A national-level informational experiment to promote enrollment in selective colleges

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Abstract: Prior research finds that low-income students are less likely to apply to and enroll in four-year colleges or more selective colleges, even after controlling for academic preparation and other background characteristics. The College Board sought to reduce barriers in the college application process through a targeted campaign of brochures and emails. These materials were sent to students two to three times between the end of eleventh grade and the middle of twelfth grade, and aimed to provide an impetus to start the college search process, minimize the costs of aggregating data, and encourage a broader college application portfolio. Some students were offered additional encouragements, such as text message reminders or college application fee waivers. In a randomized control trial with 785,000 low- and middle-income students in the top 50% of the PSAT and SAT distributions, we find no changes in college enrollment patterns.

Introduction

How can we help young adults make the best decision about where to attend college? The college admissions process requires students to meet a number of deadlines for entrance exams, college applications, and financial aid, and missing any of these steps can be a stumbling block to successful enrollment (Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2012; Hurwitz, Smith, Niu, & Howell, 2015; Hyman, 2017; Klasik, 2012). Yet recent research has reaffirmed the importance of the college-going decision, as where students attend can determine the likelihood of earning a degree and lifetime earnings (Bhuller, Mogstad, & Salvanes, 2017; Chetty, Friedman, Saez, Turner, & Yagan, 2017; Goodman, Hurwitz, & Smith, 2017; Hoekstra, 2009; Kirkeboen, Leuven, & Mogstad, 2016; Zimmerman, 2014). College choice is shaped not only by the student and their academic preparation, but also by financial constraints, lack of information about the value of different college options, and other factors that are driven by family, peers, school, and community (Bailey & Dynarski, 2011; Hamilton, Roksa, & Nielsen, 2018; Radford, 2013; Roderick, Coca, & Nagaoka, 2011). As a result, first-generation students and those from lower-income families typically "undermatch" and attend less selective institutions, preserving or exacerbating inequality by socioeconomic status (Belasco & Trivette, 2015; Dynarski, Libassi, Michelmore, & Owen, 2018; Hoxby & Avery, 2013; Smith, Pender, & Howell, 2013).

This paper provides results from a series of large randomized control trials administered by the College Board, which sought to increase enrollment in selective colleges by reducing informational or behavioral barriers in the application process. The College Board is a not-for-profit membership organization that includes over 6,000 of the world's leading educational institutions, and prepares students for the transition to college through programs and services in college readiness and college success—including the SAT® and the Advanced Placement

Program®. The intervention was named internally as the "Reach Your College Potential" (RYCP) project. The intervention's aim was to provide students easily digestible information on a varied set of academically strong colleges. The experiment focused on low- and middle-income students identified as "high-achieving" or "on-track" for college, which corresponded to approximately the top 10% and top 50% of students in the national PSAT/SAT distributions, respectively.[1] The interventions focused on these groups for two primary reasons. First, prior research shows large differences in college enrollment patterns by income (Bailey & Dynarski, 2011). In particular, Hoxby and Avery (2013) identify the "missing one-offs" – academically strong students who receive insufficient counseling by virtue of being geographically isolated in high schools with few high achievers – as benefiting from increased outreach that steers them toward more selective colleges (Hoxby & Turner, 2013). Second, the typical college information we could provide (e.g., net tuition, graduation rates) was considered more accurate for academically stronger students, who were more likely to start college at traditional four-year colleges without the need for developmental education.

The College Board sent students information two to three times between the end of the 11th grade year and middle of 12th grade, in order to provide an impetus to start the college search process, minimize the costs of aggregating data, and encourage a broader college application portfolio. The experiment relied on three primary treatment arms. The primary treatment was a brochure or "mailer" that was physically sent to each student at their home. The mailers were typically 8-12 pages in length (see Appendices 2 to 4), and included a number of items such as a personalized "starter list" that compared the graduation rate or likely true cost at various postsecondary

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[1] We recognize that "on-track" simply describes academic preparedness, as there is significant variation in whether students engage in the steps to be on-track to meet college application requirements (Klasik & Strayhorn, 2018).

institutions, or checklists to help students manage the lengthy college application process. The brochure was visually attractive with large font, clear messages around action steps, and (where applicable) used slogans intended to change how students might perceive challenges to college enrollment in more selective colleges ("Apply to colleges where people like you succeed", "Forget what you've heard about the price of college"). The second treatment arm included the same brochure but also randomly offered students some short-term interventions by external agencies (e.g., text reminders, advising), or eliminated small financial barriers through college application fee waivers and additional opportunities to send SAT scores directly to colleges (reporting SAT results is often a requirement of a college's application process and is colloquially referred to as SAT "score sends"). The third treatment arm was an even "lighter-touch" approach where students were not mailed a full brochure but were contacted via email, which provided many of the same services but required them to visit the College Board BigFuture website. The aim of the last arm was to see whether an even lower cost but potentially less enticing format might deliver similar shifts in college enrollment. Although we focus on these three treatment arms, there are some minor and ultimately inconsequential differences even within these arms between years or across income and achievement groups, described later in this text.

We find that our interventions led to no change in the likelihood or sector of college enrollment of treated students. The study relied on approximately 785,000 students in the high school graduating cohorts of 2016 and 2017 and, as a result, we can eliminate the possibility of medium or large impacts typically observed in studies of educational interventions (Kraft, forthcoming). For example, we estimate a 0.0 percentage point impact on four-year college attendance and our 95% confidence interval rejects an increase of 0.4 percentage points, or a 0.6% increase over a baseline attendance rate of 64.5%. As the initiative's goal was to increase the selectivity of the college

attended, we estimate impacts on median freshmen SAT of enrolled students, one common proxy for selectivity. In this case, treated students attended a college with median SAT scores of 0.3 points higher, relative to a control group mean of 1229 and standard deviation of 132; this point estimate implies an effect size of 0.002 with the 95% confidence interval rejecting an effect size of 0.01. We show that these null results cannot be attributed simply to an unawareness about the interventions. Approximately one-third of treated students viewed specific materials provided for them on College Board's BigFuture website, and students also increased their use of College Board services when financial costs for college applications or sending SAT scores were eliminated, implying that students likely applied to more colleges when the process was simplified.

Getting lower income students to enroll in more selective institutions is a challenge due to the multiple steps involved, many of which involve decisions outside of the students' control. Although interventions might induce students to incorporate new information and alter their application patterns, they must then rely on colleges with often low admission rates changing their acceptance decisions and providing enough financial aid and other supports to convince these students they will be successful in this new environment, which may be particularly important for low-income students (Dynarski et al., 2018; Gurantz, Hurwitz, & Smith, 2017). Although informational and procedural barriers are one potential issue, our results suggest that lighter touch interventions are generally ineffective at increasing enrollment in more selective colleges without stronger one-on-one college counseling type supports, which may be more difficult to implement at scale (Barr & Castleman, 2017; Castleman & Page, 2015; Gurantz, Pender, Mabel, Larson, & Bettinger, 2020; Sullivan, Castleman, & Bettinger, 2019). Importantly, previous work by Hoxby and Turner (2013), which served in part as the inspiration for many of these projects cited above, found positive impacts on college match through a primarily informational driven intervention.

We discuss potential differences between the College Board's approach and prior work in the conclusion.

The paper proceeds as follows: Section 2 briefly reviews the literature; Section 3 discusses the intervention, including how the sample was selected, the experimental treatments, and differences between the 2016 and 2017 outreach; Section 4 describes the sample and primary outcome measures; Section 5 describes the results, and; Section 6 concludes with a discussion of the findings and reasons the intervention may have not been successful.

Literature Review

Improving college enrollment outcomes requires insight into the challenges students face when considering where to attend. Lower income students apply to and attend less selective institutions, even after controlling for academic preparation (Hoxby & Avery, 2013; Smith et al., 2013). Common explanations for these differences include variation in college-relevant information, financial constraints, or unobserved preferences. Students have limited information on many key aspects of the college-going process, such as the likelihood they will complete a credential, the actual (net) price of college, or the financial returns to specific degrees, and offering accurate information can induce students to update their beliefs (Baker, Bettinger, Jacob, & Marinescu, 2018; Bleemer & Zafar, 2018). When information is costly to access and process, individuals simplify the task by creating heuristics that effectively eliminate large numbers of options for consideration, and this approach can exacerbate inequality across groups (Thaler & Sunstein, 2008). Low-income or first-generation students might eliminate high-quality but nominally expensive colleges because they focus on sticker price at the expense of net price, or may choose

better known but lower quality, geographically proximate options that can negatively impact degree completion.

An additional issue is the length of the college application process, with a large number of distinct steps that involve some level of time or financial commitment. Attention is a limited resource and complex processes are more likely to lead individuals to miss crucial steps, but simplified information and intermittent reminders can help students complete important tasks (Castleman & Page, 2013, 2015, 2016; Gabaix, 2017; Hoxby & Turner, 2013). Individuals frequently avoid important activities due to small financial costs, even when these are disproportionately small relative to the expected benefits, and minimizing these small barriers has led to significant behavioral shifts in many educational contexts (Gurantz, 2018; Hurwitz, Mbekeani, Nipson, & Page, 2016; Pallais, 2015; Smith, Hurwitz, & Howell, 2015). Taken together, these studies show that small investment differences in the college application process can have significant impacts on where students ultimately enroll, and raises the likelihood that a student, particularly one from a traditionally underrepresented background, either does not pursue a degree or enrolls in an undermatch college (Belasco & Trivette, 2015; Dynarski et al., 2018; Smith et al., 2013).

A number of experimental interventions have supported the idea that students are more likely to apply to and attend college, or more selective colleges, with additional supports. Large-scale interventions that are predominately "light-touch" and information driven have produced essentially no changes in college-going patterns (Bergman, Denning, & Manoli, 2019; Bird et al., 2019; Darolia & Harper, 2018; Hyman, 2020). Information-driven interventions have generally produced larger impacts when they are paired with human assistance or alter some aspect of the application process, such as a transparent offer of full tuition or changing the default architecture of loan packages (Barr & Turner, 2018; Bettinger et al., 2012; Dynarski et al., 2018; Finkelstein

& Notowidigdo, forthcoming; Marx & Turner, forthcoming). One-on-one, student-centered outreach and counseling are more time-consuming and expensive approaches to increase college enrollment than information-driven interventions, yet these consistently generate positive impacts on application and attendance decisions (Andrews, Imberman, & Lovenheim, forthcoming; Bettinger & Evans, forthcoming; Gurantz et al., 2020; Oreopoulos & Ford, 2019).

Intervention Background

Sample Selection

The experiments in this paper relied primarily on low- and middle-income students who took the PSAT or SAT during their 11th grade year, and who were identified as "high-achieving" or "on-track" based on their exam scores placing these students in the top 10% or 50% of the national distribution, respectively.[2] We identified income status through a combination of SAT fee waiver usage, PSAT and SAT questionnaire responses, and a methodology that predicted income using geographic data (e.g., census tract, high school).[3] Each student was assigned to one of four groups based on the interaction of these academic and income measures: high-achieving, low-income, high-achieving, middle-income, on-track, low-income, and on-track, middle-income. For brevity, many details of the experiment, including treatments and sample sizes, are discussed more fully in Appendix 1.

Experimental Treatment Conditions

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[2] The class of 2017 predominately took the newly redesigned SAT and PSAT, which did not have separate verbal and writing sections. Where we discuss SAT verbal scores, this refers to the verbal subsection for the 2016 cohort and the "evidence-based reading and writing" (EBRW) subsection for the 2017 cohort.

[3] Low-income students were those whose estimated annual income was below $40,000 (2016 cohort) or $58,000 (2017 cohort); moderate-income students were identified based on incomes below approximately $77,000 per year.

Treatment students were assigned to one of three broad interventions, though as we discuss below there were additional variations within these categories. Samples of outreach materials (e.g., mailed brochures, emails, and college application fee waivers) are provided in Appendices 2 through 4.

The primary focus was the delivery of "mailers" (e.g., brochures) that were mailed to students at their homes. The mailers aggregated relevant information on key elements of the college application process. Each mailer included a personalized college "starter list" of potential postsecondary institutions (described below), information about the admission and financial aid application processes, guidance on evaluating academic, financial, and social fit, and checklists to help students manage the college application process without missing steps.

"Starter lists" consisted of twelve colleges selected by a College Board algorithm, and attempted to kick-start informed college search and exploration, as well as introduce students to the concept of a college application portfolio with balanced risk. Each list included 6 academic "reach" colleges, 4 "fit" colleges and 2 "safety" colleges, where "reach" colleges are the most selective and aspirational.[4] As there are many possible institutions meeting these criteria, the algorithm ranked colleges based on the likelihood of earning a bachelor's degree for similar scoring students from the same county, a measure we developed using National Student Clearinghouse data. Each

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[4] "Reach" indicates an institution where the student's SAT score falls below the college's 25th percentile or less than 20 percent of applicants receive offers of admission. "Match" are those where a student's SAT scores falls within institutional interquartile SAT ranges. "Safety" are those where the student's SAT score exceeds the institution's 75th percentile. In the 2016 mailers, the starter list was described as being derived from where students who performed similar to them on the PSAT/SAT and had lived in their area had successfully graduated, whereas in the 2017 mailers the College Board was more explicit about the reach, fit, and safety notation and how these were calculated.

list also contained a college that we classified as the "best in-state public option", the public "fit" or "safety" institution with the highest average SAT score in the students' state of residence.

The second treatment is referred to as "mailers plus", which were mailers combined with offers of additional services like direct outreach to help in the college application (e.g., text messaging, small doses of virtual advising), though these required students to opt-in and were not well utilized. Some students were also offered small financial incentives that were reductions in the typical cost of the college application process: (1) college application fee waivers for a set of participating colleges, and (2) free SAT "score sends", which refers to the process where students elect to send their SAT score to a specific college as part of the application process. Roughly 150 selective colleges, which we label as RYCP colleges (from the "Reach Your College Potential" campaign label), elected to partner with the College Board and accept the specially designed, simplified college application fee waivers for use at those institutions. Sample fee waivers identifying this set of colleges is provided in the appendix.

