	0.042	-0.005	-0.025	-0.017	0.005
						(0.036)	(0.039)	(0.042)	(0.024)
Multiethnic	0.411	0.395	0.297	0.408	0.390	0.010	0.115	0.115	0.011
						(0.077)	(0.074)	(0.078)	(0.062)
GPA	3.918	3.924	3.918	3.876	3.861	-0.005	0.001	0.009	0.013
						(0.019)	(0.020)	(0.021)	(0.018)
Free/reduced-price lunch	0.478	0.500	0.554	0.342	0.372	-0.040	-0.061	-0.039	-0.029
						(0.075)	(0.076)	(0.079)	(0.059)
Standardized math score	2.016	1.808	2.045	1.467	1.694	0.217	-0.024	-0.221	-0.190
						(0.173)	(0.128)	(0.161)	(0.218)
Female	0.500	0.500	0.500	0.500	0.388	0.000	0.000	0.000	0.000
						(0.000)	(0.000)	(0.000)	(0.000)
First-generation college	0.467	0.513	0.419	0.329	0.284	-0.048	0.057	0.103	0.038
						(0.078)	(0.075)	(0.080)	(0.059)
					p-value	0.924	0.218	0.563	0.891
Observations	90	76	74	76	432	166	164	150	508

Notes: This table shows means for baseline characteristics and outcomes. Columns 1 through 5 shows the proportion of students assigned to each program with a given characteristic. Columns 6 through 9 report coefficients from regressions of the student characteristic on assignment to each program, including controls for randomization strata (+ $p<0.10$). N=748.

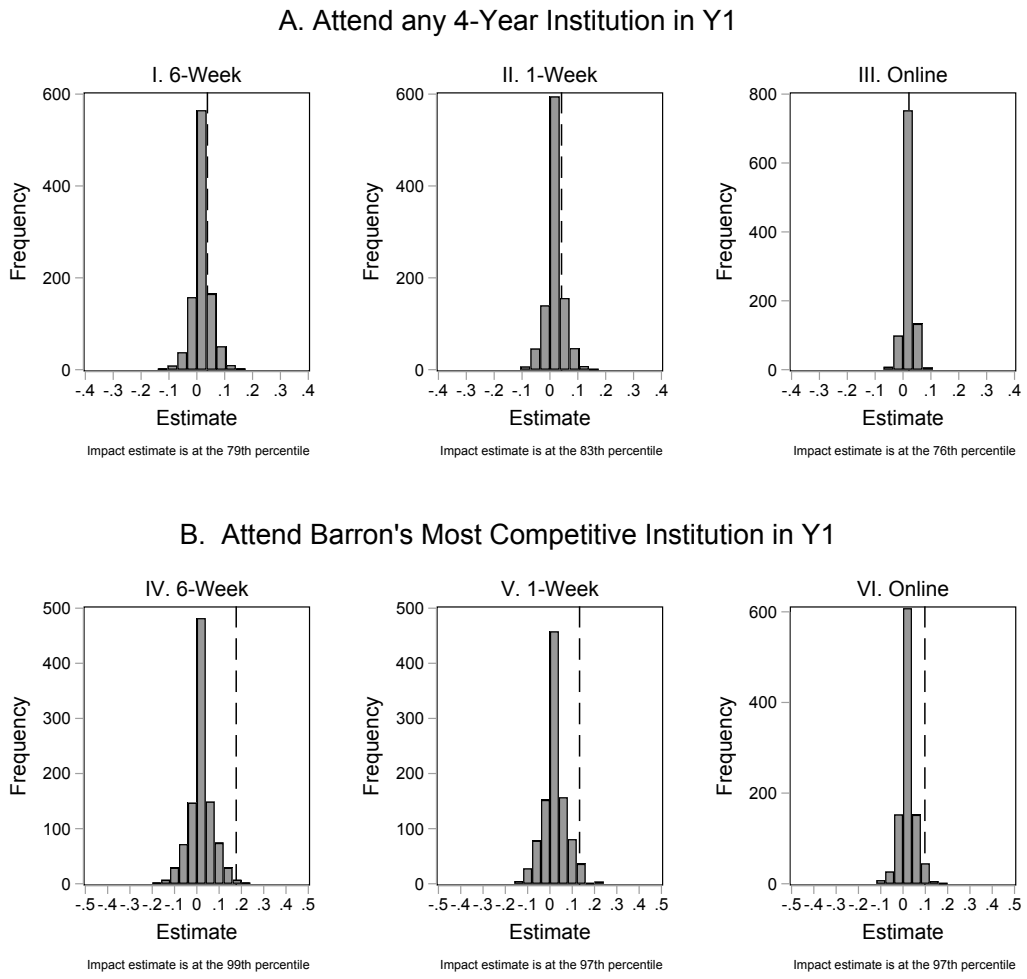
Appendix B: Additional results and robustness checks

Figure B.1: The Impact of STEM Summer Assignment on Key HI Outcomes



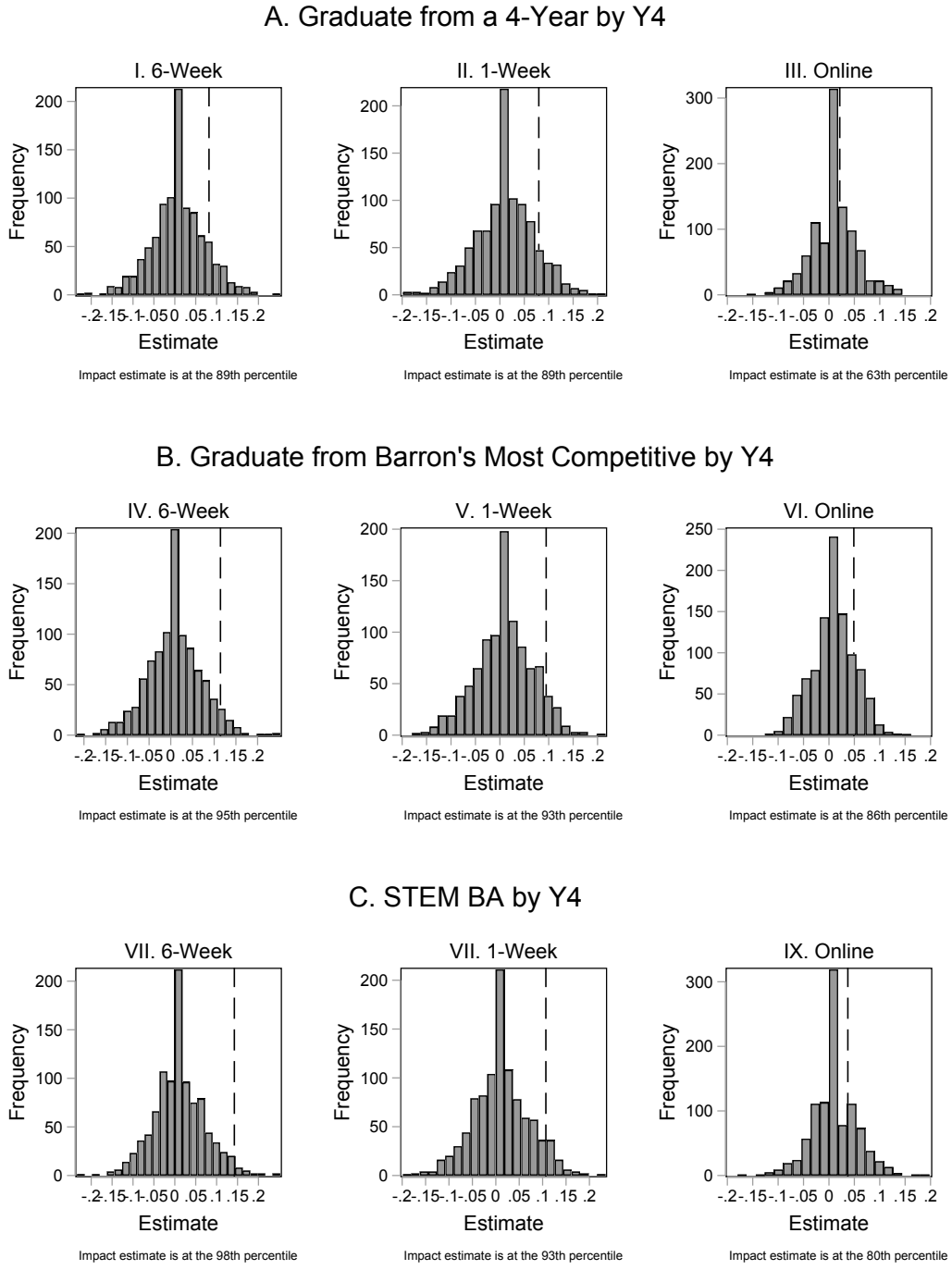
Notes: This figure summarizes impact estimates for HI outcomes. For details on the specification and exact point estimates and standard errors, see Table B.1.