The third treatment is an "email only" treatment, which provided information through biweekly emails rather than mailers, including links that directed students to the College Board's BigFuture website where they could receive additional advice on the college application process. For example, this group also received a college starter list but it was not listed within the email; they needed to navigate to the BigFuture website to see the results and learn more about these colleges. This third treatment arm was the largest in scope and was intended to measure whether lower cost digital information provision could effect change at scale.

There is variation in which group received which treatment due to a variety of considerations, including statistical power, cost, and the desires of partner organizations (Appendix Table 1). In

general, high-achieving students in the top 10% of the national distribution were almost always assigned to the mailers or mailers plus groups, though a subset of middle-income students in the 2016 cohort who were classified by their SAT performance were assigned to receive emails as a test case. The primary reason for this approach was twofold: (1) the smaller size of the high-achieving sample led to the College Board preferring two treatment arms, rather than three, to prioritize precision, and (2) some of the partners that provided texting or counseling services focused on serving only low-income, high-achieving students as a key part of their organization's mission. Although the majority of on-track students were assigned to the email treatment – close to 500,000 students – we still assigned over 100,000 on-track students to receive mailers, and have sufficient power to estimate impacts for each of these distinct treatment arms when using pooled results. In addition to learning about whether emails were an effective outreach tool, even a small marginal cost would make sending mailers to half a million additional students a significant expense. Some of the treatment assignment decisions were made on a rolling basis depending on internal feedback from the outreach efforts, new ideas as to the kinds of services and messaging that might work for students, and the availability of partner organizations to support the College Board's work, but typically the College Board attempted to increase the number of students targeted for treatment (i.e., with less consideration to have 50/50 treatment/control splits for maximum power).

Across experiments, the College Board provided extra encouragement for students to log on and interact with the BigFuture website. BigFuture is a free online tool that provides students with comprehensive, step-by-step guidance in the college application process, and was publicly available to all students, not just those in the experimental group. Students can use BigFuture to search for and compare colleges, find scholarships, understand financial aid, navigate the college

application process from start to finish, and receive personalized deadline reminders, tips, and guidance along the way. By creating a College Board account, students can use BigFuture to manage their personal college list, save scholarship searches, compare college costs, and more. Both treatment and control students had general access to BigFuture, though treated students were offered additional functionality (e.g., their college starter list was pre-populated into BigFuture, rather than control students who would have built a list from scratch). Treatment students also had their starter college list pre-loaded in the BigFuture website and they received a pop-up letting them know that we had added colleges to their list the first time they logged on.

Brief descriptions of differences between the 2016 and 2017 treatment conditions is described below.

Outreach for 2016 cohort

The first round of students were identified from their 10th or 11th grade PSAT and received three mailings: May 2015 (right before the summer leading into their 12th grade year), September 2015 (at the start of 12th grade), and January 2016 (halfway through their 12th grade year). Appendix Figure 1 shows the timeline for delivery of materials in the 2016 cohort, with sample mailers and fee waivers shown in Appendix 2. A second round of students were identified in July 2015 from SAT administrations and received two mailings; the first combined key elements from the May and September mailings, but the January mailing was identical for both groups.[5]

The organization of the mailings was as follows:

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[5] In addition to the four primary achievement-income groups, the College Board delivered the intervention to an additional group of approximately 12,000 high-achieving or on-track SAT-taking students who were identified as first-generation but whose income status identified them as above middle-income. These students were identified in the second round and only provided access to the low-cost email treatment.

- The first mailing encouraged students to access the BigFuture website and provided their personalized starter list of 12 colleges, information to help students evaluate college "fit" (i.e., financial, academic, social), and actions to take over the summer to help students prepare for the application process (e.g., visiting nearby colleges, talking with their school counselor or recent high school graduates about their experiences).

- The second mailing provided information about the admissions and financial aid application processes, timelines, and checklists to help manage the application process.

- The final mailing detailed the steps required to complete the FAFSA and provided high-achieving students four college application fee waivers for a set of participating colleges described below.

For the "mailers plus" treatment, the College Board partnered with outside organizations to provide opportunities for counseling services through text-messaging or phone-based outreach activities. In 2016, every interaction with students required an affirmative opt-in, leading to very low take-up rates of these services, often in the single digits. The opportunities were typically one-time activities, such as a phone call for advising on college choice or to discuss financial aid in conjunction with their student aid report, rather than large campaigns that work directly with students over a longer time-frame.

The "email" treatment was directed primarily to hundreds of thousands of on-track students identified through their SAT performance. These students received a bi-weekly email with key actions and milestones, typically directing them to the College Board's BigFuture website for further exploration and to explore their college lists.

Outreach for 2017 cohort

Students in the 2017 cohort were similarly divided into three treatment groups: emails, mailers, and mailers plus, with the timeline shown in Appendix Figure 1 and sample documents in Appendix 3 and 4. There were three key differences in the 2017 cohort, as the College Board:

- Sent two mailers, not three. The omitted material was mostly reminders about important deadlines, as this information was migrated to the BigFuture website.

- Provided on-track, low-income students more free score sends and college application fee waivers than before, which is detailed below.

- Worked with a behavioral design firm to enhance the mailer's messaging. The two primary messages were intended to reduce concerns about cost by focusing on net price rather than sticker price ("Forget what you've heard about the cost of college") or social belonging ("Students like you go to great colleges like these"). Some students were also randomly provided College Scorecard information on average salaries of graduates for their starter list colleges.

Data and Outcomes

Table 1 provides descriptive statistics for the full sample in the first column, broken down by cohort year (columns 2 and 3) and academic and income status (columns 4 through 7). The 2016 and 2017 samples consisted of 536,533 and 249,219 students, respectively. The 2016 cohort was significantly larger due to the identification by 10th grade PSAT, which was not done in 2017, and by definition there were significantly more on-track than high-achieving students. A more detailed description of the randomization process is provided in Appendix Table 1, which shows all three distinct randomizations within the 14 total randomization blocks, for students identified in 2016 via PSAT, in 2016 via SAT, or in 2017.

Table 1 shows 88% of the sample received some treatment, ranging from 66% of the high-achieving, low-income group to 93% of the on-track, middle-income group. As described above, some of the variation in treatment assignment stems from the mailer or mailer plus intervention materials being more expensive and thus provided to fewer students, whereas the emails that dominated the on-track experiments were inexpensive and provided to most students. The full sample was 55% female with an ethnic breakdown of 10% African-American, 13% Asian, 23% Hispanic, and 47% white. We were able to identify high school characteristics using the Common Core of Data and Private School Survey for 93% of the sample; non-matches occurred if there was no recorded high school variable, a miscoded high school identifier, or the student had alternate schooling arrangements (e.g., home schooled). About 23% of the full sample lived in areas often considered rural (i.e., "town" or "rural" classification).

Table 1 also shows that there are relatively small differences between our low- and middle-income samples across characteristics that are typically highly correlated with income status. For example, among high-achieving students the low-income group is actually slightly more "advantaged" than middle-income students along a few characteristics (e.g., college-educated parents, private high school attendance) but this relationship follows a more conventional pattern for on-track students, with more "advantaged" characteristics higher in the middle-income group. We hypothesize two primary reasons why our income categorizations might produce this pattern. First, our income measure depends in part on self-reports from student surveys, and students are likely able to differentiate whether they are relatively low- or high-income better than where exactly they lie in the income distribution. Second, a student who qualifies for an SAT fee waiver is by definition low-income, but this might also be indicative of positive selection among families with higher unobserved levels of motivation or social support that helped them apply for and navigate this

process. Nonetheless, the income determination is also identified by the economic status of the residential zip code and high school attended, so is on average capturing students of lower socioeconomic status.

The empirical strategy based on our experimental design is represented by Equation (1):

$$Y_{igt} = \beta_0 + \beta_1 * Treatment_{igt} + \theta_{gt} + \varepsilon_{igt} \qquad (1)$$

Y_{ig} represents an outcome of interest for individual i in academic and income group g in high school graduation year t. As randomization occurred by year and academic-income group status we include these 14 randomization blocks as "group-by-year" fixed effects (θ_{gt}), which are shown in detail in Appendix Table 1. $Treatment_{igt}$ is equal to one for individuals assigned to a treatment condition, with robust standard errors. Appendix Table 2 shows fidelity of the randomization process, with background characteristics well balanced across individual- and school-level variables, for the full sample and separately by treatment arm (email, mailer, mailer plus).

One set of outcome measures are College Board data on SAT "score sends". Many four-year colleges require students to use an SAT "score send" as part of the application process to verify their exam performance. Prior work finds that roughly two-thirds of score sends convert into college applications, and thus can serve as a rough proxy for application patterns (Smith, 2018). There are two reasons for thinking our observed score sends are good proxies for college applications, as Smith (2018) finds they are more likely to convert to completed applications if they were sent to more selective institutions or during the senior year of high school. We examine the quantity and selectivity of colleges to which students send their scores using IPEDS data on the median SAT of the incoming freshmen class. We then combine these data to look at each student's score sending behavior, such as the average college SAT or the maximum and minimum

SAT (i.e., "best" and "worst" college), to see whether there is an indication that students may have broadened their application portfolio or targeted more selective colleges. Unfortunately, we have no data on whether students were admitted to any institutions, so can only observe application proxies and subsequent enrollment.

The second set of outcome measures is based on National Student Clearinghouse (NSC) data that identify students' initial postsecondary enrollment. We first examine whether a student enrolled in a two-year or four-year college; given the short time-frame there are few students who exhibit enrollment in multiple institutions and using alternate enrollment measures (e.g., the most selective college) does not change results. We also use IPEDS data to create metrics of the quality of the four-year college attended, using both median SAT and the college's six-year (150% time) graduation rates.[6] As much of the intervention provided simplified information on college costs, we also examine whether student shifts altered the sticker price or net costs for students from low-income families (i.e., incomes of $48,000 and below).[7]

Thus, we focus primarily on initial two- versus four-year enrollment and, for those attending four-year colleges, the characteristics of the institutions attended. In addition to these metrics we examine whether students enrolled at an institution highlighted in the intervention materials. We present results from four primary sectors of highlighted colleges:

1. The intervention materials included a customized college starter list of 12 postsecondary institutions, and we examine student enrollment at these "starter list" colleges (the method identifying these schools is described below).

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[6] Median SAT is just the midpoint of the 25th and 75th percentile as provided by IPEDS. Alternate measures of institutional quality, such as these alternate percentiles or expenditures per FTE, produce similar results.
[7] We adjust cost variables to reflect in- or out-of-state enrollment, but cannot account for unobserved differentials, such as state or institutional aid programs.

2. Roughly 150 selective "RYCP" colleges chose to accept the simplified college application fee waivers provided to a subset of randomly assigned students, and we examine enrollment in this select group of colleges. RYCP derived from "Reach Your College Potential", the name selected by the College Board for the intervention.

3. We examine enrollment at the set of approximately 270 "Aspen" colleges that were selected due to high graduation rates. These colleges are affiliated with the American Talent Initiative and the Aspen Institute's College Excellence Program. Aspen colleges can be thought of a more expansive list than the RYCP college list, as 85% of RYCP colleges were also in this Aspen category.

4. Enrollment within each Barron's selectivity level, as a broad measure of potential changes in institutional selectivity of where students attend.

Although there was interest in enrollment at RYCP and Aspen colleges due to their partnerships with the College Board, these colleges were not given any special priority in the starter college list selection process.

Results

Overall impacts

Table 2 presents a concise summary of the main experimental results, which show no meaningful impacts of the intervention on postsecondary enrollment outcomes. In general binary outcomes (e.g., two-year or four-year college attendance, attendance at specific colleges) are within 0.3 percentage points of zero, and 95% confidence intervals reject all estimates as large as 0.6 percentage points. For continuous outcomes, estimates are again close to zero and generally reject impacts as large as 0.01 standard deviations. Additional results, described below, confirm

consistently small and statistically insignificant results across all the treatment conditions and for various student subgroups, providing evidence that this experiment led to no meaningful changes to whether or where students attend college.

Overall Table 2 provides evidence there was no change in either two-year or four-year college enrollment, with an increase of 0.2 percentage points the largest estimate across cohorts. Although we focus on students in the top 50% of the national PSAT and SAT distributions, roughly 12% still choose to attend a two-year college. Some of this may be driven by differences across students in issues of affordability or major choice, or from students without any real intention to attend a four-year college, such as those in states that require students to take the SAT. Although beginning at a two-year rather than four-year college is one form of "undermatching" that has been shown to negatively impact degree completion outcomes (Goodman et al., 2017; Long & Kurlaender, 2009), the information on cost or degree completion rates provided to students did not appear to motivate them to shift into four-year colleges.

For the 2017 cohort, students were no more likely to attend one of the 12 institutions on their college starter list and, particularly relevant to the goals of the intervention, were not more likely to attend any of the six "reach" colleges on the list (Table 2, columns 3 and 4). (This analysis is possible in 2017 as the College Board created simulated starter college lists for control students, even though the control group never observed these lists; although treated students in 2016 received college starter lists, we cannot do this analysis as there were no counterfactual lists for control students). That the college starter list, which was likely the strongest nudge within the experiment, had no impact suggests that students were generally unresponsive to the information provided. Finally, Table 2 shows that conditional on four-year college enrollment there were no differences in key measures of college quality derived from IPEDS data, including the college's

median SAT scores or net cost for students coming from families with annual incomes less than $48,000.