Figure B.2: Randomization Inference: 4-Year Institution Attendance



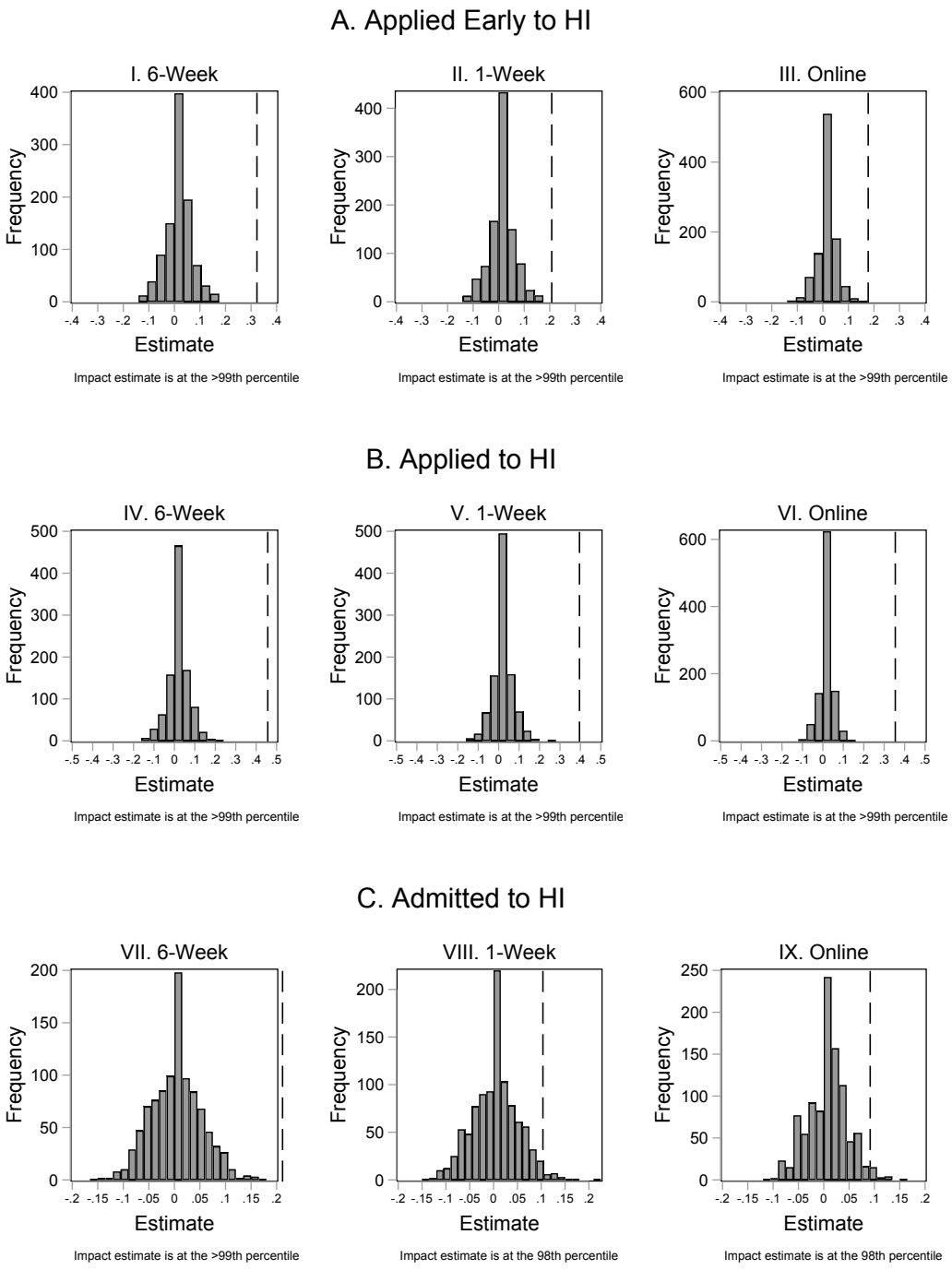
Notes: Each panel in the above figure shows the distribution of treatment impacts from 1,000 randomizations subject to the same criteria as the main randomization design but with a new random number. This generates placebo estimates of impacts on outcomes, to which the actual outcome, indicated by a dashed line, is compared.

Figure B.3: Randomization Inference: Graduation



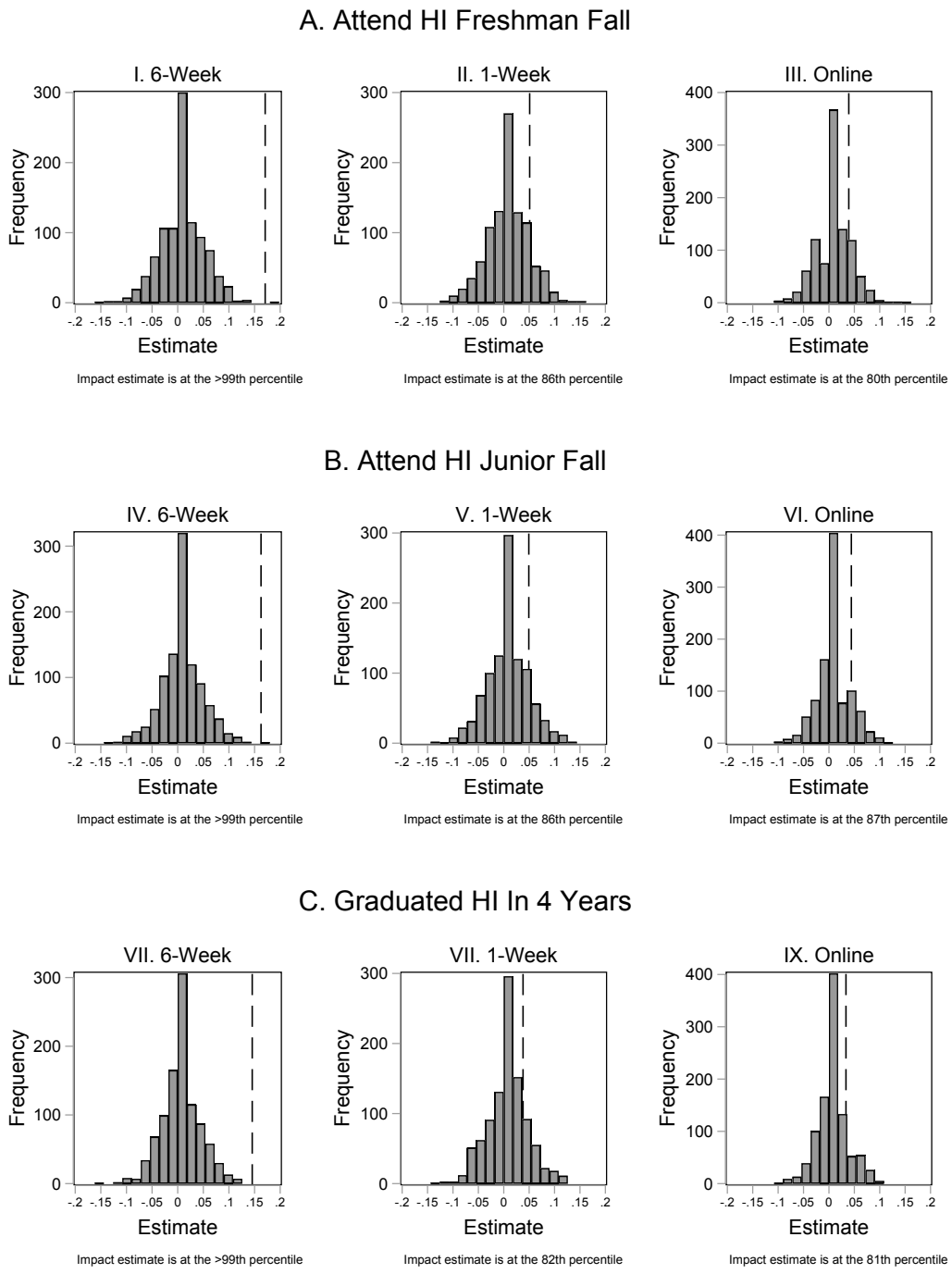
Notes: Each panel in the above figure shows the distribution of treatment impacts from 1,000 randomizations subject to the same criteria as the main randomization design but with a new random number. This generates placebo estimates of impacts on outcomes, to which the actual outcome, indicated by a dashed line, is compared.

Figure B.4: Randomization Inference: HI Application and Admission



Notes: Each panel in the above figure shows the distribution of treatment impacts from 1,000 randomizations subject to the same criteria as the main randomization design but with a new random number. This generates placebo estimates of impacts on outcomes, to which the actual outcome, indicated by a dashed line, is compared.

Figure B.5: Randomization Inference: HI Attendance and Graduation



Notes: Each panel in the above figure shows the distribution of treatment impacts from 1,000 randomizations subject to the same criteria as the main randomization design but with a new random number. This generates placebo estimates of impacts on outcomes, to which the actual outcome, indicated by a dashed line, is compared. Attendance at the HI in the second and fourth years is omitted for space.

Table B.1: The Impact of Assignment to STEM Summer Programs on Key HI Outcomes

	Applied Early to HI (1)	Applied to HI (2)	Accepted to HI (3)	Attended HI First Year (4)	Attended HI Second Year (5)	Attended HI Third Year (6)	Attended HI Fourth Year (7)	Graduated HI Within 4 Years (8)
6-Week	0.330***	0.464***	0.207***	0.169***	0.171***	0.161***	0.178***	0.146***
	(0.058)	(0.050)	(0.041)	(0.041)	(0.038)	(0.038)	(0.044)	(0.035)
1-Week	0.211***	0.398***	0.105*	0.053	0.058	0.051	0.059	0.040
	(0.054)	(0.055)	(0.042)	(0.038)	(0.038)	(0.038)	(0.039)	(0.036)
Online	0.176***	0.352***	0.088***	0.038+	0.043+	0.043+	0.047*	0.033+
	(0.034)	(0.024)	(0.028)	(0.020)	(0.022)	(0.022)	(0.022)	(0.019)
Control Mean	0.183	0.312	0.106	0.080	0.076	0.078	0.070	0.065

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084.

Table B.2: The Impact of Assignment to STEM Summer Programs on HI Graduation

	4-Year Graduation (1)	5-Year Graduation (2)	6-Year Graduation (3)
(A) All cohorts			
6-Week	0.146***	0.133*	0.204***
	(0.035)	(0.051)	(0.060)
1-Week	0.040	0.022	-0.009
	(0.036)	(0.049)	(0.053)
Online	0.033+	0.024	0.022*
	(0.019)	(0.027)	(0.007)
Control Mean	0.065	0.084	0.086
N	2,084	1,335	634
(B) Cohorts 2014 and 2015			
6-Week	0.117*	0.133*	0.204***
	(0.049)	(0.051)	(0.060)
1-Week	0.021	0.022	-0.009
	(0.048)	(0.049)	(0.053)
Online	0.026	0.024	0.022*
	(0.026)	(0.027)	(0.007)
Control Mean	0.081	0.084	0.086
N	1,335	1,335	634
(C) Cohort 2014			
6-Week	0.137*	0.190***	0.204***
	(0.056)	(0.060)	(0.060)
1-Week	-0.018	-0.022	-0.009
	(0.054)	(0.053)	(0.053)
Online	0.013*	0.009+	0.022*
	(0.005)	(0.005)	(0.007)
Control Mean	0.089	0.091	0.086
N	634	634	634

Notes: The notes for this table are the same as in Table B.1 except the outcomes are limited to college graduation from the HI in the fourth, fifth, and sixth year. Because some graduation outcomes are limited in availability by time, Panel A shows the results for all outcomes regardless of cohort with the sample changing by outcome, and Panels B and C restrict this sample to older cohorts. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001.)

Table B.3: The Impact of STEM Summer Program Attendance on Key Outcomes (2SLS)

	Attended 4-Year in Y1 (1)	Attended Barron's Most Comp. in Y1 (2)	Graduated 4-Year by Y4 (3)	Graduated Barron's Most Comp. by Y4 (4)	STEM Degree by Y4 (5)	(6)
6-Week	0.863***	0.042	0.192***	0.092	0.128^{+}	0.162*
		(0.046)	(0.066)	(0.068)	(0.067)	(0.068)
1-Week	0.856***	0.048	0.157*	0.094	0.115^{+}	0.125^{+}
		(0.043)	(0.065)	(0.066)	(0.065)	(0.065)
Online	0.785***	0.025	0.122***	0.021	0.059	0.040
		(0.031)	(0.045)	(0.046)	(0.044)	(0.044)
Control Mean		0.872	0.473	0.525	0.342	0.350

Notes: Each coefficient in columns 2 through 9 is the instrumental variables estimate of the effect of attending the indicated summer program. An indicator variable for assignment to a particular program is the instrument for program attendance. Column 1 presents first stage estimates of the impact of assignment to a program on attendance. All regressions control for randomization strata, as well as a vector of characteristics including GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015 and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084.

Table B.4: The Impact of STEM Summer Program Attendance on Key HI Outcomes (2SLS)

	First Stage (1)	Applied Early to HI (2)	Applied to HI (3)	Accepted to HI (4)	Attended HI First Year (5)	Attended HI Second Year (6)	Attended HI Third Year (7)	Attended HI Fourth Year (8)	Graduated HI Within 4 Years (9)
6-Week	0.863***	0.369***	0.512***	0.233***	0.193***	0.195***	0.184***	0.203***	0.167***
		(0.065)	(0.060)	(0.058)	(0.052)	(0.051)	(0.052)	(0.051)	(0.048)
1-Week	0.856***	0.243***	0.456***	0.121*	0.062	0.068	0.060	0.070	0.047
		(0.062)	(0.058)	(0.053)	(0.045)	(0.045)	(0.045)	(0.045)	(0.042)
Online	0.785***	0.226***	0.451***	0.113***	0.049+	0.055*	0.055*	0.060*	0.042+
		(0.041)	(0.040)	(0.031)	(0.026)	(0.026)	(0.026)	(0.026)	(0.023)
Control Mean		0.184	0.317	0.061	0.057	0.056	0.056	0.051	0.040

Notes: Each coefficient in columns 2 through 9 is the instrumental variables estimate of the effect of attending the indicated summer program. An indicator variable for assignment to a particular program is the instrument for program attendance. Column 1 presents first stage estimates of the impact of assignment to a program on attendance. All regressions control for randomization strata, as well as a vector of characteristics including GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015 and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084.

Table B.5: The Impact of Assignment to STEM Summer Programs on 4-Year College Graduation by College Type

	Any 4-Year Institution (1)	Technical Institutions (2)	Barron's Most Competitive (3)	Barron's Highly Competitive (4)	Barron's Very Competitive (5)	Barron's Competitive (6)
(A) All Institutions						
6-Week	0.082^{+}	0.104*	0.115^{+}	-0.013	-0.018	0.007
	(0.048)	(0.041)	(0.061)	(0.039)	(0.022)	(0.019)
1-Week	0.080	-0.006	0.099	-0.027	-0.023	0.020
	(0.056)	(0.047)	(0.066)	(0.033)	(0.020)	(0.019)
Online	0.016	0.021	0.046	-0.010	-0.006	-0.003
	(0.027)	(0.020)	(0.039)	(0.021)	(0.010)	(0.015)
Control Mean	0.532	0.130	0.368	0.099	0.032	0.022
(B) Host Institution						
6-Week	0.146***	0.146***	0.146***			
	(0.035)	(0.035)	(0.035)			
1-Week	0.040	0.040	0.040			
	(0.036)	(0.036)	(0.036)			
Online	0.033^{+}	0.033^{+}	0.033^{+}			
	(0.019)	(0.019)	(0.019)			
Control Mean	0.065	0.065	0.065			
(C) Institutions Except HI						
6-Week	-0.064	-0.042*	-0.031			
	(0.054)	(0.019)	(0.069)			
1-Week	0.040	-0.046*	0.059			
	(0.050)	(0.020)	(0.064)			
Online	-0.016	-0.011	0.014			
	(0.038)	(0.011)	(0.048)			
Control Mean	0.468	0.065	0.303			

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084.

Table B.6: The Impact of Assignment to STEM Summer Programs on STEM and non-STEM Degrees, Counting Missing as Non-STEM

	Degree Within 4 Years			Degree Within 5 Years		
	Any	STEM	Non-STEM	Any	STEM	Non-STEM
	(1)	(2)	(3)	(4)	(5)	(6)
(A) Any 4-Year Institution						
6-Week	0.082^{+}	0.127*	-0.045	0.122^{+}	0.202*	-0.080
	(0.048)	(0.057)	(0.037)	(0.061)	(0.075)	(0.067)
1-Week	0.080	0.092	-0.012	0.163*	0.145^{+}	0.018
	(0.056)	(0.059)	(0.033)	(0.072)	(0.083)	(0.070)
Online	0.016	0.034	-0.018	0.082^{+}	0.045	0.037
	(0.027)	(0.026)	(0.016)	(0.047)	(0.045)	(0.030)
Control Mean	0.532	0.368	0.164	0.654	0.452	0.202
(B) Host Institution						
6-Week	0.146***	0.145***	0.001	0.133*	0.141***	-0.009
	(0.035)	(0.029)	(0.019)	(0.051)	(0.043)	(0.024)
1-Week	0.040	0.056	-0.016	0.022	0.056	-0.034^{+}
	(0.036)	(0.035)	(0.014)	(0.049)	(0.049)	(0.017)
Online	0.033^{+}	0.033^{+}	-0.000	0.024	0.031	-0.007^{+}
	(0.019)	(0.018)	(0.006)	(0.027)	(0.026)	(0.004)
Control Mean	0.065	0.051	0.014	0.084	0.064	0.020
(C) Other Institutions						
6-Week	-0.064	-0.018	-0.046	-0.010	0.061	-0.071
	(0.054)	(0.055)	(0.035)	(0.064)	(0.071)	(0.057)
1-Week	0.040	0.036	0.004	0.141*	0.088	0.052
	(0.050)	(0.045)	(0.029)	(0.059)	(0.056)	(0.062)
Online	-0.016	0.001	-0.018	0.058	0.015	0.043
	(0.038)	(0.029)	(0.017)	(0.048)	(0.041)	(0.029)
Control Mean	0.468	0.317	0.151	0.570	0.388	0.182

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084 for outcomes during the fourth year and prior and N = 1,335 for fifth year graduation.