One explanation for the null effects is that students simply ignored or were unaware of the experiment, but we provide two pieces of evidence that this is not the case. First, we note that students increased their usage of free score sends, our rough proxy for college applications, when these were randomly offered. Table 3 shows that, in general, the intervention produced no changes in how many scores students sent or the average quality of the colleges these were sent to. For example, in the 2016 cohort all results are null and 95% confidence intervals reject impacts as large as 0.03 standard deviations, which would typically be considered a small effect (Kraft, forthcoming). The one exception is for the mailer plus group in the 2017 cohort, which was the only group offered additional free score sends as part of the intervention. For this group total score sends increased by 0.34, a 9.4% increase over baseline. Although the average quality of the score sends remains unchanged (column 2), students increased the breadth of colleges under consideration. Treated students' score send portfolios included both more and less selective colleges, as shown by an increase in the maximum SAT of the portfolio of 4.4 SAT points (on a 1600 point scale) and a decrease in the minimum SAT of 5.3 SAT points. These changes correspond to a 0.08 standard deviation increase in the spread of the score send portfolio, relative to the control group.[8] Further analyzed in Appendix Table 3, we find that students sent more scores when they were offered eight free score sends rather than two, and that score sends also increased for high-achieving students randomly offered college application fee waivers even when they were not accompanied by additional score sends, providing more evidence these sends are likely a proxy

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[8] As noted in Table 3 the standard deviation in the median SAT of the scores for the control group was roughly 120 points. Alternately, for students who sent multiple score sends the individual-level standard deviation in their score send portfolio was closer to 100 points.

for application behaviors. Nonetheless, these behavioral changes always produce the same two results: (1) both increases and decreases in the selectivity of the colleges sent scores and (2) no changes in enrollment outcomes.[9]

A second piece of evidence that students were aware of the intervention comes from some limited ability to track students' usage of the BigFuture website for just the 2017 cohort (Appendix Table 4). We can observe two behaviors. First, we can see whether treated students visited their information made available to them in the BigFuture website through a website link provided. Approximately 33 percent of treated students offered pre-populated college starter lists on the website accessed those data, with higher rates for mailer plus students (47%) and lower rates for mailer or email students (26%). Control students were not offered this option. Second, we have a snapshot from March 2017 of students' BigFuture college lists; for treated students we can see whether they added a new college over and above their prepopulated list, whereas for control students this would indicate whether they added any college at all. Control students were about one percentage point more likely to add a college to their list, as pre-populating the lists likely induced some mild inertia for treated students. Yet using an omnibus measure of engagement –

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[9] In the 2017 cohort, on-track, low-income students identified through their SAT fee waiver usage who were in the treatment group were randomly assigned to either (i) two free score sends but no fee waivers; (ii) two free score sends and two additional fee waivers; (iii) eight free score sends and eight additional fee waivers. These offers were in addition to the baseline College Board policy that fee-waiver students receiver eight free SAT score sends and four fee waivers. The top panel of Appendix Table 3 shows an increase of 0.25 to 0.32 score sends when offered two additional score sends and 0.88 when offered eight additional sends, respectively, indicating that about 11-16% of the free sends were utilized. Students offered eight BigFuture score sends had a portfolio where the best and worst school had a median SAT 17 points higher and 16 points lower, a much larger spread than those offered just two score sends. We investigated whether this pattern might have changed the variance of college attended in the treatment group, but find small and generally null evidence of distributional changes. There is additional evidence that changes to score sends do indeed reflect changes to application behavior, as those given college application fee waivers increased score sending behavior: (1) students who received two free score sends and two college application fee waivers sent an additional 0.074 additional score sends ($p<0.05$) over those just receiving two score sends and no fee waivers; (2) high-achieving students, who were not offered additional score sends but did receive eight additional fee waivers, also had a statistically significant increase in score sending behavior.

either accessing the prepopulated list or adding a new school – this still results in treated students being 17 percentage points more likely to engage with the website than control group students.[10]

Disaggregated impacts

Additional disaggregation by treatment arm, income and achievement levels, demographic characteristics, or other values consistently finds null impacts. Table 4 presents complete results for the 2016 and 2017 cohorts, disaggregated by the three treatment arms and employing a more expansive set of outcomes. There are no impacts on initial attendance at a two- or four-year college, at any of the colleges on students' starter lists, or measures of college quality or cost (we find no impacts on the "best in-state public option" provided in the starter list, and alternate college quality or college cost measures show no impacts, but are omitted for brevity). Results in this slightly more disaggregated sample still reject binary outcomes as large as 1 percentage point and continuous outcomes of 0.03 to 0.04 standard deviations. Appendix Table 5 shows that students were not generally more likely to attend RYCP, Aspen, or higher ranked Barron's colleges. This table also highlights the need for replication; although we find a small but positive and statistically significant effect that the intervention increased enrollment in RYCP colleges for the "mailer plus" group in the 2016 cohort, there was no such effect for the 2017 cohort, suggesting this initial result was likely spurious. Figure 1 further extends this approach by estimating treatment effects on

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[10] As noted above, control students had access to BigFuture but treated students received more encouragement to engage with the BigFuture website and their college starter lists came pre-populated into their BigFuture account. In raw terms, among treated students 17% followed the link but did not add at least one school to their list on BigFuture, 14% followed the link and added a school, 9% did not follow the link but visited BigFuture and added a school, and 61% neither followed the link or added a school. Among control students, 26% visited BigFuture and added at least one school to their list and 74% did not add a school. In total, 39% of treated students either followed the link or added a school, compared to 26% of control group students (who never were offered the link). We do not use this difference as a first-stage of engagement as there were other ways in which the brochure might have spurred discussions with parents or counselors independent of the website usage, but doing so would not change the substance of the results as a simple rescaling would still produce impacts of generally less than 1 percentage point on the type of college attended, with all results statistically insignificant.

college selectivity, as measured by median freshmen SAT, for all 22 experiments within the 14 randomization blocks, each distinct but with more limited power than the previously presented aggregated results. (For example, high-achieving, low-income students in Fall 2016 were randomly assigned to either mailers or mailers, which could be evaluated as two separate experiments, and on down the line). Overall the results are all close to zero and symmetric in their distribution, with the strongest result still rejecting impacts as large as 0.07 standard deviations and the weakest result rejecting negative impacts as large as 0.08 standard deviations. Thus pooling results across different experimental conditions that varied by achievement, income, and year does not appear to mask important results; alternate versions focused on other outcomes are similar.[11]

We also find no evidence that null impacts on average college characteristics mask important distributional effects in outcomes or for specific groups. There are no impacts on enrollment based on deciles of college quality, as measured by median freshmen SAT, or academic measures of "fit" between students and colleges (e.g., having a PSAT or SAT score that more closes matches the average academic score of attending students; attending a "reach" or "fit" college); these results are omitted for brevity.

Table 5 explores heterogeneity in student outcomes based on background characteristics, with Appendix Table 6 showing impacts on score sending and enrollment in targeted postsecondary sectors. The first rows of Table 5 focus on individual-level differences by achievement and income categories, ethnicity (Asian and white students compared to African-American and Hispanic

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[11] Using median freshmen SAT as a sample outcome, power calculations for each of these separate 22 experiments would allow us to identify individual effects that ranged from 0.038 to 0.072 standard deviations, though this can be considered the low end of our power range as we assume sample sizes based only on observations with a valid value (i.e., students who attend no college or a two-year college are not included in power calculations). Power calculations are derived post-hoc from 'power twomeans' in Stata 15.1 and are based on control and treatment group sample sizes with a valid value, assuming power of 0.8 and using the mean and standard deviation values from the control group and no explanatory value from covariates.

students), and gender. In general we find small and statistically insignificant impacts. The largest observed gains come from students often considered underrepresented in higher education, as African-American and Hispanic students are one-half of a percentage point more likely to attend a reach college on their starter list (p<0.10) and exhibit an increase in median SAT of where they enroll by 3.1 points (p<0.01), with no similar gains for Asian or white students; Appendix Table 6 shows small positive impacts on attendance at RYCP and Aspen colleges as well. Yet it is unclear how much to make of these results: the gain in college SAT is very small at roughly 0.02 standard deviations and enrollment outcomes do not retain statistical significance after adjusting for multiple hypothesis testing.[12] Another concern is overall treatment effects may not be comparable given variation in assignment to the mailers plus, mailers, and email treatments arising from variation in income and academic background status. For example, African-American and Hispanic students are less likely to be classified as high-achieving than Asian or white students, so examining differences in treatment impacts across groups may be confounding ethnic background (or some other characteristic) with the specific treatment received. Appendix Table 7 shows full results based on each treatment arm, but again notes no consistent differences. In particular, we find the largest impacts on college selectivity for African-American and Hispanic students are from the lighter-touch email intervention, which does not conform to standard expectations and further complicates these results.

The bottom half of Table 5 focuses on high school characteristics, including urbanicity (as defined by high school geography) and whether a student attended a school with few high-achieving students. Schools with few high-achieving students are labeled "non-feeder" schools and defined similarly to Hoxby and Turner (2013), indicating fewer than 30 high-achieving (i.e., top 10%)

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[12] Multiple hypothesis testing was done based on the Westfall-Young technique using Stata's wyoung command.

students in a cohort (Hoxby & Avery, 2013). In prior work, Hoxby and Avery (2013) found that interventions targeting students not in feeder schools were effective as these students were more academically isolated and less likely to receive common forms of college outreach, simply due to economies of scale that make visiting these schools infeasible. In neither case do we find evidence of impacts on college attendance outcomes.[13]

As one final experiment, in 2017 the College Board also tested two different messaging campaigns, one based on "cost", which delivered a message that sticker price gave a misleading indication of average price for low- or middle-income students, and one on "fit", which told the recipients that other individuals just like them went to these types of colleges (sample mailers are provided in Appendix 3). In addition, each brochure randomly did or did not provide data on the average earnings for each college based on the College Scorecard data. Appendix Table 8 shows that in general there were no differences in outcomes based on any of these treatment arms.

Conclusion

The College Board undertook a large, national experiment that sent students brochures and emails about the college application process but produced no observable changes in postsecondary enrollment outcomes. Null results did not vary across the format of our delivery or whether we included financial incentives or administrative reminders. The lone exception are positive impacts among African-American and Hispanic students, though these are extremely small and not

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[13] Feeder school calculations described more fully in Appendix 1. Finer grain measures of what determines "feeder" status – for example, focusing on schools where 5 or 10 or 20 students are high scorers, produces consistently null results. Results that focus only on high-achieving, low-income students enrolled in non-feeder high schools, which most closely approximates Hoxby and Turner (2013), produces different point estimates though results are statistically noisy. For example, for this group we find a statistically insignificant but positive impact on median SAT of the college attended of 2.7 SAT points with a standard error of 2.7, compared an effect of 15.5 SAT points with a standard error of 7.1 as found in Hoxby and Turner (2013).

consistently found across outcome measures. Given the scale of the intervention and the large sample size, our statistically precise estimates rule out meaningful impacts.

Given these results, what have we learned? We believe that two potential problems in the college application process – attention and information salience – cannot entirely explain the null results. First, increased usage of College Board's BigFuture website and the free SAT score sends shows that students were aware of and responded to the intervention materials. Salience could be an issue if students were unaware of the College Board brand, but the national reach and importance of the PSAT, SAT, and AP suggests students did not completely dismiss this information. On the other hand, the branding associated with our intervention was substantially different from most prior interventions. Prior outreach efforts have typically come from academics with affiliated postsecondary institutions, government agencies, or from smaller, non-profit organizations (e.g., Dynarski et al. (2018)),. Students may place different value on information from independent college counseling services or higher education institutions. Although there was no cost to the student to participate in the initiative, providing information via an organization that typically has a more transactional relationship with the student may complicate how this information is received.

Our evidence suggests that one key issue is students received the information but did not use it to consistently apply to more selective colleges. Data on SAT score sends suggests that students became interested in both higher and lower quality institutions, though even these changes were of a relatively small magnitude and unlikely to result in large changes to observed enrollment. Thus it appears that efforts to shift college enrollment were thwarted primarily, though not exclusively, at the application stage. Given the influence of neighborhood, family, and peers in the college selection process, the type of information we provided may not have been sufficiently novel or compelling to change student behavior. The College Board was also comfortable

providing to students publicly available data on the relative costs or selectivity of various colleges, and advocating broadly for the importance of attending a more selective college, but did not want to take a role in promoting specific institutions as being more meritorious. College outreach or direct service programs, which provide a more intensive but human touch working directly with students, may be more efficacious than information-based initiatives in substantially altering college application behaviors, potentially through advising students towards specific institutions (Barr & Castleman, 2017; Gurantz et al., 2017; Gurantz et al., 2020; Sullivan et al., 2019). In general, research suggests that simply providing information is less effective than interventions that provide direct application assistance (Bettinger et al., 2012; Finkelstein & Notowidigdo, forthcoming). If we hope that predominately information driven interventions are to move the needle on enrollment, we may need improved data using both individual-level information on students' preferences combined with detailed information on college-specific offerings or strengths, and more tailored information on college costs. Yet this approach also suggests that large-scale informational interventions may not be sufficient to move many individual students into new academic environments, given the specificity of the data required.

Although many researchers have worked to improve various aspects of the college application process, the initial stages of the intervention was most closely inspired by the successful ECO-C intervention (Hoxby & Turner, 2013), though there were substantial differences between the two research designs. First, we targeted a much larger group of students, including those below the 90th SAT percentile, students with higher projected incomes, and students attending "feeder" schools (i.e., generally urban or higher-performing). For many students, we conducted outreach through emails, which may have diluted impacts due to distaste of electronic correspondence (qualitative

results from ECO-C support this idea). Nonetheless, our best attempt at mimicking their sample still produces no statistically significant effects, so cannot fully explain differences in outcomes.