Table B.7: The Impact of Assignment to STEM Summer Programs on STEM and non-STEM Degrees, Counting Missing as STEM

	Degree Within 4 Years			Degree Within 5 Years		
	Any	STEM	Non-STEM	Any	STEM	Non-STEM
	(1)	(2)	(3)	(4)	(5)	(6)
(A) Any 4-Year Institution						
6-Week	0.082^{+}	0.108^{+}	-0.026	0.122^{+}	0.211***	-0.089
	(0.048)	(0.055)	(0.034)	(0.061)	(0.057)	(0.056)
1-Week	0.080	0.085	-0.005	0.163*	0.174*	-0.011
	(0.056)	(0.059)	(0.027)	(0.072)	(0.068)	(0.050)
Online	0.016	0.017	-0.001	0.082^{+}	0.068^{+}	0.014
	(0.027)	(0.026)	(0.018)	(0.047)	(0.035)	(0.028)
Control Mean	0.532	0.423	0.109	0.654	0.506	0.149
(B) Host Institution						
6-Week	0.146***	0.145***	0.001	0.133*	0.141***	-0.009
	(0.035)	(0.029)	(0.019)	(0.051)	(0.043)	(0.024)
1-Week	0.040	0.056	-0.016	0.022	0.056	-0.034^{+}
	(0.036)	(0.035)	(0.014)	(0.049)	(0.049)	(0.017)
Online	0.033^{+}	0.033^{+}	-0.000	0.024	0.031	-0.007^{+}
	(0.019)	(0.018)	(0.006)	(0.027)	(0.026)	(0.004)
Control Mean	0.065	0.051	0.014	0.084	0.064	0.020
(C) Other Institutions						
6-Week	-0.064	-0.037	-0.027	-0.010	0.070	-0.080
	(0.054)	(0.055)	(0.031)	(0.064)	(0.051)	(0.050)
1-Week	0.040	0.029	0.011	0.141*	0.118*	0.023
	(0.050)	(0.050)	(0.025)	(0.059)	(0.042)	(0.046)
Online	-0.016	-0.015	-0.001	0.058	0.037	0.021
	(0.038)	(0.035)	(0.017)	(0.048)	(0.032)	(0.028)
Control Mean	0.468	0.372	0.095	0.570	0.442	0.129

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084 for outcomes during the fourth year and prior and N = 1,335 for fifth year graduation.

Table B.8: The Impact of Assignment to STEM Summer Programs on Detailed STEM Majors

	Computer Science (1)	Engineering (2)	Engineering Tech (3)	Bio and Biomed Sci (4)	Math and Stats (5)	Phys Sci (6)	No STEM Major (7)	Missing Major Code (8)
(A) By Year 4								
6-Week	-0.007	0.121*	-0.009	0.035	0.013	0.009	-0.026	-0.036
	(0.036)	(0.045)	(0.007)	(0.033)	(0.022)	(0.022)	(0.034)	(0.026)
1-Week	-0.032	0.098*	-0.002	0.034	0.021	0.006	-0.005	-0.021
	(0.026)	(0.046)	(0.009)	(0.021)	(0.016)	(0.018)	(0.027)	(0.030)
Online	-0.018	0.053*	0.000	-0.004	-0.005	-0.003	-0.001	-0.014
	(0.014)	(0.022)	(0.005)	(0.015)	(0.008)	(0.006)	(0.018)	(0.021)
Control Mean	0.104	0.145	0.006	0.046	0.026	0.033	0.109	0.073
(B) By Year 5								
6-Week	0.011	0.109*	-0.009	0.036	0.005	0.014	-0.049	0.014
	(0.040)	(0.051)	(0.007)	(0.035)	(0.023)	(0.022)	(0.036)	(0.030)
1-Week	-0.022	0.093+	-0.002	0.036	0.019	0.007	-0.001	0.027
	(0.028)	(0.053)	(0.009)	(0.025)	(0.017)	(0.018)	(0.033)	(0.035)
Online	-0.015	0.046	0.000	-0.009	-0.007	-0.005	0.010	0.022
	(0.015)	(0.028)	(0.005)	(0.018)	(0.009)	(0.007)	(0.019)	(0.027)
Control Mean	0.110	0.187	0.006	0.050	0.030	0.034	0.094	0.042

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084 for outcomes during the fourth year and prior, N = 1,335 for fifth year graduation, and N = 634 for sixth year graduation. Students who attained degrees, had at least one major code, and had no STEM major codes were categorized as non-STEM. Students who attained degrees, but had no major codes, were categorized as missing major. Coefficients may not add up to the coefficients on degree attainment, since students can have multiple major.

Table B.9: The Impact of Assignment to STEM Summer Programs on Potential Earnings (Natural Log)

	Potential Earnings Based on Degree Within 4 Years				Potential Earnings Based on Degree Within 5 Years			
	Only Degree Holders	Non-Degrees Imputed With: 5th Percentile	Median	95th Percentile	Only Degree Holders	Non-Degrees Imputed With: 5th Percentile	Median	95th Percentile
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
6-Week	0.038^{+}	0.082*	0.046*	0.015	0.057*	0.088^{+}	0.056*	0.028^{+}
	(0.022)	(0.031)	(0.017)	(0.010)	(0.026)	(0.043)	(0.024)	(0.015)
1-Week	0.038^{+}	0.073*	0.042*	0.015	0.051^{+}	0.093^{+}	0.055*	0.023
	(0.021)	(0.033)	(0.018)	(0.010)	(0.025)	(0.047)	(0.026)	(0.015)
Online	0.014	0.020	0.012	0.005	0.019***	0.032	0.018	0.007*
	(0.009)	(0.016)	(0.007)	(0.005)	(0.006)	(0.029)	(0.013)	(0.003)
Control Mean	11.625	11.376	11.521	11.647	11.617	11.432	11.543	11.639

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). N = 2,084 for outcomes during the fourth year and prior and N = 1,335 for fifth year graduation. Columns labeled Only Degree Holders are limited to degree holders with a major listed (N = 1,024 for 4 year, = 841 for 5 year). The other columns impute potential earnings with the 5th, 50th, and 95th percentile of earnings in the distribution of earnings at the major level. Potential earnings measures come from Sloan et al. (2021) and are reported in natural log units.

Table B.10: The Impact of Assignment to STEM Summer Programs on Key Outcomes by Gender

	Attended Any 4-Year in Y1 (1)	Attended HI in Y1 (2)	Attended Barron's Most Competitive in Y1 (3)	Graduated from 4-Year by Y4 (4)	Graduated from HI by Y4 (5)	Graduated from Barron's Most Competitive by Y4 (6)	STEM Degree by Y4 (7)
(A) Full Sample							
6-Week	0.038	0.169***	0.172*	0.082+	0.146***	0.115+	0.144*
	(0.025)	(0.041)	(0.065)	(0.048)	(0.035)	(0.061)	(0.056)
1-Week	0.042	0.053	0.136*	0.080	0.040	0.099	0.107+
	(0.031)	(0.038)	(0.060)	(0.056)	(0.036)	(0.066)	(0.059)
Online	0.020	0.038+	0.095*	0.016	0.033+	0.046	0.031
	(0.015)	(0.020)	(0.035)	(0.027)	(0.019)	(0.039)	(0.027)
Control Mean	0.867	0.080	0.494	0.532	0.065	0.368	0.350
(B) Male							
6-Week	0.034	0.191*	0.185+	0.081	0.155*	0.114	0.125+
	(0.033)	(0.065)	(0.092)	(0.072)	(0.057)	(0.076)	(0.068)
1-Week	-0.003	0.020	0.055	0.067	0.001	0.027	0.048
	(0.044)	(0.054)	(0.092)	(0.076)	(0.050)	(0.097)	(0.091)
Online	0.013	0.047	0.058	0.002	0.042	-0.011	0.021
	(0.014)	(0.032)	(0.041)	(0.032)	(0.033)	(0.033)	(0.039)
Control Mean	0.876	0.081	0.487	0.499	0.069	0.349	0.365
(C) Female							
6-Week	0.024	0.137*	0.137+	0.065	0.132***	0.113	0.157+
	(0.032)	(0.050)	(0.077)	(0.066)	(0.040)	(0.070)	(0.086)
1-Week	0.074+	0.070	0.197*	0.094	0.070	0.178*	0.172*
	(0.042)	(0.045)	(0.072)	(0.085)	(0.042)	(0.082)	(0.070)
Online	0.024	0.022	0.121*	0.026	0.019*	0.110+	0.046
	(0.029)	(0.021)	(0.051)	(0.048)	(0.009)	(0.061)	(0.039)
Control Mean	0.854	0.084	0.505	0.583	0.063	0.392	0.330