We believe there are four relevant differences between the two initiatives that might help inform these disparate results. First, as noted above, the specific messaging offered by the College Board may be consumed differently than what could be offered by government agencies or individual colleges. Small but potentially important branding differences, such as our mailer design or use of a website for organizing college lists, may have been less catchy relative to alternative formats. Second, ECO-C also utilized their own list selection process, which may have less constraints on which types of colleges to promote than what was produced by the College Board. Third, our sample was drawn from PSAT and SAT test-takers, while ECO-C also created a sample using student ACT scores. Geographical differences in the sample may have contributed to our smaller results, with ACT participation less concentrated on the coasts and more concentrated in the middle of the U.S.[14]

A final concern is the timing of our initiatives, with our initiative targeting students in the 2016 and 2017 graduating cohorts. Increased efforts on the part of selective colleges to improve the enrollment of lower- and middle-income students, in particular as a result of prior work by Avery, Hoxby, and Turner and other similar research, means that control group students may be receiving considerably more outreach from selective colleges than even a few years ago. Experimental work on application and enrollment has spurred a growth in the development of college assistance organizations toward traditionally underrepresented students, perhaps muting the College Board's

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[14] We find no differences in results when disaggregating by SAT versus ACT dominant states but the problem may be that we lack the relevant ACT taking population.

efforts to provide informational interventions.[15] Tracking students from 2004 through 2016 suggests that high-achieving, low-income students have closed the gap in score sending behavior and college enrollment with their similarly prepared but high-income peers, though this work is in progress and trends in the self-selected sample of SAT takers presents many challenges (Pender & Welch, 2018).[16] On the other hand, the college-going rate of our high-achieving, low-income student sample is relatively similar to that of the ECO-C project – although not directly comparable, 67% of our sample in non-feeder schools attended a four-year college compared to roughly 72% of their sample, highlighting that the problem of undermatch is by no means solved.[17] Thus general knowledge as to the existence of undermatch, combined with work by schools, colleges, philanthropies, and other organizations, may have had some impact on the compliers most likely to be influenced by a "lighter-touch", information-based intervention, though ultimately more work is needed to understand trends over time.

Finally, it is possible that the intervention changed student outcomes in ways unobserved by the researchers. The intervention may have expanded the application portfolio for some students but narrowed it for others, depending on the types of colleges offered, leaving the average enrollment decisions unchanged. The information may have also changed where students enroll in subtle ways, such as their "fit" or "match" to an institution, that do not show up in typical outcome measures, or simply saved students time along the way. Future exploration will examine whether

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[15] A comparable example is the introduction of the College Navigator that occurred between the first and second waves of ECO-C project, leading the "application guidance" portion of their initiative to be less relevant over time (Hoxby & Turner, 2013).

[16] Pender & Welch (2018) analyze enrollment outcomes from SAT takers from 2004 through 2016, though there are a few limitations to their analysis, primarily that: the results only pertain to SAT takers, and do not reflect gaps in enrollment between all low- and high-income students; income is self-reported, with approximately 40% of students not reporting family income, and; the size of the SAT-taking population has generally increased over time, with the largest gains from students who are self-reporting high-income levels.

[17] In Appendix A6 of Hoxby and Turner (2013) they show that 67% of control group students attend an institution that is "peer minus 30 percentiles", which should cover many though not all four-year colleges.

there are changes in persistence or completion for treated students, though as of this writing we find no evidence of persistence effects into the second year of college for the 2016 cohort. At a minimum, providing additional information and a set of starter colleges did not lead students to any observable negative impacts, which is always a possibility and has been observed in some public policy programs (e.g,. Cohodes and Goodman (2014)). The key finding is that continued exploration on how best to serve the millions of students navigating their path to college is warranted.

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Figure 1. Impact on median SAT of college attended, by experimental condition
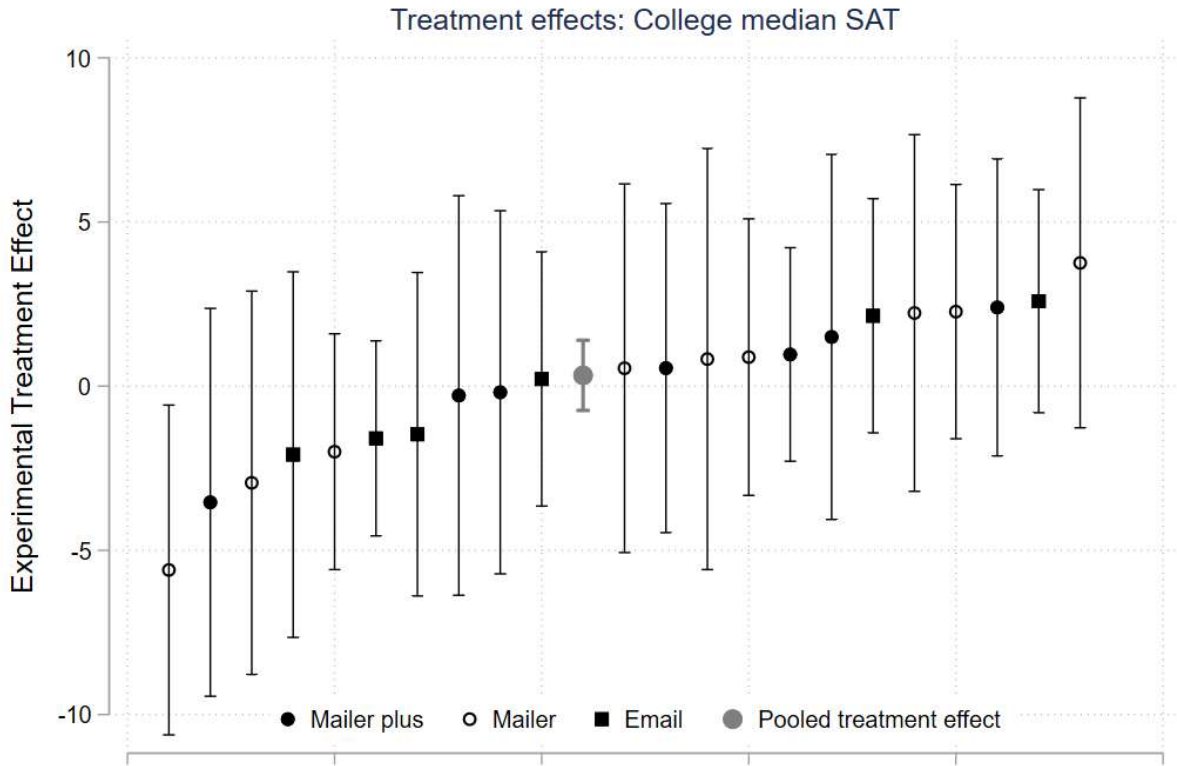
Notes. Figure includes 22 distinct treatment effects derived from the 14 randomization blocks based on randomization timing (Spring 2016, Fall 2016, Spring 2017) and academic and income status (high-achieving or on-track and middle- or low-income), as described in Appendix Table 1. Some blocks assigned students to one of two potential treatment arms (mailers plus vs mailers; mailers vs. emails; mailers plus vs. emails). The pooled treatment effect for the entire sample is in gray and provided in Table 2.

Table 1. Student characteristics of participants in Reach Your College Potential intervention, by background status

Sample	(1) Full sample	(2) 2016 cohort only	(3) 2017 cohort only	(4) High-achieving Low-income	(5) High-achieving Middle-income	(6) On-track Low-income	(7) On-track Middle-income
N	785752	536533	249219	37436	55204	305121	375518
Treatment	88.0%	89.2%	85.4%	66.3%	75.2%	88.9%	92.5%
Treatment type[a]							
Mailers plus	11.7%	6.8%	22.1%	37.3%	36.1%	17.4%	1.3%
Mailers	12.3%	10.0%	17.2%	29.0%	30.4%	10.8%	9.6%
Emails	64.0%	72.3%	46.1%	0.0%	8.7%	60.7%	81.6%
Demographics[b]							
Female	54.5%	54.9%	53.5%	45.3%	44.9%	56.1%	55.5%
African-American	9.8%	9.8%	10.0%	4.8%	4.4%	12.8%	9.0%
Asian	13.3%	12.8%	14.3%	24.3%	29.5%	11.5%	11.4%
Hispanic	22.5%	19.1%	29.8%	14.4%	12.6%	29.9%	19.1%
White	46.9%	51.5%	37.0%	50.3%	46.5%	38.6%	52.5%
Other ethnicity	7.5%	6.8%	9.0%	6.2%	7.0%	7.3%	7.9%
College-educated parents	31.5%	26.7%	41.7%	57.1%	53.9%	26.0%	31.1%
Academics							
Took PSAT	86.3%	96.0%	65.4%	91.7%	90.0%	87.5%	84.1%
PSAT: Math	526	533	505	640	646	506	511
PSAT: Verbal	513	522	486	613	621	493	502
PSAT: Writing	499	508	468	597	600	479	488
Took SAT	66.3%	65.2%	68.5%	84.2%	81.4%	68.3%	60.1%
SAT: Verbal[c]	566	553	592	663	662	548	550
SAT: Math	565	557	583	677	675	547	545
High school characteristics[d]							
Type: Public	84.5%	81.8%	90.3%	81.0%	82.4%	85.8%	84.2%
Type: Private	8.1%	8.6%	7.1%	12.6%	9.7%	7.1%	8.1%
Type: Unknown	7.4%	9.6%	2.7%	6.4%	7.9%	7.1%	7.7%
Location: City	32.4%	30.2%	37.2%	36.4%	35.8%	36.9%	28.2%
Location: Suburb	37.0%	36.3%	38.4%	43.6%	36.3%	37.6%	35.3%
Location: Town	8.0%	8.3%	7.4%	4.2%	7.1%	6.2%	10.1%
Location: Rural	15.2%	15.7%	14.3%	9.4%	12.9%	12.2%	18.7%

Notes. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. [a] Treatment type indicates whether students received outreach primarily in the form of emails, mailed brochures, or brochures with extra outreach opportunities, as defined in the text. [b] Demographics are student self-reports. [c] The 2016 cohort primarily took the three-section, 2400 point SAT and the 2017 cohort took the revised, two-section, 1600 point SAT; thus verbal indicates "critical reading" for the 2016 cohort and "evidence-based reading and writing" for the 2017 cohort. [d] High school characteristics are taken from the Common Core of Data (CCD) or Private School Survey (PSS).

Table 2. Impact of Reach Your College Potential intervention on postsecondary enrollment outcomes, by high school graduation

		(1)	(2)	(3)	(4)	(5)	(6)
		Initial attendance		College Starter list		College characteristics	
	N	Two-year	Four-year	Any college	"Reach" college	College median SAT	Net cost, family income <= $48K
Full sample	785752	0.001	-0.000	--	--	0.329	0.750
		(0.001)	(0.002)	--	--	(0.545)	(28.287)
2016 cohort	536533	0.000	0.001	--	--	1.037	33.344
		(0.002)	(0.002)	--	--	(0.705)	(37.705)
2017 cohort	249219	0.002	-0.003	-0.000	0.000	-0.726	-43.086
		(0.002)	(0.003)	(0.003)	(0.002)	(0.862)	(42.489)
Baseline means		0.116	0.645	0.347	0.073	1229	$13,073
Baseline st. deviation		0.321	0.479	0.476	0.261	132	$6,334

Notes. + $p<0.1$, * $p<0.05$, ** $p<0.01$. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Baseline means and standard deviations calculated from control group students who did not receive treatment. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers. The College Starter list refers to the 12 total colleges or 6 "reach" colleges generated for student brochures or available on the BigFuture website; "reach" indicates the applicant's SAT falls below the colleges 25th percentile SAT score or the college accepts less than 20 percent of all applicants. College characteristics are only for students attending four-year colleges. College median SAT is the midpoint of the 25th and 75th percentile SAT of freshmen enrollees as determined by IPEDS. Baseline means and standard deviations are for the full sample and vary slightly between years.

Table 3. Impact of Reach Your College Potential intervention on SAT score sending outcomes, by high school graduation year and treatment arm

	(1)	(2)	(3)	(4)
		SAT score sends		
	Total sends	Average of median college SAT	Minimum of median college SAT	Maximum of median college SAT
2016 cohort				
Mailers Plus	0.007	1.433	1.654+	1.745
	(0.028)	(0.951)	(1.004)	(1.235)
Mailers	0.012	1.366	1.278	1.667
	(0.024)	(0.877)	(0.925)	(1.138)
Email	0.016	0.354	-0.728	0.937
	(0.023)	(0.886)	(0.936)	(1.151)
Baseline means	3.65	1268	1158	1369
Baseline st. dev.	4.39	124	124	147
N	536533	283096	283096	283096
2017 cohort				
Mailers Plus	0.344**	-0.617	-5.278**	4.448**
	(0.035)	(1.073)	(1.140)	(1.423)
Mailers	0.006	-0.006	-0.361	-0.868
	(0.030)	(1.130)	(1.201)	(1.499)
Email	0.038	-0.830	-1.504	-0.657
	(0.027)	(1.037)	(1.102)	(1.376)
Baseline means	3.66	1240	1128	1348
Baseline st. dev.	3.86	115	119	144
N	249219	158288	158288	158288

Notes. + $p<0.1$, * $p<0.05$, ** $p<0.01$. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Baseline means and standard deviations calculated from control group students who did not receive treatment. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. Treatment type indicates whether students received outreach primarily in the form of emails, mailed brochures, or brochures with extra outreach opportunities. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers.

Table 4. Impact of Reach Your College Potential intervention on postsecondary enrollment outcomes, by high school graduation year and treatment arm

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Initial attendance		College Starter list				College quality		College cost	
							College median SAT	Six-year bachelor's rate	Cost of attendance	Net cost, family income <= $48K
	Two-year	Four-year	Any	Reach	Fit	Safety				
2016 cohort										
Mailers Plus	0.003	-0.002	--	--	--	--	1.222	0.003+	-63.915	17.393
	(0.003)	(0.004)	--	--	--	--	(1.046)	(0.001)	(112.263)	(59.121)
Mailers	0.003	-0.003	--	--	--	--	0.848	0.001	-82.074	9.452
	(0.002)	(0.003)	--	--	--	--	(0.957)	(0.001)	(98.840)	(52.058)
Email	-0.003	0.006+	--	--	--	--	1.074	0.001	-5.578	57.419
	(0.002)	(0.003)	--	--	--	--	(0.974)	(0.001)	(94.607)	(49.833)
Baseline means	0.108	0.651	--	--	--	--	1240	0.671	$30,113	$13,453
Baseline st. dev.	0.310	0.477	--	--	--	--	134	0.176	$13,142	$6,438
N	536533	536533	--	--	--	--	298546	313192	342401	342054
2017 cohort										
Mailers Plus	0.003	-0.004	-0.005	0.001	-0.006	-0.002	-0.192	-0.001	-136.728	-96.461
	(0.003)	(0.005)	(0.005)	(0.003)	(0.004)	(0.002)	(1.352)	(0.002)	(130.735)	(69.058)
Mailers	0.001	-0.004	0.002	-0.001	0.005	-0.002	-1.147	-0.001	-246.300*	-82.306
	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	(0.002)	(1.287)	(0.002)	(118.056)	(62.376)
Email	0.002	-0.001	0.003	-0.001	0.003	-0.001	-1.059	-0.001	-57.105	26.478
	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	(0.001)	(1.177)	(0.002)	(106.527)	(56.285)
Baseline means	0.130	0.636	0.347	0.073	0.198	0.052	1212	0.633	$28,415	$12,509
Baseline st. dev.	0.336	0.481	0.476	0.261	0.399	0.223	127	0.174	$12,030	$6,134
N	249219	249219	249219	249219	249219	249219	145357	154079	172752	172544

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Baseline means and standard deviations calculated from control group students who did not receive treatment. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. Treatment type indicates whether students received outreach primarily in the form of emails, mailed brochures, or brochures with extra outreach opportunities. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers. The College Starter list refers to the 12 total colleges generated for student brochures or available on the BigFuture website; "reach" indicates the applicant's SAT falls below the colleges 25th percentile SAT score or the college accepts less than 20 percent of all applicants, "fit" are where a student's SAT falls with an institution's interquartile range, and "safety" is where the student's SAT exceeds the 75th percentile SAT score. Counterfactual college starter lists for control group students were not available in 2016. College characteristics are only for students attending four-year colleges. College median SAT is the midpoint of the 25th and 75th percentile SAT of freshmen enrollees as determined by IPEDS.

Table 5. Impact of Reach Your College Potential intervention on postsecondary enrollment outcomes, heterogeneous effects

		(1)	(2)	(3)	(4)	(5)	(6)
		Initial attendance		College Starter list		College characteristics	
					"Reach"	College median	Net cost, family
	N	Two-year	Four-year	Any college	college	SAT	income <= $48K
High-achieving, low-income	37436	0.000	-0.001	0.007	0.004	0.148	-92.184
		(0.002)	(0.004)	(0.010)	(0.005)	(1.585)	(90.157)
Baseline means		0.037	0.809	0.444	0.066	1313	$14,080
High-achieving, middle-income	55204	0.003	-0.006	-0.016	-0.007+	0.358	-15.675
		(0.002)	(0.004)	(0.011)	(0.004)	(1.445)	(75.816)
		0.043	0.794	0.463	0.047	1293	$13,709
On-track, low-income	305121	-0.003	0.004	0.001	0.004+	0.344	49.747
		(0.002)	(0.003)	(0.004)	(0.002)	(0.933)	(45.490)
		0.146	0.580	0.322	0.077	1191	$12,361
On-track, middle-income	375518	0.004+	-0.005	-0.002	-0.006*	0.665	-21.246
		(0.002)	(0.003)	(0.005)	(0.003)	(0.967)	(49.389)
		0.148	0.572	0.331	0.076	1182	$12,823
Ethnicity: White or Asian	472834	0.002	-0.001	-0.004	-0.004+	-0.547	29.772
		(0.002)	(0.002)	(0.004)	(0.002)	(0.650)	(36.309)
		0.106	0.668	0.375	0.073	1236	$13,569
Ethnicity: African-American or Hispanic	254231	0.001	-0.003	0.002	0.005+	3.005**	-13.657
		(0.002)	(0.003)	(0.004)	(0.002)	(1.078)	(49.173)
		0.132	0.616	0.328	0.076	1214	$12,094
Female	428144	0.001	0.000	0.001	0.002	0.463	6.262
		(0.002)	(0.002)	(0.004)	(0.002)	(0.737)	(38.595)
		0.110	0.677	0.361	0.084	1225	$13,234
Male	355654	0.001	-0.001	-0.002	-0.002	0.180	-5.291
		(0.002)	(0.003)	(0.004)	(0.002)	(0.810)	(41.491)
		0.124	0.612	0.333	0.061	1235	$12,888
Location: City or suburb	544892	0.001	-0.001	0.000	-0.001	-0.050	-17.691
		(0.001)	(0.002)	(0.003)	(0.002)	(0.628)	(33.038)
		0.118	0.680	0.353	0.078	1236	$13,009
Location: Town or rural	182874	0.003	-0.002	-0.003	0.004	0.691	51.394
		(0.003)	(0.004)	(0.006)	(0.003)	(1.135)	(56.669)
		0.134	0.639	0.336	0.059	1199	$13,197
HS type: Feeder[a]	200548	0.001	-0.002	0.009+	0.001	0.207	-7.472
		(0.002)	(0.003)	(0.005)	(0.003)	(0.955)	(53.213)
		0.108	0.720	0.375	0.079	1265	$13,130
HS type: Non-feeder	585204	0.001	0.000	-0.004	-0.000	0.282	6.005
		(0.001)	(0.002)	(0.003)	(0.002)	(0.658)	(33.411)
		0.120	0.614	0.337	0.071	1211	$13,048

Notes. + p<0.1, * p<0.05, ** p<0.01. a Feeder schools are either (i) magnet schools or (ii) had 30 or more high-achieving (top 10%) SAT students in the 2015 cohort. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Baseline means and standard deviations calculated from control group students who did not receive treatment. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency.The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers. The College Starter list refers to the 12 total colleges or 6 "reach" colleges generated for student brochures or available on the BigFuture website; "reach" indicates the applicant's SAT falls below the colleges 25th percentile SAT score or the college accepts less than 20 percent of all applicants. College characteristics are only for students attending four-year colleges. College median SAT is the midpoint of the 25th and 75th percentile SAT of freshmen enrollees as determined by IPEDS. Baseline means and standard deviations are for the full sample and vary slightly between years.

Appendix Table 1. Treatment assignment for Reach Your College Potential intervention, by background status

Background	Timing	Control	Treatment	Mailers plus	Mailers	Email
				Treatment assignment		
HALI: High-achieving, low-income	Spring 2016	4046	4045	0	4045	0
	Fall 2016	5000	13599	6799	6800	0
	Spring 2017	3582	7164	7164	0	0
HAMI: High-achieving, middle-income	Spring 2016	5997	21113	15112	6001	0
	Fall 2016	5000	9596	4798	0	4798
	Spring 2017	2700	10798	0	10798	0
OTLI: On-track, low-income	Spring 2016	5996	16990	4996	11994	0
All students	Fall 2016	8000	163347	0	5000	158347
Identified through SAT fee waiver	Spring 2017	9981	48000	48000	0	0
Not identified through SAT fee waiver	Spring 2017	10000	42807	0	16000	26807
OTMI: On-track, middle-income	Spring 2016	9996	24989	4996	19993	0
	Fall 2016	8000	218346	0	0	218346
	Spring 2017	10000	104187	0	15999	88188
First-generation	Fall 2016	6000	6473	0	0	6473

Appendix Table 2. Balance checks for randomization of Reach Your College Potential intervention

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
															High School Characteristics					
	Female	African-American	Asian	Hispanic	White	Other ethnicity	Parent has bachelor's	Took PSAT	PSAT math	PSAT verbal	PSAT writing	Took SAT	SAT Verbal	SAT Math	Public	Private	City	Suburb	Town	Rural
All years	0.000	-0.001	0.001	0.001	0.001	-0.001	-0.002	0.001	0.356	0.043	-0.056	0.004**	-0.152	0.567*	0.001	-0.000	0.001	-0.000	0.001	-0.001
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.264)	(0.250)	(0.269)	(0.002)	(0.265)	(0.281)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Main treatment arms																				
Mailers Plus	-0.001	-0.003+	0.002	0.004+	-0.003	-0.000	-0.004	0.002	-0.042	0.182	0.124	0.003	-0.097	0.610	-0.000	0.001	0.000	0.002	0.001	-0.002
	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.408)	(0.386)	(0.415)	(0.003)	(0.387)	(0.411)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Mailers	-0.002	-0.002+	0.002	-0.003	0.003	-0.000	0.000	0.002	0.566	-0.215	-0.306	0.001	-0.388	0.569	0.003	-0.001	0.001	-0.001	0.000	0.001
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.349)	(0.330)	(0.355)	(0.002)	(0.360)	(0.381)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Email	0.002	0.000	-0.001	0.001	0.002	-0.002+	-0.001	0.001	0.464	0.133	0.001	0.007**	-0.036	0.530	0.002	-0.001	0.002	-0.001	0.000	-0.001
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.339)	(0.320)	(0.344)	(0.002)	(0.349)	(0.369)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Baseline means	0.525	0.090	0.161	0.225	0.449	0.075	0.345	0.851	549.5	532.8	517.1	0.714	590.5	592.5	0.847	0.087	0.341	0.384	0.070	0.138
N	785752	785752	785752	785752	785752	785752	785752	785752	678151	678144	677964	785752	520736	520736	785752	785752	785752	785752	785752	785752

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Baseline means calculated from control group students who did not receive treatment. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. Treatment type indicates whether students received outreach primarily in the form of emails, mailed brochures, or brochures with extra outreach opportunities.

Appendix Table 3. SAT score sending and postsecondary enrollment outcomes for 2017 cohort

On-track, low-income SAT fee-waiver students who received offer of SAT score sends or college application fee waivers	(1) Had a least one score send	(2) Total score sends	(3) Average of median college SAT	(4) Minimum of median college SAT	(5) Maximum of median college SAT	(6) Freshmen median SAT of college attended
Two free score sends and no CAFW	0.011*	0.246**	-0.946	-5.577**	3.261	0.420
	(0.005)	(0.045)	(1.617)	(1.720)	(2.071)	(1.883)
Two free score sends and two CAFW	0.010*	0.321**	-0.665	-6.204**	6.029**	1.593
	(0.005)	(0.043)	(1.545)	(1.643)	(1.978)	(1.798)
Eight free score sends and eight CAFW	0.014*	0.884**	0.618	-16.398**	16.937**	0.096
	(0.007)	(0.059)	(2.108)	(2.242)	(2.699)	(2.459)
Baseline means	0.77	3.52	1222	1120	1321	1193
Baseline st. dev.	0.42	3.46	113	120	143	120
N	57981	57981	43080	43080	43080	37789
High-achieving, low-income students offered college application fee waivers but no free score sends						
Mailers plus	0.025**	0.246**	-4.294	-4.247	-2.272	-3.538
	(0.008)	(0.095)	(2.727)	(3.163)	(3.005)	(3.013)
Baseline means	0.48	2.02	1226	1140	1311	1200
Baseline st. dev.	0.50	3.17	118	121	147	120
N	10746	10746	8393	8393	8393	8401
All other students who did not receive free score sends or college application fee waivers						
Mailers	0.001	0.008	0.359	-0.116	-0.290	-1.147
	(0.004)	(0.026)	(1.306)	(1.374)	(1.711)	(1.242)
Emails	0.001	0.018	-0.277	-0.870	-0.063	-1.059
	(0.004)	(0.023)	(1.201)	(1.264)	(1.573)	(1.136)
Baseline means	0.79	4.59	1343	1221	1437	1306
Baseline st. dev.	0.41	4.50	118	138	129	132
N	180492	180492	80175	80175	80175	99167

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Estimates based only on score sends that occurred after the experiment started. Baseline means and standard deviations calculated from control group students who did not receive treatment. Sample restricted to students: (i) in the high school cohort of 2017; (ii) identified as high-achieving based on PSAT/SAT performance in the top 10% of the national distribution; and (iii) low-income students, as identified by SAT fee waiver usage. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers. College median SAT is the midpoint of the 25th and 75th percentile SAT of freshmen enrollees as determined by IPEDS. The last category of students includes: on-track low-income students who did not use an SAT fee waiver, and both high-achieving and on-track middle-income students.

Appendix Table 4. Utilization of BigFuture website for 2017 cohort

	(1)	(2)	(3)
	Accessed pre-populated college starter list on BigFuture website	Added at least one school to college starter list as of March during 12th grade	Accessed starter list or added at least one school
Treatment	0.332**	-0.011**	0.165**
	(0.002)	(0.002)	(0.003)
Treated Categories			
Mailers Plus	0.469**	-0.007+	0.224**
	(0.004)	(0.004)	(0.005)
Mailers	0.254**	-0.012**	0.128**
	(0.003)	(0.003)	(0.004)
Email	0.259**	-0.015**	0.134**
	(0.003)	(0.003)	(0.004)
Baseline means	0.001	0.257	0.258

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Baseline means and standard deviations calculated from control group students who did not receive treatment. Sample restricted to 249,219 students: (i) in the high school cohort of 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. Treatment type indicates whether students received outreach primarily in the form of emails, mailed brochures, or brochures with extra outreach opportunities.