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).N = 2,084 for the full sample, N = 1,242 for the male sample, N = 842 for the female sample

Table B.11: The Impact of Assignment to STEM Summer Programs on Key Outcomes by Underrepresented Race/Ethnicity

	Attended Any 4-Year in Y1 (1)	Attended HI in Y1 (2)	Attended Barron's Most Competitive in Y1 (3)	Graduated from 4-Year by Y4 (4)	Graduated from HI by Y4 (5)	Graduated from Barron's Most Competitive by Y4 (6)	STEM Degree by Y4 (7)
(A) Full Sample							
6-Week	0.038	0.169***	0.172*	0.082+	0.146***	0.115+	0.144*
	(0.025)	(0.041)	(0.065)	(0.048)	(0.035)	(0.061)	(0.056)
1-Week	0.042	0.053	0.136*	0.080	0.040	0.099	0.107+
	(0.031)	(0.038)	(0.060)	(0.056)	(0.036)	(0.066)	(0.059)
Online	0.020	0.038+	0.095*	0.016	0.033+	0.046	0.031
	(0.015)	(0.020)	(0.035)	(0.027)	(0.019)	(0.039)	(0.027)
Control Mean	0.867	0.080	0.494	0.532	0.065	0.368	0.350
(B) Underrepresented Minority							
6-Week	0.051	0.155***	0.161*	0.073	0.135***	0.105	0.095
	(0.031)	(0.044)	(0.067)	(0.062)	(0.039)	(0.072)	(0.060)
1-Week	0.060	0.026	0.143*	0.093	0.007	0.102	0.062
	(0.039)	(0.044)	(0.064)	(0.070)	(0.039)	(0.076)	(0.061)
Online	0.031	0.037+	0.121***	0.017	0.030	0.066	0.035
	(0.019)	(0.021)	(0.039)	(0.045)	(0.021)	(0.044)	(0.035)
Control Mean	0.854	0.091	0.491	0.523	0.073	0.361	0.352
(C) Not Underrepresented Minority							
6-Week	-0.012	0.229*	0.300*	0.142	0.176*	0.206	0.345*
	(0.094)	(0.089)	(0.139)	(0.147)	(0.086)	(0.131)	(0.143)
1-Week	-0.015	0.176+	0.136	0.045	0.192+	0.122	0.257+
	(0.073)	(0.094)	(0.128)	(0.140)	(0.095)	(0.140)	(0.143)
Online	-0.025	0.018	-0.024	-0.028	0.017	-0.078	-0.043
	(0.058)	(0.036)	(0.070)	(0.092)	(0.035)	(0.082)	(0.060)
Control Mean	0.917	0.035	0.501	0.572	0.028	0.400	0.366

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).N = 2,084 for the full sample, N = 1,717 for the underrepresented minority sample, N = 367 for the non-underrepresented minority sample. Underrepresented minority is defined as Black, Native American, or Hispanic. Multiethnic and other race are not included in underrepresented minority.

Table B.12: The Impact of Assignment to STEM Summer Programs on Key Outcomes by Free or Reduced-Price Lunch Status

	Attended Any 4-Year in Y1 (1)	Attended HI in Y1 (2)	Attended Barron's Most Competitive in Y1 (3)	Graduated from 4-Year by Y4 (4)	Graduated from HI by Y4 (5)	Graduated from Barron's Most Competitive by Y4 (6)	STEM Degree by Y4 (7)
(A) Full Sample							
6-Week	0.038	0.169***	0.172*	0.082+	0.146***	0.115+	0.144*
	(0.025)	(0.041)	(0.065)	(0.048)	(0.035)	(0.061)	(0.056)
1-Week	0.042	0.053	0.136*	0.080	0.040	0.099	0.107+
	(0.031)	(0.038)	(0.060)	(0.056)	(0.036)	(0.066)	(0.059)
Online	0.020	0.038+	0.095*	0.016	0.033+	0.046	0.031
	(0.015)	(0.020)	(0.035)	(0.027)	(0.019)	(0.039)	(0.027)
Control Mean	0.867	0.080	0.494	0.532	0.065	0.368	0.350
(B) Free or Reduced-Price Lunch							
6-Week	-0.019	0.147*	0.079	0.036	0.135*	-0.014	0.052
	(0.062)	(0.062)	(0.094)	(0.101)	(0.064)	(0.111)	(0.109)
1-Week	-0.040	0.087	0.034	0.014	0.085+	-0.042	0.024
	(0.063)	(0.055)	(0.097)	(0.095)	(0.049)	(0.101)	(0.111)
Online	-0.001	0.028	0.096+	-0.063	0.008	-0.029	-0.023
	(0.045)	(0.030)	(0.054)	(0.045)	(0.027)	(0.061)	(0.043)
Control Mean	0.882	0.068	0.507	0.515	0.052	0.393	0.340
(C) Not Free or reduced-price Lunch							
6-Week	0.076	0.189***	0.238***	0.072	0.151***	0.189***	0.180***
	(0.046)	(0.053)	(0.075)	(0.062)	(0.053)	(0.050)	(0.057)
1-Week	0.107*	0.021	0.224***	0.102	-0.001	0.190***	0.144***
	(0.040)	(0.052)	(0.068)	(0.068)	(0.050)	(0.058)	(0.047)
Online	0.033	0.038	0.098*	0.049	0.040	0.085*	0.053
	(0.025)	(0.026)	(0.039)	(0.038)	(0.029)	(0.035)	(0.033)
Control Mean	0.858	0.090	0.487	0.552	0.075	0.361	0.366

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).N = 2,084 for the full sample, N = 814 for the free or reduced-price lunch sample, N = 1,270 for the non-free or reduced-price lunch sample.

Table B.13: The Impact of Assignment to STEM Summer Programs on Key Outcomes by Parental College Experience

	Attended Any 4-Year in Y1 (1)	Attended HI in Y1 (2)	Attended Barron's Most Competitive in Y1 (3)	Graduated from 4-Year by Y4 (4)	Graduated from HI by Y4 (5)	Graduated from Barron's Most Competitive by Y4 (6)	STEM Degree by Y4 (7)
(A) Full Sample							
6-Week	0.038	0.169***	0.172*	0.082+	0.146***	0.115+	0.144*
	(0.025)	(0.041)	(0.065)	(0.048)	(0.035)	(0.061)	(0.056)
1-Week	0.042	0.053	0.136*	0.080	0.040	0.099	0.107+
	(0.031)	(0.038)	(0.060)	(0.056)	(0.036)	(0.066)	(0.059)
Online	0.020	0.038+	0.095*	0.016	0.033+	0.046	0.031
	(0.015)	(0.020)	(0.035)	(0.027)	(0.019)	(0.039)	(0.027)
Control Mean	0.867	0.080	0.494	0.532	0.065	0.368	0.350
(B) Parents Did Not Attend College							
6-Week	-0.023	0.178*	0.064	0.180	0.173+	0.132	0.197+
	(0.058)	(0.080)	(0.119)	(0.119)	(0.090)	(0.096)	(0.108)
1-Week	-0.090	0.000	-0.078	0.035	0.017	-0.017	0.131
	(0.067)	(0.071)	(0.117)	(0.116)	(0.068)	(0.118)	(0.105)
Online	0.009	-0.010	-0.011	-0.103+	-0.025	-0.106	-0.020
	(0.036)	(0.018)	(0.047)	(0.053)	(0.022)	(0.064)	(0.041)
Control Mean	0.890	0.068	0.539	0.488	0.050	0.358	0.299
(C) At Least One Parent Attended College							
6-Week	0.055+	0.164***	0.209***	0.032	0.136***	0.101+	0.116+
	(0.030)	(0.036)	(0.068)	(0.051)	(0.040)	(0.059)	(0.061)
1-Week	0.078***	0.071	0.210***	0.102	0.051	0.148*	0.109+
	(0.028)	(0.044)	(0.057)	(0.063)	(0.044)	(0.061)	(0.059)
Online	0.023	0.050+	0.126***	0.049	0.047+	0.091*	0.043
	(0.020)	(0.028)	(0.036)	(0.040)	(0.028)	(0.036)	(0.037)
Control Mean	0.864	0.086	0.484	0.548	0.070	0.373	0.366

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001).N = 2,084 for the full sample, N = 504 for the no parental college attendance sample, N = 1,580 for the parental college attendance sample. Students missing parent education data (N = 21) are counted as having a parent with college experience.