Appendix Table 5. Impact of Reach Your College Potential intervention on sector of postsecondary enrollment, by high school graduation year and treatment arm

	(1)	(2)	(3)	(4)	(5)
			Barrons' selectivity category		
	RYCP	Aspen	Top 1	Top 2	Top 3
2016 treatments					
Mailers Plus	0.008**	0.003	-0.001	-0.000	-0.000
	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)
Mailers	-0.001	0.001	-0.001	-0.000	-0.000
	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)
Emails	0.002	0.004	0.001	-0.000	-0.000
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Control means (2016)	0.165	0.292	0.053	0.114	0.186
2017 treatments					
Mailers Plus	-0.002	-0.001	-0.001	0.001	-0.003
	(0.003)	(0.004)	(0.001)	(0.002)	(0.003)
Mailers	-0.004	-0.001	-0.001	-0.001	0.001
	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)
Emails	-0.002	0.000	-0.001	-0.000	0.000
	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)
Control means (2017)	0.119	0.228	0.028	0.076	0.142

Notes. + $p<0.1$, * $p<0.05$, ** $p<0.01$. RYCP refers to a set of approximately 150 selective colleges that partnered with the College Board to accept specially designed college application fee waivers. Aspen refers to approximately 270 colleges with high graduation rates; almost all RYCP colleges are also Aspen colleges. Barron's selectivity categories 1, 2, and 3 refer to "most competitive", "highly competitive plus", and "highly competitive", respectively. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Baseline means calculated from control group students who did not receive treatment. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. The number of observations includes 536,533 and 249,219 in the 2016 and 2017 cohorts, respectively. Treatment type indicates whether students received outreach primarily in the form of emails, mailed brochures, or brochures with extra outreach opportunities. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers.

Appendix Table 6. Impact of Reach Your College Potential intervention on SAT score sending and sector of postsecondary enrollment, heterogeneous outcomes

		(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)	(9)
		\multicolumn{4}{c}{SAT score sends}		\multicolumn{5}{c}{Barrons' selectivity category}
	N	Total	Average SAT	Min SAT	Max SAT		RYCP	Aspen	Top 1	Top 2	Top 3
High-achieving, low-income	37436	0.117*	0.440	0.692	0.327		-0.001	0.001	-0.004	-0.006	-0.008
		(0.057)	(1.345)	(1.564)	(1.445)		(0.005)	(0.006)	(0.004)	(0.005)	(0.005)
High-achieving, middle-income	55204	0.016	1.468	0.917	1.461		0.000	-0.003	-0.000	0.001	0.001
		(0.050)	(1.260)	(1.413)	(1.412)		(0.004)	(0.005)	(0.003)	(0.004)	(0.004)
On-track, low-income	305121	0.142**	0.026	-3.112**	2.849**		-0.000	0.005*	-0.001	0.001	0.002
		(0.021)	(0.782)	(0.820)	(1.042)		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
On-track, middle-income	375518	-0.011	-0.084	-0.295	0.532		0.001	-0.002	0.000	-0.001	-0.002
		(0.021)	(0.914)	(0.943)	(1.256)		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Ethnicity: White or Asian	472834	0.027	0.110	-0.091	0.809		-0.001	-0.000	-0.001	-0.001	-0.001
		(0.017)	(0.608)	(0.640)	(0.796)		(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Ethnicity: African-American or Hispanic	254231	0.127**	0.281	-2.765**	2.528*		0.003+	0.005+	0.001	0.002	0.001
		(0.024)	(0.866)	(0.918)	(1.127)		(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Female	428144	0.070**	0.654	-1.010	2.364**		-0.001	-0.000	-0.000	0.001	0.002
		(0.019)	(0.646)	(0.677)	(0.854)		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Male	355654	0.058**	-0.148	-1.023	0.462		0.001	0.003	-0.001	-0.002	-0.004*
		(0.019)	(0.725)	(0.774)	(0.937)		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Location: City or suburb	544892	0.068**	0.201	-1.304*	1.430*		-0.001	0.000	-0.001	0.000	-0.000
		(0.016)	(0.549)	(0.590)	(0.711)		(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Location: Town or rural	182874	0.042+	0.439	0.405	1.131		0.001	0.002	-0.001	-0.003*	-0.002
		(0.024)	(1.096)	(1.108)	(1.509)		(0.002)	(0.003)	(0.001)	(0.002)	(0.003)
HS type: Feeder[b]	200548	0.061*	0.059	-0.731	0.642		-0.003	-0.001	-0.002	-0.001	-0.002
		(0.029)	(0.809)	(0.902)	(1.018)		(0.002)	(0.003)	(0.001)	(0.002)	(0.003)
HS type: Non-feeder	585204	0.061**	0.290	-1.238*	1.800*		0.001	0.002	-0.000	-0.000	0.000
		(0.015)	(0.595)	(0.616)	(0.793)		(0.001)	(0.002)	(0.001)	(0.001)	(0.001)

Notes. + p<0.1, * p<0.05, ** p<0.01. RYCP refers to a set of approximately 150 selective colleges that partnered with the College Board to accept specially designed college application fee waivers. Aspen refers to approximately 270 colleges with high graduation rates; almost all RYCP colleges are also Aspen colleges. Barron's selectivity categories 1, 2, and 3 refer to "most competitive", "highly competitive plus", and "highly competitive", respectively. b Feeder schools are either (i) magnet schools or (ii) had 30 or more high-achieving (top 10%) SAT students in the 2015 cohort. cEstimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers.

Appendix Table 7. Impact of Reach Your College Potential intervention on SAT score sending and postsecondary enrollment outcomes, by treatment arm, heterogeneous outcomes

			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
			SAT score sends				Initial attendance		College Starter list (2017 cohort only)				College quality		College cost	
																Net cost, family income <= $48K
	N		Total sends	Average of median college SAT	Minimum of median college SAT	Maximum of median college SAT	Two-year	Four-year	Any	Reach	Fit	Safety	College median SAT	Six-year bachelor's rate	Cost of attendance	
High-achieving, low-income	37436	Mailers plus	0.185**	-0.266	-0.630	0.015	0.002	0.002	0.007	0.004	-0.001	0.001	-1.539	-0.002	-161.616	-14.141
			(0.067)	(1.573)	(1.828)	(1.690)	(0.003)	(0.005)	(0.010)	(0.005)	(0.009)	(0.007)	(1.878)	(0.002)	(232.969)	(105.904)
		Mailers	0.043	1.300	2.304	0.706	-0.001	-0.004	--	--	--	--	2.003	0.003	-409.278+	-184.081+
			(0.069)	(1.672)	(1.944)	(1.797)	(0.003)	(0.005)	--	--	--	--	(1.934)	(0.002)	(245.041)	(111.396)
		Emails	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			--	--	--	--	--	--	--	--	--	--	--	--	--	--
High-achieving, middle-income	55204	Mailers plus	0.011	1.566	1.911	1.656	0.002	-0.003	--	--	--	--	1.376	0.003	-157.621	20.751
			(0.058)	(1.477)	(1.657)	(1.655)	(0.002)	(0.005)	--	--	--	--	(1.680)	(0.002)	(196.736)	(88.712)
		Mailers	0.046	2.131	0.749	1.661	0.005+	-0.012*	-0.016	-0.007+	-0.004	-0.006	0.074	-0.000	-328.279	-50.690
			(0.067)	(1.719)	(1.927)	(1.926)	(0.003)	(0.005)	(0.011)	(0.004)	(0.009)	(0.008)	(1.946)	(0.002)	(225.631)	(101.751)
		Emails	-0.033	-0.069	-1.454	0.549	0.001	-0.004	--	--	--	--	-2.145	0.000	-277.179	-47.326
			(0.093)	(2.259)	(2.533)	(2.531)	(0.004)	(0.008)	--	--	--	--	(2.690)	(0.003)	(310.366)	(139.963)
On-track, low-income	305121	Mailers plus	0.261**	0.134	-4.773**	5.075**	0.000	-0.002	-0.009+	0.000	-0.007	-0.002	1.435	0.002	-77.223	-52.422
			(0.033)	(1.094)	(1.147)	(1.458)	(0.003)	(0.005)	(0.005)	(0.003)	(0.004)	(0.002)	(1.362)	(0.002)	(126.831)	(68.251)
		Mailers	0.064*	0.507	-0.967	1.515	-0.002	0.005	0.009	0.007*	0.005	-0.001	-1.298	-0.001	19.712	57.616
			(0.029)	(1.160)	(1.216)	(1.546)	(0.003)	(0.004)	(0.006)	(0.003)	(0.005)	(0.002)	(1.339)	(0.002)	(120.611)	(64.911)
		Emails	0.091**	-0.370	-2.272*	0.878	-0.005+	0.009*	0.013*	0.007*	0.005	0.000	0.132	0.001	128.762	137.431*
			(0.027)	(1.087)	(1.139)	(1.448)	(0.003)	(0.004)	(0.005)	(0.003)	(0.005)	(0.002)	(1.241)	(0.002)	(110.495)	(59.474)
On-track, middle-income	375518	Mailers plus	-0.123*	1.435	2.812	1.505	0.011+	-0.017*	--	--	--	--	-1.163	-0.001	-335.828	-275.041*
			(0.053)	(2.384)	(2.458)	(3.276)	(0.006)	(0.008)	--	--	--	--	(2.492)	(0.004)	(232.310)	(126.243)
		Mailers	-0.018	0.048	-0.004	0.304	0.005+	-0.008+	0.000	-0.006+	0.009+	-0.001	0.791	-0.000	-158.381	-70.205
			(0.027)	(1.153)	(1.188)	(1.584)	(0.003)	(0.004)	(0.006)	(0.003)	(0.005)	(0.002)	(1.224)	(0.002)	(115.083)	(62.545)
		Emails	0.002	-0.270	-0.685	0.551	0.003	-0.002	-0.002	-0.006*	0.003	-0.000	0.768	-0.001	-18.311	22.870
			(0.023)	(0.985)	(1.015)	(1.353)	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)	(0.002)	(1.047)	(0.002)	(98.224)	(53.379)
Ethnicity White or Asian	472834	Mailers plus	0.074**	0.554	0.471	1.884	0.002	-0.001	-0.002	0.000	-0.002	-0.001	0.182	0.000	-169.541	-31.040
			(0.027)	(0.877)	(0.924)	(1.148)	(0.002)	(0.004)	(0.007)	(0.004)	(0.006)	(0.003)	(0.959)	(0.001)	(106.948)	(56.150)
		Mailers	0.006	0.667	0.789	0.725	0.002	-0.004	-0.002	-0.004	0.003	-0.000	-0.185	-0.000	-121.190	10.127
			(0.022)	(0.809)	(0.852)	(1.059)	(0.002)	(0.003)	(0.006)	(0.003)	(0.005)	(0.002)	(0.855)	(0.001)	(91.500)	(48.043)
		Emails	0.014	-0.681	-1.223	-0.017	0.002	0.001	-0.005	-0.006*	0.000	-0.001	-1.359	-0.001	-0.438	79.420+
			(0.021)	(0.806)	(0.849)	(1.055)	(0.002)	(0.003)	(0.005)	(0.003)	(0.004)	(0.002)	(0.850)	(0.001)	(86.950)	(45.657)
Ethnicity: African-American or Hispanic	254231	Mailers plus	0.229**	-0.078	-4.821**	3.887*	0.004	-0.008+	-0.008	0.004	-0.010+	-0.001	1.876	0.003	111.272	19.870
			(0.038)	(1.256)	(1.330)	(1.633)	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.003)	(1.608)	(0.002)	(145.336)	(76.796)
		Mailers	0.083*	0.600	-1.380	1.665	0.002	-0.003	0.005	0.005	0.007	-0.005*	2.773+	0.003	-98.244	-97.737
			(0.032)	(1.220)	(1.292)	(1.587)	(0.003)	(0.004)	(0.006)	(0.004)	(0.005)	(0.002)	(1.488)	(0.002)	(127.432)	(67.356)
		Emails	0.084**	0.438	-1.583	1.714	-0.002	0.000	0.010+	0.005+	0.003	-0.001	4.148**	0.004*	8.143	10.286
			(0.030)	(1.163)	(1.232)	(1.513)	(0.003)	(0.004)	(0.006)	(0.003)	(0.005)	(0.002)	(1.416)	(0.002)	(118.527)	(62.654)

Notes. + p<0.1, * p<0.05, ** p<0.01. a Feeder schools are either (i) magnet schools or (ii) had 30 or more high-achieving (top 10%) SAT students in the 2015 cohort. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. The College Starter list refers to the 12 total colleges generated for student brochures or available on the BigFuture website; "reach" indicates the applicant's SAT falls below the colleges 25th percentile SAT score or the college accepts less than 20 percent of all applicants, "fit" are where a student's SAT falls with an institution's interquartile range, and "safety" is where the student's SAT exceeds the 75th percentile SAT score. College characteristics are only for students attending four-year colleges. College median SAT is the midpoint of the 25th and 75th percentile SAT of freshmen enrollees as determined by IPEDS. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers.