Table B.14: The Impact of Assignment to STEM Summer Programs on College Applications and Admissions for Summer Experience Attenders

	HI			Barron's Most Competitive			Most Competitive, Excluding HI		
	Applied	Unconditional Admission	Admitted if Applied	Applied	Unconditional Admission	Admitted if Applied	Applied	Uncond. Admission	Admitted if Applied
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(A) Full Control Group									
6-Week	0.464***	0.207***	0.142*	0.102***	0.095	0.021	0.113*	0.103+	0.020
	(0.050)	(0.041)	(0.055)	(0.032)	(0.056)	(0.047)	(0.041)	(0.054)	(0.044)
1-Week	0.398***	0.105*	0.049	0.066+	0.066	0.022	0.061	0.096	0.062
	(0.055)	(0.042)	(0.064)	(0.034)	(0.060)	(0.044)	(0.049)	(0.060)	(0.040)
Online	0.352***	0.088***	0.055	0.040+	0.085*	0.062*	0.043+	0.081*	0.054+
	(0.024)	(0.028)	(0.039)	(0.022)	(0.031)	(0.028)	(0.023)	(0.030)	(0.027)
Control Mean	0.312	0.106	0.282	0.874	0.733	0.837	0.840	0.688	0.818
(B) Control Group Members with a STEM Summer Experience									
6-Week	0.422***	0.204***	0.107	0.071	0.034	-0.015	0.086	0.041	-0.020
	(0.062)	(0.053)	(0.074)	(0.046)	(0.086)	(0.069)	(0.054)	(0.070)	(0.055)
1-Week	0.353***	0.104+	0.013	0.035	0.008	-0.011	0.033	0.037	0.026
	(0.064)	(0.054)	(0.082)	(0.046)	(0.088)	(0.067)	(0.059)	(0.074)	(0.053)
Online	0.307***	0.086+	0.019	0.010	0.028	0.029	0.017	0.024	0.017
	(0.042)	(0.044)	(0.064)	(0.038)	(0.072)	(0.059)	(0.041)	(0.054)	(0.045)
Control Mean	0.358	0.150	0.324	0.903	0.804	0.887	0.862	0.749	0.866

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). Data on summer experiences come from the post-program follow-up survey. For Panel B, we excluded control students who did not respond to the follow-up survey or did not attend a STEM summer experience. For HI outcomes, N = 2,084 for the full sample and N = 1,177 for Panel B. Data on non-HI applications and admissions come from the follow-up survey at the end of the senior year of HS. The samples for these outcomes (Columns 4-9) are restricted to those with data on admissions to specific colleges. The sample sizes are N = 1,402 for Panel A and N = 928 for Panel B. Samples for columns 3, 6, and 9 are conditional on applying to the institution type.

Table B.15: The Impact of Assignment to STEM Summer Programs on College Graduation and STEM Degrees for Summer Experience Attenders

	Host Institution				Any 4-Year				Any 4-Year, Excluding HI			
	Grad in Y4 (1)	Grad in Y5 (2)	STEM Degree in Y4 (3)	STEM Degree in Y5 (4)	Grad in Y4 (5)	Grad in Y5 (6)	STEM Degree in Y4 (7)	STEM Degree in Y5 (8)	Grad in Y4 (9)	Grad in Y5 (10)	STEM Degree in Y4 (11)	STEM Degree in Y5 (12)
(A) Full Control Group												
6-Week	0.146***	0.133*	0.145***	0.141***	0.082+	0.122+	0.127*	0.202*	-0.064	-0.010	-0.018	0.061
	(0.035)	(0.051)	(0.029)	(0.043)	(0.048)	(0.061)	(0.057)	(0.075)	(0.054)	(0.064)	(0.055)	(0.071)
1-Week	0.040	0.022	0.056	0.056	0.080	0.163*	0.092	0.145+	0.040	0.141*	0.036	0.088
	(0.036)	(0.049)	(0.035)	(0.049)	(0.056)	(0.072)	(0.059)	(0.083)	(0.050)	(0.059)	(0.045)	(0.056)
Online	0.033+	0.024	0.033+	0.031	0.016	0.082+	0.034	0.045	-0.016	0.058	0.001	0.015
	(0.019)	(0.027)	(0.018)	(0.026)	(0.027)	(0.047)	(0.026)	(0.045)	(0.038)	(0.048)	(0.029)	(0.041)
Control Mean	0.065	0.084	0.051	0.064	0.532	0.654	0.368	0.452	0.468	0.570	0.317	0.388
(B) Control Group Members with a STEM Summer Experience												
6-Week	0.135***	0.119	0.126***	0.122	0.006	0.074	0.006	0.076	-0.129	-0.045	-0.120+	-0.046
	(0.044)	(0.081)	(0.039)	(0.078)	(0.068)	(0.125)	(0.059)	(0.089)	(0.083)	(0.142)	(0.061)	(0.085)
1-Week	0.029	0.006	0.037	0.035	0.007	0.121	-0.025	0.025	-0.022	0.114	-0.062	-0.009
	(0.046)	(0.082)	(0.044)	(0.082)	(0.073)	(0.130)	(0.059)	(0.094)	(0.081)	(0.142)	(0.053)	(0.077)
Online	0.021	0.007	0.013	0.008	-0.054	0.039	-0.081***	-0.075	-0.075	0.032	-0.094*	-0.083
	(0.033)	(0.071)	(0.032)	(0.071)	(0.055)	(0.120)	(0.028)	(0.063)	(0.074)	(0.138)	(0.040)	(0.067)
Control Mean	0.100	0.134	0.085	0.107	0.609	0.690	0.485	0.555	0.510	0.556	0.400	0.448

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). Data on summer experiences come from the post-program follow-up survey. For Panel B, we excluded control students who did not respond to the follow-up survey or did not attend a STEM summer experience. N = 2,084 for the full sample and N = 1,177 for Panel B.

Table B.16: The Impact of Assignment to STEM Summer Programs on Institution-Level Graduation Rates and STEM Degree

	IPEDS Bachelor's 4-Year Grad Rate (1)	4-Year Degree by Y4 (2)	IPEDS STEM as Pct of Bachelor's Degrees (3)	STEM Degree by Y4 (4)
(A) Full Sample				
6-Week	0.093***	0.082^{+}	0.070*	0.127*
	(0.023)	(0.048)	(0.027)	(0.057)
1-Week	0.072***	0.080	0.008	0.092
	(0.025)	(0.056)	(0.031)	(0.059)
Online	0.044***	0.016	0.023^{+}	0.034
	(0.011)	(0.027)	(0.012)	(0.026)
Control Mean	0.603	0.532	0.346	0.368
Observations	2084	2084	2084	2084
(B) Non-HI Attenders				
6-Week	0.072*	0.021	-0.020	0.049
	(0.029)	(0.054)	(0.016)	(0.061)
1-Week	0.066*	0.066	-0.028	0.047
	(0.029)	(0.054)	(0.021)	(0.052)
Online	0.039***	0.006	0.003	0.019
	(0.013)	(0.034)	(0.011)	(0.028)
Control Mean	0.585	0.510	0.302	0.352
Observations	1843	1843	1843	1843

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses ($+$ $p<0.10$ * $p<0.05$ ** $p<0.01$ ***$p<0.001$). The institutional-level outcomes in Columns 1 and 3 are college-level characteristics calculated from IPEDS data in 2013. Values for community colleges and non-college-going respondents are set to 0 for both institutional-level bachelor's four-year graduation rates and STEM degrees.

Table B.17: The Impact of Assignment to STEM Summer Programs on STEM Intentions

	STEM Major				STEM Career	
	Post-Program Survey	First Year College Survey	Second Year College Spring Survey	STEM Degree by Y4 NSC	Post-Program Survey	Second Year College Spring Survey
	(1)	(2)	(3)	(4)	(5)	(6)
6-Week	0.010	0.008	-0.038	0.144*	0.083+	0.040
	(0.042)	(0.055)	(0.058)	(0.056)	(0.047)	(0.079)
1-Week	-0.001	0.022	0.003	0.107+	0.006	0.058
	(0.041)	(0.054)	(0.044)	(0.059)	(0.050)	(0.058)
Online	-0.007	0.028	-0.003	0.031	0.077*	0.008
	(0.035)	(0.035)	(0.026)	(0.027)	(0.037)	(0.036)
Control Mean	0.932	0.832	0.828	0.350	0.835	0.614
N	1410	1255	1191	2084	1382	1144

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). The survey variables use declared major, if available, and intended major if the respondent is undeclared. The first-year survey was only fielded to non-HI attenders. The survey was fielded at the end of the spring semester for cohorts 2014 and 2016 and at the end of the fall semester for cohort 2015. Column 2 combines the first-year survey data for non-HI attenders and NSC data on declared majors for the fall of sophomore year for HI attenders. Column 4 uses degree data from the NSC and HI.

Table B.18: Baseline Characteristics by Program Assignment

	Control Group With STEM Summer (1)	Control Group Without STEM Summer (2)
Black	0.32	0.34
Hispanic	0.45	0.44
Native American	0.04	0.04
Asian	0.16	0.14
White	0.03	0.04
Multiethnic	0.37	0.36
GPA	3.84	3.83
Free/reduced-price lunch	0.40	0.35
Standardized math score	1.83	1.82
Female	0.42	0.29
First-generation college	0.26	0.21
First-generation college	0.26	0.21
Standardized Rating Variable	-0.72	-0.87
N	166	907

Notes: This table summarizes demographic characteristics, test scores, and GPA for program applicants. Column 1 shows averages taken across the entire sample. Columns 2 through 5 display means of these traits at baseline by program assignment. Race/ethnicity categories are not exclusive. First-generation college is defined as no parental college attendance. Students missing parental college information (N=21) were coded as not first-generation.

Appendix C: Additional survey results and weighting exercises

We detail the contents of the three longer-form surveys below. This appendix also shows different survey weighting schemes and additional survey results.

C.1 Survey Details

C.1.1 Post-program survey

The first long-form outcome survey was offered to the randomized applicants in the fall after the programs. It asked students about:

- Summer programs attended (in addition to HI programs for treatment groups, any for control group)
- College application plans
- Preferences for various college offerings (location, academics, extracurriculars, etc.)
- College major plans
- Familiarity with various colleges
- Career plans
- Sources of advice on college and careers
- AP, IB, and mathematics high school course taking plans
- Study skills
- Life skills
- Self-confidence
- Math problems and a brain teaser

C.1.2 End of high school survey

The second long-form outcome survey was offered to the randomized applicants at the end of their senior year in high school (about eight months after the first long-form survey). It asked students about:

- College enrollment plans
- College application and admissions offers
- SAT and/or ACT scores
- High school GPA

C.1.3 Second-year college spring survey

The third long-form outcome survey was offered to the randomized applicants in the spring of their sophomore year of college (about 2.5 years after the first long-form survey). It asked students about:

- College enrollment
- College major

- College math courses
- College study skills
- Educational experiences outside of class
- Social life
- Summer plans
- Graduate school plans
- Career plans

C.2 Creating indices from survey responses

To avoid emphasizing spurious results due to multiple hypothesis testing, outcomes are grouped into related "families." Following Anderson (2008), each family is converted into an index according to the following procedure:

- For each individual outcome in the family, we define each variable such that higher values are "better."
- We then normalize each outcome into a z-score relative to the control group for that cohort. That is, subtract the cohort-specific control group mean and divide by the standard deviation.
- Construct the weighted average of all the outcomes in the family by cohort. The weight on each outcome is the inverse of the covariance matrix of the outcomes.
- Normalize the index again by subtracting the cohort's control group mean and dividing by the standard deviation.
- If a respondent is missing the answer to some, but not all, items in a family, construct the index based on non-missing items.

We report our findings using survey data with such indices.

The indices used in Table 6 use the following outcomes:

- Life skills
  - I set my alarm each night before I go to bed when I need to wake up early.
  - I return phone calls and emails in a timely manner.
  - I can do my own laundry.
  - I can plan meals for myself.
  - I can balance my checking account. (2014 only)
- Study skills
  - I ask myself questions to make sure I know the material I have been studying.
  - Before I begin studying, I think about the things I will need to do to learn.
  - When I'm reading, I stop once in a while and go over what I have read. (2015 and 2016 only)

  - When I get stuck on a problem, I ask a classmate or friend for help. (2015 only)
  - I always persist to the end of a project, even when the work is hard. (2014 only)
  - I work hard to get a good grade even when I don't like a class. (2014 only)
  - When I get stuck on a problem, I ask a teacher for help. (2015 and 2016 only)
- Confidence
  - I am confident that I will succeed in my courses this semester. (2015 only)
  - I am good at math. (2015 and 2016 only)
- Likes intellectual activities
  - I like to tinker (take things apart, fix things, etc.). (2015 and 2016 only)
  - I like brain teasers and puzzles. (2015 and 2016 only)
- Attention
  - I often find that I have been reading for class but don't know what it is all about. (2015 and 2016 only)
  - I find that when the teacher is talking, I think of other things and don't really listen to what is being said.

The indices used in Appendix Table C.6 use the following outcomes:

- Community and belonging
  - I feel a sense of belonging to my college community
  - I feel that I am a member of my college's community
  - I see myself as part of my college's community
  - My friends are taking the same classes as me
- Use of school academic supports
  - I have attended professors' office hours (hours per semester)
  - I have attended teaching assistants' office hours (hours per semester)
  - I have used my university's tutoring resources
- Use of peer academic supports
  - I have a study group for at least one of my classes
  - My friends help me with coursework (e.g., study groups, doing problem sets together).
- Professional development
  - I have worked with a professor as a research assistant
  - I have had an internship while enrolled at my university
  - I know a professor who would be willing to write me a recommendation letter

Table C.1: Main Estimates Restricted to Survey Responders and Inverse Propensity Weights, with Assignment Variables

		Post-Program		End of High School		Sophomore Year	
	Full Sample	Responders Unweighted	Responders IPW	Responders Unweighted	Responders IPW	Responders Unweighted	Responders IPW
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Attended Any Four-Year Institution in Year 1							
6-Week	0.038	0.029	0.022	0.008	0.006	-0.008	0.025
	(0.041)	(0.044)	(0.057)	(0.045)	(0.051)	(0.050)	(0.055)
1-Week	0.042	0.047	0.045	0.003	0.011	0.022	0.040
	(0.037)	(0.041)	(0.050)	(0.041)	(0.045)	(0.045)	(0.048)
Online	0.020	-0.004	-0.001	-0.004	0.003	0.023	0.032
	(0.024)	(0.027)	(0.036)	(0.028)	(0.029)	(0.029)	(0.032)
(B) Attended Barron's Most Competitive Institution							
6-Week	0.172***	0.123^{+}	0.152^{+}	0.116^{+}	0.169*	0.095	0.192*
	(0.059)	(0.063)	(0.082)	(0.066)	(0.076)	(0.071)	(0.078)
1-Week	0.136*	0.097	0.121	0.084	0.145*	0.114^{+}	0.186*
	(0.055)	(0.061)	(0.078)	(0.063)	(0.071)	(0.067)	(0.074)
Online	0.095***	0.036	0.062	0.058	0.076^{+}	0.067	0.088^{+}
	(0.035)	(0.040)	(0.052)	(0.041)	(0.045)	(0.044)	(0.048)
(C) Degree from Any Four-Year Institution by Year							
6-Week	0.082	0.069	0.111	0.062	0.085	0.093	0.135
	(0.061)	(0.065)	(0.083)	(0.069)	(0.080)	(0.075)	(0.084)
1-Week	0.080	0.068	0.131^{+}	0.070	0.113	0.103	0.136^{+}
	(0.057)	(0.062)	(0.076)	(0.064)	(0.073)	(0.071)	(0.077)
Online	0.016	-0.023	0.026	-0.006	0.023	0.020	0.049
	(0.036)	(0.040)	(0.052)	(0.042)	(0.045)	(0.045)	(0.050)
(D) Degree from Barron's Most Competitive Institution							
6-Week	0.115^{+}	0.087	0.122	0.073	0.111	0.100	0.168*
	(0.059)	(0.064)	(0.082)	(0.068)	(0.076)	(0.072)	(0.080)
1-Week	0.099^{+}	0.074	0.115	0.071	0.127^{+}	0.147*	0.200***
	(0.056)	(0.061)	(0.078)	(0.064)	(0.071)	(0.068)	(0.074)
Online	0.046	0.011	0.058	0.015	0.038	0.029	0.046
	(0.034)	(0.039)	(0.051)	(0.040)	(0.043)	(0.043)	(0.048)
(E) STEM Degree by Year 4							
6-Week	0.144*	0.116^{+}	0.169*	0.105	0.139^{+}	0.143^{+}	0.201*
	(0.060)	(0.064)	(0.084)	(0.069)	(0.075)	(0.075)	(0.082)
1-Week	0.107^{+}	0.093	0.157*	0.102	0.121^{+}	0.136^{+}	0.152*
	(0.056)	(0.061)	(0.079)	(0.064)	(0.069)	(0.070)	(0.077)
Online	0.031	-0.006	0.052	0.019	0.040	0.025	0.035
	(0.034)	(0.038)	(0.051)	(0.040)	(0.043)	(0.043)	(0.049)

Notes: Each panel uses a different attendance or graduation outcome. Column 1 is the main specification. Columns 2, 4, and 6 restrict the sample to survey responders. Columns 3, 5, and 7 use inverse propensity weighting with survey responders. The response prediction regression includes assignment to programs, randomization strata, rating variable, GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status.

Table C.2: Predictors of Survey Response

	Post-Program (1)	End of High School (2)	Sophomore Year (3)
main			
6-Week	0.745***	0.546***	0.176
	(0.224)	(0.181)	(0.167)
1-Week	0.668***	0.518***	0.046
	(0.193)	(0.168)	(0.154)
Online	0.680***	0.526***	0.245***
	(0.110)	(0.099)	(0.094)
Rating Variable	0.201***	0.179***	0.035
	(0.065)	(0.057)	(0.054)
Free/Reduced Lunch	0.092	0.054	0.151*
	(0.072)	(0.065)	(0.062)
GPA	0.097	0.092	0.272*
	(0.124)	(0.118)	(0.122)
Standardized Math Score	0.039	0.086***	0.010
	(0.037)	(0.033)	(0.031)
Black	0.165	-0.052	0.217
	(0.171)	(0.158)	(0.150)
Hispanic	0.240	-0.029	0.394*
	(0.175)	(0.162)	(0.153)
Native American	-0.089	-0.104	-0.001
	(0.223)	(0.212)	(0.200)
Asian	0.296	0.141	0.562***
	(0.185)	(0.171)	(0.162)
Multiethnic	-0.010	-0.066	-0.025
	(0.079)	(0.073)	(0.070)

Notes: Each column displays probit regression coefficients for the predictors of survey response. Regression coefficents for randomization strata are not displayed.