Appendix Table 7. Impact of Reach Your College Potential intervention on SAT score sending and postsecondary enrollment outcomes, by treatment arm, heterogeneous outcomes (continued)

	N		(1) Total sends	(2) Average of median college SAT	(3) Minimum of median college SAT	(4) Maximum of median college SAT	(5) Two-year	(6) Four-year	(7) Any	(8) Reach	(9) Fit	(10) Safety	(11) College median SAT	(12) Six-year bachelor's rate	(13) Cost of attendance	(14) Net cost, family income <= $48K
			SAT score sends				Initial attendance		College Starter list (2017 cohort only)				College quality		College cost	
Female	428144	Mailers plus	0.132**	1.844+	-0.509	4.244**	0.001	-0.003	-0.008	0.002	-0.008	-0.003	1.481	0.002	-56.428	-14.414
			(0.030)	(0.945)	(0.991)	(1.250)	(0.003)	(0.004)	(0.006)	(0.004)	(0.005)	(0.002)	(1.112)	(0.002)	(116.619)	(61.042)
		Mailers	0.065**	0.922	-0.434	2.438*	0.001	0.001	0.009	0.003	0.010*	-0.003	0.581	0.000	-89.304	0.759
			(0.025)	(0.881)	(0.924)	(1.165)	(0.002)	(0.003)	(0.006)	(0.003)	(0.005)	(0.002)	(0.987)	(0.001)	(99.017)	(51.839)
		Emails	0.036	-0.532	-1.816*	0.721	0.001	0.002	0.005	0.002	0.003	-0.002	-0.358	-0.001	-88.937	22.115
			(0.023)	(0.848)	(0.889)	(1.121)	(0.002)	(0.003)	(0.005)	(0.003)	(0.004)	(0.002)	(0.948)	(0.001)	(91.852)	(48.086)
Male	355654	Mailers plus	0.121**	-1.129	-2.387*	0.741	0.004	-0.002	-0.001	0.001	-0.003	-0.000	-0.605	0.000	-170.190	-61.709
			(0.030)	(1.030)	(1.099)	(1.331)	(0.003)	(0.004)	(0.007)	(0.003)	(0.006)	(0.003)	(1.170)	(0.002)	(118.259)	(62.939)
		Mailers	0.008	0.432	0.224	-0.358	0.002	-0.006+	-0.006	-0.004	-0.000	-0.000	-0.286	0.000	-224.898*	-79.806
			(0.025)	(0.972)	(1.037)	(1.255)	(0.002)	(0.003)	(0.006)	(0.003)	(0.005)	(0.002)	(1.071)	(0.002)	(103.233)	(54.947)
		Emails	0.051*	0.338	-0.693	0.835	-0.002	0.002	0.000	-0.004	0.003	0.000	1.234	0.002	84.892	84.717
			(0.024)	(0.975)	(1.041)	(1.260)	(0.002)	(0.003)	(0.005)	(0.003)	(0.004)	(0.002)	(1.079)	(0.002)	(99.360)	(52.896)
Location: City or suburb	544892	Mailers plus	0.115**	0.106	-1.912*	2.293*	0.003	-0.004	-0.004	0.002	-0.004	-0.002	-0.279	-0.000	-209.951*	-83.647+
			(0.025)	(0.782)	(0.840)	(1.012)	(0.002)	(0.003)	(0.005)	(0.003)	(0.004)	(0.002)	(0.914)	(0.001)	(95.003)	(50.240)
		Mailers	0.043+	0.161	-0.733	0.598	0.001	-0.003	-0.000	-0.003	0.007+	-0.002	-0.372	-0.001	-201.308*	-41.965
			(0.022)	(0.749)	(0.804)	(0.969)	(0.002)	(0.003)	(0.005)	(0.003)	(0.004)	(0.002)	(0.841)	(0.001)	(83.867)	(44.360)
		Emails	0.053*	0.323	-1.132	1.198	-0.001	0.002	0.004	-0.003	0.005	0.000	0.389	0.000	-22.318	45.370
			(0.021)	(0.741)	(0.796)	(0.959)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.002)	(0.834)	(0.001)	(79.777)	(42.198)
Location: Town or rural	182874	Mailers plus	0.135**	2.392	1.285	4.819*	-0.000	-0.002	-0.019	-0.003	-0.018+	0.003	2.537	0.005+	183.758	132.676
			(0.041)	(1.691)	(1.710)	(2.328)	(0.005)	(0.007)	(0.012)	(0.006)	(0.010)	(0.005)	(1.806)	(0.003)	(179.199)	(95.179)
		Mailers	0.016	2.078	2.354	2.216	0.004	-0.007	0.008	0.006	0.003	0.000	1.244	0.003	-64.465	-20.153
			(0.031)	(1.451)	(1.467)	(1.998)	(0.004)	(0.005)	(0.008)	(0.004)	(0.007)	(0.004)	(1.487)	(0.002)	(139.793)	(74.244)
		Emails	0.016	-1.787	-1.338	-1.844	0.003	0.001	-0.000	0.006	-0.002	-0.003	-0.654	-0.000	-4.385	55.432
			(0.029)	(1.362)	(1.377)	(1.875)	(0.003)	(0.005)	(0.007)	(0.004)	(0.006)	(0.003)	(1.398)	(0.002)	(127.994)	(67.987)
HS type: Feeder[a]	200548	Mailers plus	0.070+	-0.330	-0.933	1.002	0.003	-0.003	0.006	0.000	0.005	-0.000	-0.616	-0.000	-302.645*	-70.395
			(0.042)	(1.119)	(1.248)	(1.408)	(0.003)	(0.005)	(0.009)	(0.005)	(0.007)	(0.004)	(1.330)	(0.002)	(149.457)	(77.450)
		Mailers	0.052	0.201	-0.014	0.306	0.003	-0.004	0.006	0.001	0.007	-0.004	-0.155	-0.000	-328.646*	-40.361
			(0.037)	(1.072)	(1.196)	(1.349)	(0.003)	(0.004)	(0.008)	(0.004)	(0.007)	(0.003)	(1.253)	(0.002)	(135.692)	(70.329)
		Emails	0.060	0.353	-1.166	0.557	-0.003	-0.000	0.015*	0.002	0.006	0.001	1.398	0.002	-88.572	70.619
			(0.038)	(1.134)	(1.265)	(1.427)	(0.003)	(0.004)	(0.007)	(0.004)	(0.006)	(0.003)	(1.334)	(0.002)	(135.999)	(70.487)
HS type: Non-feeder	585204	Mailers plus	0.151**	0.888	-1.644+	3.502**	0.002	-0.002	-0.010+	0.002	-0.010*	-0.002	1.109	0.002	-27.585	-20.035
			(0.024)	(0.880)	(0.912)	(1.173)	(0.002)	(0.003)	(0.005)	(0.003)	(0.005)	(0.002)	(1.007)	(0.001)	(100.551)	(53.445)
		Mailers	0.023	0.718	-0.347	1.329	0.001	-0.003	0.000	-0.001	0.005	-0.001	0.163	0.000	-84.474	-34.320
			(0.020)	(0.815)	(0.844)	(1.086)	(0.002)	(0.003)	(0.005)	(0.002)	(0.004)	(0.002)	(0.883)	(0.001)	(84.227)	(44.774)
		Emails	0.033+	-0.466	-1.468+	0.712	0.000	0.003	-0.001	-0.001	0.002	-0.001	-0.217	-0.001	21.337	44.260
			(0.018)	(0.772)	(0.799)	(1.028)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.002)	(0.837)	(0.001)	(77.624)	(41.267)

Notes. + p<0.1, * p<0.05, ** p<0.01. a Feeder schools are either (i) magnet schools or (ii) had 30 or more high-achieving (top 10%) SAT students in the 2015 cohort. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. Sample restricted to students: (i) in the high school cohorts of 2016 and 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by SAT fee waiver usage and an algorithm incorporating self-reported income, high school attended, and geographic residency. The College Starter list refers to the 12 total colleges generated for student brochures or available on the BigFuture website; "reach" indicates the applicant's SAT falls below the colleges 25th percentile SAT score or the college accepts less than 20 percent of all applicants, "fit" are where a student's SAT falls with an institution's interquartile range, and "safety" is where the student's SAT exceeds the 75th percentile SAT score. College characteristics are only for students attending four-year colleges. College median SAT is the midpoint of the 25th and 75th percentile SAT of freshmen enrollees as determined by IPEDS. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers.

Appendix Table 8. SAT score sending and postsecondary enrollment outcomes for 2017 cohort of high-achieving who did not use a fee waiver and on-track students, by variation in brochure messaging campaign

	(1)	(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9)
		SAT score sends			Initial attendance		College quality		College cost	
		Average of median	Minimum of median	Maximum of median			College	Six-year bachelor's	Cost of	Net cost, family
	Total sends	college SAT	college SAT	college SAT	Two-year	Four-year	median SAT	rate	attendance	income <= $48K
Cost message and Scorecard data	-0.060+	0.614	0.765	-0.414	0.004	-0.004	-0.377	-0.001	-325.466*	-132.153+
	(0.035)	(1.365)	(1.431)	(1.855)	(0.004)	(0.005)	(1.536)	(0.002)	(143.621)	(76.937)
Cost message and no Scorecard data	-0.035	-0.030	-0.435	0.114	-0.003	-0.004	-1.661	-0.003	-175.083	-84.699
	(0.035)	(1.366)	(1.433)	(1.858)	(0.004)	(0.005)	(1.532)	(0.002)	(143.860)	(77.033)
Social fit message and Scorecard data	0.003	1.384	1.553	0.265	-0.002	0.003	-0.521	-0.001	-65.664	37.989
	(0.035)	(1.361)	(1.427)	(1.850)	(0.004)	(0.005)	(1.521)	(0.002)	(143.217)	(76.712)
Social fit message and no Scorecard data	0.003	0.427	1.054	-1.511	0.001	-0.009+	1.102	0.004+	-247.345+	-231.389**
	(0.035)	(1.358)	(1.424)	(1.846)	(0.004)	(0.005)	(1.539)	(0.002)	(143.580)	(76.888)
Baseline means	2.80	1227	1126	1328	0.144	0.587	1200	0.614	$27,341	$12,480
Baseline st. dev.	3.52	110	113	143	0.351	0.492	120	0.172	$11,539	$6,038
N	180492	99773	99773	99773	180492	180492	99167	105968	121608	121447

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates are from a linear regression of the outcomes listed on randomly-assigned treatment status and randomization block fixed effects that account for the timing of the experiment and the academic and income status of each student, as shown in Appendix Table 1. The cost message indicates brochures focused on reducing concerns about cost by focusing on net price rather than sticker price ("Forget what you've heard about the cost of college"). The social fit message indicates brochures focused on social belonging ("Students like you go to great colleges like these"). College Scorecard indicates students randomly provided College Scorecard information on average salaries of graduates for their starter list colleges. Baseline means and standard deviations calculated from control group students who did not receive treatment. Sample restricted to students: (i) in the high school cohorts of 2017; (ii) identified as high-achieving or on-track based on PSAT/SAT performance in the top 10% or 50% of the national distribution, respectively; and (iii) low- and middle-income students, as identified by an algorithm incorporating self-reported income, high school attended, and geographic residency, but not SAT fee waiver usage. The 2017 mailer groups received two packets rather than three, and included messaging changes based on behavioral design that focused on social belonging or reducing concerns about college costs; the 2017 mailer plus group offered on-track, low-achieving students additional free score sends and college application fee waivers. College characteristics are only for students attending four-year colleges. College median SAT is the midpoint of the 25th and 75th percentile SAT of freshmen enrollees as determined by IPEDS.

Appendix 1. Experimental Design

This appendix provides more complete details regarding the experimental design and aspects of the treatment conditions. For readability, it reproduces some descriptions found in the main text. Sample mailers are default production copies that occasionally include superfluous language on font sizes or other graphical details.

Sample Selection

The experiments relied primarily on students who took the PSAT or SAT during their 11th grade year, who were then identified as academically "high-achieving" or "on-track" based on their exam scores placing them in the top 10% or 50% of the national pools of test-takers, respectively. Students in the class of 2017 predominately took the newly redesigned SAT and PSAT, leading to new cut scores. In the class of 2016, students were identified as "high-achieving" if they scored at least (1) 125 (out of 160) on the sum of their Critical Reading and Math sections of the PSAT, or (2) 1250 (out of 1600) on the sum of their SAT Critical Reading and Math sections. "On-track" students scored at least: (1) 130 (out of 240) on the Critical Reading, Math, and Writing sections of the PSAT in 10th grade; (2) 140 (out of 240) on the Critical Reading, Math, and Writing sections of the PSAT in 11th grade; or (3) 1500 (out of 2400) on the Critical Reading, Math, and Writing sections of the SAT (aligned to minimum college-readiness benchmarks). In the 2017 cohort, students were identified as "high-achieving" if they scored at least: (1) 1280 (out of 1600) on the Evidence-Based Reading and Writing and Math sections of the PSAT, or (2) 1310 (out of 1600) on the Evidence-Based Reading and Writing and Math sections of the SAT. "On-track" students scored at least: (1) 1010 (out of 1600) on the Evidence-Based Reading and Writing and Math sections of the PSAT, or (2) 1090 (out of 1600) on the Evidence-Based Reading and Writing and Math sections of the SAT. These latter two points were included as they were considered aligned to minimum college-readiness benchmarks.

Only students identified as low- or middle-income were eligible for the intervention. PSAT and SAT questionnaire data either do not ask for income levels or may be subject to non-response, thus limiting the ability to accurately identify students who are likely to enter college with financial need. To handle this, we relied on two approaches. First, we considered students to be low-income if they received a College Board SAT fee waiver. Eligibility for fee waiver status could occur through a variety of methods, most commonly National Student Lunch Program eligibility, receipt of public assistance, or participation in an authorized program serving low-income students (e.g., Upward Bound).[18] As these qualifications rely on students sharing this potentially sensitive information with their school counselors, not all low-income students who would qualify for a fee

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[18] Students are eligible for fee waivers if they: enrolled in or eligible to participate in the National School Lunch Program (NSLP); the student's annual family income falls within the Income Eligibility Guidelines set by the USDA Food and Nutrition Service; enrolled in a federal, state, or local program that aids students from low-income families (e.g., Federal TRIO programs such as Upward Bound); were receiving public assistance; lived in federally subsidized public housing or a foster home; are homeless, a ward of the state, or an orphan.

waiver are identified. The College Board supplements fee waiver information by developing a methodology to identify low- and middle-income students through an algorithm that includes student self-reported data on the SAT's student data questionnaire (SDQ), high school attended, and census tract. Low-income students were identified then by either receipt of an SAT fee waiver or an estimated annual income below approximately $40,000 (2016 cohort) or $58,000 (2017 cohort); moderate-income students were identified based on incomes below approximately $77,000 per year, but above the low-income threshold.

Each student was then assigned to one of four groups based on the interaction of these academic and income measures: high-achieving, low-income (HALI), high-achieving, middle-income (HAMI), on-track, low-income (OTLI), and on-track, middle-income (OTMI). The interventions focused on these groups for two primary reasons. First, we felt that the typical college information we could provide, such as costs (e.g., net tuition) and benefits (e.g., graduation rates), was more accurate for "on-track" students, who were more likely to start college at traditional four-year colleges without the need for developmental education. Second, prior research shows large differences in college enrollment patterns by income for academically strong students (e.g., Hoxby and Avery (2013)).