Table C.3: The Impact of Assignment to STEM Summer Programs on College Application Knowledge

	Sources of Application Advice				Have Heard of Specific Colleges				
	Teacher or Counselor (1)	Family Members (2)	Friends (3)	Internet or Other Written (4)	Non-HI Technical Institute (5)	Ivy League (6)	Liberal Arts College (7)	Top Public (8)	Fake College (9)
6-Week	0.102^{+}	0.065	0.133^{+}	-0.018	0.071^{+}	0.014^{+}	0.108*	-0.080	-0.052
	(0.052)	(0.052)	(0.074)	(0.078)	(0.037)	(0.007)	(0.044)	(0.082)	(0.034)
1-Week	0.035	0.019	0.016	0.000	0.068	0.013^{+}	0.102^{+}	-0.076	-0.039
	(0.050)	(0.050)	(0.066)	(0.075)	(0.044)	(0.007)	(0.056)	(0.070)	(0.030)
Online	0.023	0.023	0.069*	-0.030	0.101***	0.007^{+}	0.069***	-0.036	-0.007
	(0.034)	(0.039)	(0.030)	(0.060)	(0.022)	(0.004)	(0.016)	(0.051)	(0.015)
Control Mean	0.777	0.625	0.489	0.746	0.704	0.991	0.607	0.637	0.113
Observations	1401	1401	1401	1401	1411	1411	1410	1403	1412

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). Data are from surveys conducted post program, in the fall of the senior year of high school.

Table C.4: The Impact of Assignment to STEM Summer Programs on Perceptions of College Costs and Financial Aid

	Estimated Minus IPEDS		Minus IPEDS Windsorized		Estimate with IPEDS Controls	
	Cost of Attendance	Financial Aid Coverage	Cost of Attendance	Financial Aid Coverage	Cost of Attendance	Financial Aid Coverage
	(1)	(2)	(3)	(4)	(5)	(6)
6-Week	-1490.782	0.012	-580.834	0.013	-745.096	0.040
	(2915.910)	(0.028)	(2771.935)	(0.028)	(3129.454)	(0.024)
1-Week	-424.287	0.013	-623.320	0.013	-278.095	0.021
	(2408.864)	(0.025)	(2336.924)	(0.025)	(2382.127)	(0.023)
Online	-461.791	0.016	-757.030	0.017	-351.982	0.029
	(1964.294)	(0.022)	(1910.422)	(0.022)	(1978.260)	(0.019)
Control Mean	9895.721	-0.060	9496.540	-0.061	51090.488	0.630
Observations	1342	1277	1342	1277	1341	1276

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ $p<0.10$ * $p<0.05$ ** $p<0.01$ ***$p<0.001$). Data are from surveys conducted at the end of the summer of the programs. Columns 1 and 2 take the average of respondents' estimates of their first three college choices and subtract the averaged IPEDS figures for those colleges.

Table C.5: The Impact of Assignment to STEM Summer Programs on College-Level Courses By Fall of Sophomore Year

	Completed in HS (1)	Completed by Year 2 (2)	Started and Dropped (3)	Required by Major (4)
(A) Single Variable Calculus				
6-Week	0.052	0.028	0.020	0.159^{+}
	(0.059)	(0.043)	(0.047)	(0.084)
1-Week	-0.029	0.020	0.023	0.161*
	(0.050)	(0.039)	(0.041)	(0.076)
Online	0.002	-0.006	0.000	0.064
	(0.032)	(0.032)	(0.026)	(0.062)
Control Mean	0.834	0.942	0.052	0.369
(B) Multivariable Calculus				
6-Week	0.020	0.164*	0.051	0.138^{+}
	(0.046)	(0.076)	(0.039)	(0.081)
1-Week	0.015	0.167*	0.055	0.127
	(0.046)	(0.073)	(0.043)	(0.080)
Online	-0.016	0.099*	0.043	0.056
	(0.032)	(0.037)	(0.033)	(0.062)
Control Mean	0.181	0.689	0.072	0.318
(C) Linear Algebra				
6-Week	0.020	-0.116*	-0.058	-0.063
	(0.047)	(0.054)	(0.051)	(0.075)
1-Week	0.040	0.037	-0.033	0.042
	(0.063)	(0.079)	(0.045)	(0.084)
Online	0.017	0.022	-0.019	0.017
	(0.037)	(0.035)	(0.026)	(0.043)
Control Mean	0.129	0.597	0.090	0.384
(D) Probability and Statistics				
6-Week	-0.016	-0.162^{+}	-0.003	-0.067
	(0.079)	(0.087)	(0.012)	(0.064)
1-Week	-0.021	-0.056	-0.009	-0.028
	(0.070)	(0.087)	(0.008)	(0.061)
Online	-0.073	-0.074*	-0.002	-0.013
	(0.047)	(0.035)	(0.002)	(0.035)
Control Mean	0.238	0.531	0.005	0.346
Observations	1225	1225	1225	1225

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). Data are from follow-up surveys administered during the projected second year of college in the fall.

Table C.6: The Impact of Assignment to STEM Summer Programs on College Experiences

	Community and Belonging (1)	Use of School Academic Supports (2)	Use of Peer Academic Supports (3)	Profofessional Development (4)	Percentage URM (5)
(A) Full Sample					
6-Week	0.248^{+}	-0.156	0.124	0.006	-0.015
	(0.128)	(0.153)	(0.124)	(0.130)	(0.014)
1-Week	0.225	-0.081	0.147	-0.001	-0.019
	(0.134)	(0.134)	(0.135)	(0.132)	(0.013)
Online	0.033	-0.039	0.080	-0.099	-0.017^{+}
	(0.074)	(0.101)	(0.076)	(0.064)	(0.009)
N	1178	1225	1225	1225	1934
(B) Attended HI in Year 2					
6-Week	-0.519^{+}	-0.862^{+}	0.332	0.638	0.000
	(0.292)	(0.462)	(0.553)	(0.444)	(.)
1-Week	-0.808***	-1.044*	0.141	0.681	0.000
	(0.265)	(0.431)	(0.573)	(0.416)	(.)
Online	-0.571*	-0.479^{+}	-0.061	-0.168	0.000
	(0.207)	(0.264)	(0.447)	(0.304)	(.)
N	137	140	140	140	237
(C) Did Not Attend HI in Year 2					
6-Week	0.378*	-0.096	0.059	-0.054	-0.027
	(0.145)	(0.163)	(0.130)	(0.153)	(0.017)
1-Week	0.332*	-0.014	0.073	-0.110	-0.022
	(0.130)	(0.137)	(0.136)	(0.161)	(0.015)
Online	0.093	-0.034	0.091	-0.107	-0.020^{+}
	(0.079)	(0.109)	(0.071)	(0.093)	(0.011)
N	1041	1085	1085	1085	1697

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ p<0.10 * p<0.05 ** p<0.01 ***p<0.001). Columns 1 through 4 use data from surveys fielded in the spring semester ofthe second year of college. The outcomes are indices constructed from multiple survey questionsas described in Section C.2. The last column uses IPEDS characteristics merged to NSC attendance data.

Table C.7: The Impact of Assignment to STEM Summer Programs on College Clubs and Societies

	Any Club or Society (1)	Race/Ethnicity Affinity (2)	Gender Affinity (3)	Major-Related Club/Society (4)
6-Week	0.032	0.007	-0.003	0.014
	(0.067)	(0.073)	(0.069)	(0.069)
1-Week	0.032	-0.075	-0.018	0.062
	(0.058)	(0.063)	(0.056)	(0.058)
Online	0.005	-0.008	0.010	0.032
	(0.047)	(0.032)	(0.046)	(0.034)
Control Mean	0.786	0.332	0.222	0.334
N	1225	1225	1225	1225

Notes: Each coefficient labeled by program is the estimate of the impact of assignment to one of the three STEM summer programs on the outcome indicated in the heading. All regressions control for randomization strata and a vector of characteristics including indicators for GPA, standardized math score, race/ethnicity, and free and reduced-price lunch status. The sample includes STEM summer program applicants who applied in 2014, 2015, and 2016 and passed an initial screen, who were then subject to random assignment as described in Section 4.2. The control mean is adjusted for randomization strata. Robust standard errors are in parentheses (+ $p<0.10$ * $p<0.05$ ** $p<0.01$ ***$p<0.001$). Data are from follow-up surveys administered during the spring semester of the second year of college.