Experimental Background

College Board ran two pilot studies for the high school classes of 2014 and 2015, before beginning full-scale operations for the experiments we study in the 2016 and 2017 cohorts. At a basic level the 2016 and 2017 experiments, for which we present results in this paper, consisted of three main interventions, though as we discuss below there is some nuance within these broad categories. The first treatment is referred to as "mailers" (or "brochures"), which were hard copy mailings to students at their homes that aggregated relevant information on key elements of the college application process. Example assistance included a personalized college "starter list" of potential postsecondary institutions, as well as information about the admission and financial aid application processes, guidance on evaluating academic, financial, and social fit, and checklists to help students manage the college application process without missing steps. There was some variation in mailer format and messaging across students or years, and sample mailers are provided in online appendices. The second treatment is referred to as "mailers plus", where the "plus" indicates additional services that could include things like direct outreach to help in the college application (e.g., text messaging, small doses of virtual advising) or small financial incentives (e.g., free SAT score sends or college application fee waivers). The third treatment provided information through biweekly emails rather than mailers, and provided students with links that directed them to College Board websites where they could receive additional advice on the college application process. In the 2016 cohort, students assigned to this treatment arm were automatically opted into these emails, though control group students could receive them as well if they signed up. In 2017 students assigned to the email treatment were also provided a personalized college starter list on the BigFuture website (described below), whereas control group students started their college search from a blank slate. This third treatment arm was the largest in scope and was intended to measure whether lower cost digital information provision could effect change at scale.

College starter lists consisted of twelve colleges selected by a College Board algorithm, which was intended to provide a "balanced list" for students that included 6 academic reach colleges, 4 fit colleges and 2 safety colleges. Reach colleges are defined as institutions where the student's SAT score falls below the college's 25th percentile or where less than 20 percent of applicants receive offers of admission. Fit colleges are those where a student's SAT scores falls within institutional interquartile SAT ranges, and safety colleges are those where the student's SAT score exceeds the institution's 75th percentile. The exact colleges on the student list were selected using an algorithm that ranked colleges based on the likelihood of earning a bachelor's degree for similar scoring students from the same county, a measure we developed using NSC data. Each list also contained a college that we classified as a "best in-state public option", the public "non-reach" institution with the highest average SAT score in the students' state of residence. These starter lists were intended to kick-start informed college search and exploration, as well as to introduce students to the concept of a college application portfolio with balanced risk.

Across experiments, the College Board also encouraged students to log on and interact with the BigFuture website. BigFuture is a free online tool to provide students with comprehensive, step-by-step guidance in the college application process. Students can use BigFuture to search for and compare colleges, find scholarships, understand financial aid, navigate the college application process from start to finish, and receive personalized deadline reminders, tips, and guidance along the way. By creating a College Board account, students can use BigFuture to manage their personal college list, save scholarship searches, compare college costs, and more. Students assigned to treatment had their starter college list from the intervention materials pre-loaded in the BigFuture website, and they received a pop-up letting them know that we had added colleges to their list the first time they logged on.

Initial Pilots for 2014 and 2015 cohorts

The initial pilots produced a few themes that influenced the subsequent work. The College Board began with a number of campaigns that encouraged students to expand their college application portfolios. The RYCP campaign in these two initial pilot years was intended to provide high-achieving, low-income students with personalized information about more selective institutions and encourage these students to apply to at least 8 colleges. A separate "Apply to Four or More" campaign was designed to encourage students who were academically on-track for college but not high-achieving by providing more generic information about the college application process and encouragement to apply to at least 4 colleges. These campaigns were sometimes supported by the elimination of small financial barriers, such as college application fee waivers. One general consequence of identifying 11th grade students is that there is a two-year gap between when a student is identified for treatment and when researchers can observe college attendance outcomes through NSC. This lag led to a reliance on qualitative feedback on program effectiveness in the early years, with much of the year to year changes deriving from communication with stakeholders as to the effectiveness of the materials and services provided. Based on constituent feedback from the first two years, the mailers in the pilot experiments were redesigned to be less dense and broken

down into multiple, distinct mailings that delivered information "just in time" for exploration, application, and financial aid rather than delivering all information in a single, large mailer.

Outreach for 2016 cohort

The 2016 high school cohort was the first experiment taken to scale, where the College Board had internalized the relevant low- and moderate-income tagging processes and felt the lessons from previous mailings were sufficiently strong to warrant wide-spread delivery. Appendix Figure 1 shows the timeline for delivery of materials. The first round of high-achieving and on-track students were identified in February 2015 from their 10th or 11th grade PSAT taken in October 2013 or 2014, with a second round of students identified in July 2015 from Spring SAT administrations in 2015.[19] In addition to the four primary groups (e.g., HALI, etc.), the College Board delivered the intervention to an additional group of approximately 12,000 high-achieving or on-track SAT-taking students who were identified as first-generation but whose income status identified them as above middle-income. These students were identified in the second round and treated students were only provided access to the low-cost email version of the informational intervention.

Students in the first round who were assigned to receive mailers got three separate mailings: May 2015 (right before the summer leading into their 12th grade year), September 2015 (at the start of 12th grade), and January 2016 (halfway through their 12th grade year). In the spring 2015 mailing, students received a personalized starter list of 12 colleges (the selection of the colleges is described above). The mailing also had information to help students evaluate the financial, academic, or "other" (e.g., distance from home, college size) fit of these starter list colleges, as well as actions to take over the summer to help students prepare for the application process. These actions included visiting nearby colleges, talking with their school counselor or an advisor about their college options, or talking to college students and recent graduates about their experiences, with a list of suggested questions and topics for discussion. Students were also encouraged to use this starter list as an entry point to the College Board's BigFuture website, where they could then create their own personalized list of colleges. The September 2015 mailing provided information about the admissions and financial aid application processes, timelines, and checklists to help students manage the application process. The final mailing in January 2016 to all students detailed the steps required to complete the FAFSA. Students identified for treatment in July 2015 received only the second two mailings, though aspects of the first mailing were incorporated into their second mailing so that all treated students received similar information. All HALI students also received four college application fee waivers for RYCP colleges. Sample mailers and fee waivers for 2016 are shown in Appendix 2.

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[19] Not all on-track students identified in the first round were assigned to treatment or control groups. Some were put aside and assigned to treatment or control in the second round (July 2015). On-track students who were set aside but whose subsequent SAT scores identified them as high-achieving later had their academic status updated, but their income status was assigned based on what was considered most accurate using data from their first SAT.

For the "mailers plus" treatment, the College Board offered students additional functionality with their starter college lists prepopulated into BigFuture, enabling the student to evaluate the academic fit of their colleges more easily. This included the "college list refinement tool", that provided visual feedback about that student's academic performance relative to the academic achievement levels of the colleges they added to their list, thus defining colleges as an academic reach, fit, or safety school (i.e., students were shown a bar graph of the 25th and 75th percentile SAT performance of incoming students from IPEDS, and where their score landed relative to that distribution). Students were encouraged to drag and drop colleges to and from their starter college list in BigFuture to craft their own portfolio of colleges.

As a second part of the mailer plus treatment, the College Board partnered with outside organizations to provide opportunities for counseling services through text-messaging or phone-based outreach activities. In 2016, the primary focus was to examine how to effectively partner with outside agencies and to see whether students were likely to volunteer for these services. The College Board was in the initial phase of getting permission to text and gather cell phone information, so every interaction with students required an affirmative opt-in, leading to very low take-up rates. One lesson from this approach was that take-up rates were higher in later years when students first opted-in broadly to text-message outreach in the initial stages of the project, and then were given the option to opt-out of additional services provided later.

The 2016 "mailer plus" outreach opportunities were typically one-time activities, such as a phone call for advising on college choice or to discuss financial aid in conjunction with their student aid report, rather than large campaigns that work directly with students over a longer time-frame. As take-up rates were consistently in the single digits, null results may speak more to students not utilizing these services rather than estimates of their effectiveness among treated individuals. The most effective outreach was for high-achieving students, for whom a random sample was invited to participate in a virtual advising program with an external service provider. This program paired HALI and HAMI students with a near-peer adviser to support them remotely throughout the admission and financial aid application processes, with the goal of enrolling them in an Aspen college. Approximately 7000 HALI or HAMI students opted-in to participate in the program.

The third and largest email treatment was directed primarily to hundreds of thousands of on-track students identified in the second round through their SAT performance. The primary focus was to promote well-rounded lists of colleges that served as safety, fit, or reach schools. One-third of the treated students received a bi-weekly email with key actions and milestones, often directing them to the College Board's BigFuture website. At the website, they could explore colleges, save a college list, and receive other information to help them with the admission and financial aid application processes. An additional one-third received the email and were randomly selected to interact with the college list refinement tool (described in the previous paragraph). The last one-third were emailed with an offer to receive text messages from the College Board; these texts would contain information from the BigFuture website that would discuss time-appropriate

activities to be completed during the college application process (e.g., applying for financial aid or completing college applications).[20]

Outreach for 2017 cohort

Outreach for the 2017 cohort was similarly divided into emails, mailers, and mailers plus as the three primary treatment arms, and the timeline is shown in Appendix Figure 1. Students were identified by their PSAT or SAT score in summer 2016, with initial packets mailed in late September and early October. One contextual note is that most of the students in this cohort took the newly designed SAT, first offered in March 2016. Sample mailers and fee waivers for 2017 are in Appendix 3 and sample emails in Appendix 4.
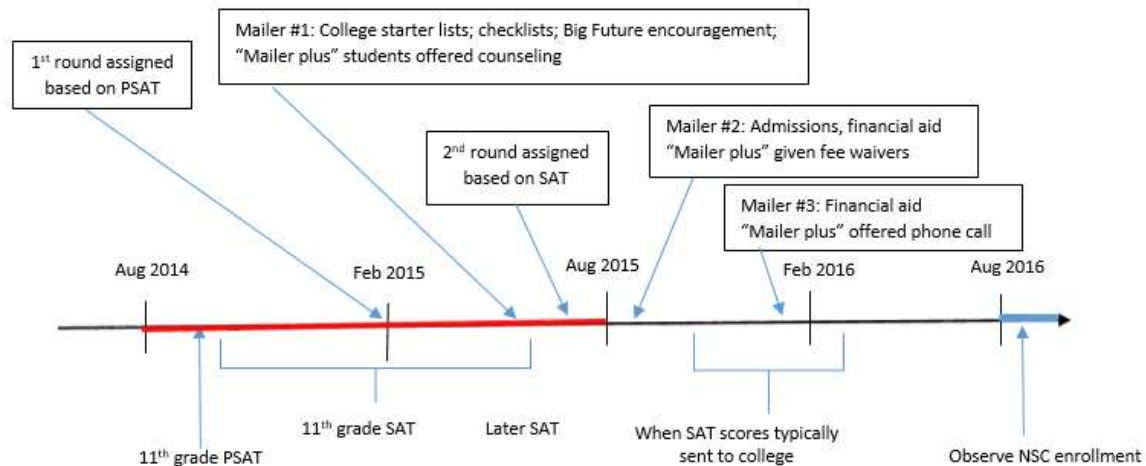
There were four key differences between the intervention materials deployed to the 2016 and 2017 cohorts. First, the College Board sent two mailers, not three. The first mailer focused on choosing a broad set of colleges and knowing key deadlines (similar to 2016 mailer one) and the second on financial aid (similar to 2016 mailer three). The omitted mailer was mostly reminders about important deadlines, and much of this information was migrated to the BigFuture website. The second difference was around messaging. The College Board worked with Ideas42 to enhance the mailers with messages based on knowledge developed in the behavioral science literature. The two primary messaging differences were intended to reduce concerns about cost by focusing on net price rather than sticker price ("Forget what you've heard about the cost of college") or social belonging ("Students like you go to great colleges like these"). Some students were also provided information on average salaries of graduates for the schools identified in the college lists, derived from the newly developed College Scorecard data. The third difference was the College Board provided more free services than in previous cohorts. Students using SAT fee waivers typically receive eight free SAT score sends and four college application fee waivers, but OTLI fee waiver students were randomly provided two or eight additional SAT score sends and zero, two, or eight additional college application fee waivers.[21] The last difference was not about the student experience but simply an improvement in the College Board's data collection. Primarily, the College Board created starter college lists for both the treatment and control group students in 2017, even though control students never received these starter lists. This allowed the College Board to test whether students were sensitive to the colleges listed, which could not be done for the 2016 cohort.

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[20] The on-track students were divided into five groups, with one control and four treatment groups that each received a postcard with different messages aimed to induce take-up. There were no differences across groups and omit these results for brevity.

[21] Of the 195,000 treated on-track students, approximately 30,000 who opted into texting with the College Board were randomly assigned to a program designed by an external service provider, where students received ten text messages between November 2016 and September 2017. These text messages were an opportunity to engage directly with an adviser who could answer questions about various parts of the financial aid process. Of the 30,000 students, the service provider assigned one-half (15,000) to treatment and roughly 40% of treated students exhibited some level of meaningful engagement with an adviser on at least one question. Given the relatively small size of the experiment relative to the entire on-track group, we omit these results, which are currently under study.

Appendix Figure 1. Timeline of interventions, 2016 and 2017 cohorts

2016 cohort timeline

Mailer #1: College starter lists; checklists; Big Future encouragement; "Mailer plus" students offered counseling

1st round assigned based on PSAT

2nd round assigned based on SAT

Mailer #2: Admissions, financial aid "Mailer plus" given fee waivers

Mailer #3: Financial aid "Mailer plus" offered phone call

Aug 2014 — Feb 2015 — Aug 2015 — Feb 2016 — Aug 2016

11th grade SAT — Later SAT — When SAT scores typically sent to college

11th grade PSAT — Observe NSC enrollment

—— = 11th grade
—— = 12th grade
—— = College

2017 cohort timeline

Mailer #1: Checklists and college starter lists; Encouragement to use Big Future

1st round assigned based on PSAT

2nd round assigned based on SAT

Mailer #2: Financial aid

Aug 2015 — Feb 2016 — Aug 2016 — Feb 2017 — Aug 2017

11th grade SAT — Later SAT — When SAT scores typically sent to college

11th grade PSAT — Observe NSC enrollment