Realizing Your College Potential?
Impacts of College Board's RYCP Campaign on Postsecondary Enrollment

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Abstract: The College Board sought to reduce barriers in the college application process by minimizing information aggregation costs, encouraging a broad application portfolio, and providing an impetus to start the search process. 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, with the exception of a 0.02σ increase in college quality measures for African-American and Hispanic students.

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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 wages (Bhuller, Mogstad, & Salvanes, 2017; Chetty, Friedman, Saez, Turner, & Yagan, 2017; Cohodes & Goodman, 2014; Goodman, Hurwitz, & Smith, 2017; Hoekstra, 2009; Kirkeboen, Leuven, & Mogstad, 2016; Zimmerman, 2014). Deciding where to attend is shaped not only by the student but by differences in family, peers, school, and community (Bailey & Dynarski, 2011; Hamilton, Roksa, & Nielsen, 2018; Radford, 2013; Roderick, Coca, & Nagaoka, 2011).

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, Pender, & Howell, 2013). Commonly held reasons 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 priors (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 individuals complete important tasks (Castleman, Arnold, & Wartman, 2012; Castleman & Page, 2013, 2015, 2016; Castleman, Page, & Schooley, 2014; Gabaix, 2017; Hoxby & Avery, 2013; Hoxby & Turner, 2013; Page, Kehoe, Castleman, & Sahadewo, 2017). 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 increases in human capital investments in many educational contexts (Gurantz, 2018; Hurwitz, Mbekeani, Nipson, & Page, 2016; Pallais, 2015; Smith, Hurwitz, & Howell, 2015). Taken together, these results 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 defaults to a college to which they undermatch (Belasco & Trivette, 2015; Dynarski, Libassi, Michelmore, & Owen, 2018; Smith et al., 2013).

This paper provides results from a series of large randomized control trials that sought to increase enrollment in selective colleges by reducing informational or behavioral barriers in the application process. The experiment was administered by the College Board and 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. The interventions focused on these groups for two primary reasons. First, the typical college information we could provide (e.g., net tuition, graduation rates) was considered more accurate for "on-track" students, who were more likely to start college at traditional four-year colleges without the need for developmental education.[1] Second, prior research shows large differences in college enrollment patterns by income for academically strong students (e.g., Hoxby and Avery (2013)).

The primary approach of the intervention was to provide students easily digestible information on a varied set of academically strong colleges. By doing so, the College Board aimed to provide an impetus to start the college search process, minimize the costs of aggregating data, and encourage a broader college application portfolio. This information also varied by delivery format (e.g., mail, email, texts) and messaging, often including slogans that capitalized on issues identified as relevant in the literature on behavioral biases. Additionally, the College Board partnered with external agencies that provided short-term interventions (e.g., text reminders, consultation) around specific educational issues. The College Board also eliminated small financial barriers for some students with free college application fee waivers (CAFW) and SAT scores sends, which are often required in the college application process.[2]

[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).
[2] The experiment is listed at the AEA registry (https://www.socialscienceregistry.org/trials/3523). The experiment, which first contacted students in the middle of 2015, was not pre-registered but only registered after the trial was completed. The intention was to investigate differences in college attendance and selectivity disaggregated by academic and income status, but given the lack of pre-registration the reader might take heterogeneous results as only suggestive of possible treatment effects.

In aggregate, we find that our interventions led to no change in the likelihood or sector of college enrollment of treated students. The one exception are small positive impacts for African-American and Hispanic students, with increases in college quality (e.g., average freshmen SAT score) of about 0.02σ. 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 substantively meaningful impacts. We also show that null results cannot be attributed 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 were eliminated. We find that students offered free services, such as SAT score sends and college application fee waivers, typically targeted institutions with both stronger and weaker academic credentials, leaving the average quality of their application portfolio unchanged. Thus the information led to a muted response for most students, with those influenced to change their behavior unlikely to target only more aspirational colleges. Ultimately, we find that these changes in students' behaviors were insufficient to substantially alter postsecondary enrollment patterns.

This paper contributes to an ongoing literature around the role of informational and behavioral interventions in improving individual welfare (Sunstein, 2017). We caution against interpreting this paper's findings to mean that the types of interventions the College Board provided cannot move the needle on college enrollment, or that low- and middle-income students do not continue to face information and procedural barriers on the path to college. A key challenge in promoting enrollment at selective institutions is the multi-step nature of the process, as we must induce students to incorporate new information and alter their application patterns, while then relying on colleges with historically low admission rates changing their acceptance decisions. Particularly for

low-income students, these colleges might also need to provide financial or other supports to induce them to enroll (Dynarski et al., 2018; Gurantz, Hurwitz, & Smith, 2017). Prior interventions have spanned from the relatively inexpensive provision of information to more expensive supports that involve one-on-one counseling or other actions that would be more difficult to implement at scale. Importantly, previous work by Hoxby and Turner (2013), which served in part as the inspiration for many of these projects, found positive impacts on college match.

We propose a few reasons why the intervention did not produce significant gains in college enrollment. First, eliminating small financial barriers through free score sends and college application fee waivers induces students to broaden their application portfolio, though these changes were not linked to enrollment in more selective colleges (Hurwitz et al., 2016; Pallais, 2015). Second, informational 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 (Bettinger et al., 2012; Dynarski et al., 2018; Finkelstein & Notowidigdo, 2018; Marx & Turner, forthcoming). This intervention was predominately driven by information provision without accompanying support, and simple letters frequently produce no impacts (Bergman, Denning, & Manoli, 2017; Darolia & Harper, 2018), though some exceptions, such as a letter that encouraged out-of-work individuals to attend college, produced gains when paired with a supportive infrastructure (e.g., employment services offices) (Barr & Turner, 2018). Third, the intervention was an attempt to see what changes could be produced at a national scale. The national reach and importance of the College Board exams, combined with the experimental data, suggests that students did not dismiss this information out of hand. Nonetheless, students may value information more from independent college counseling services or higher education institutions, given the many roles that the College

Board plays in their lives. Although there was no cost to the initiative, providing information via an organization that typically has a financial relationship with the student may complicate how this information is received. Finally, we propose another key reason that have weakened the impact of this initiative: over the past decade, many independent organizations and selective colleges have made impressive efforts to recruit high-achieving, low-income students. Early evidence suggests that low-income, high-achieving students have made significant gains over the past decade in enrolling at better matched institutions (Pender & Welch, 2018). This national focus suggests that both high schools and external organizations are likely to be working broadly with high-achieving but disadvantaged students via other channels, which may blunt the impact of many "light-touch" interventions moving forward.

The paper proceeds as follows: Section 2 discusses the intervention, including how the sample was selected and the experimental treatment conditions, and differences between the 2016 and 2017 outreach; Section 3 describes the sample and discusses the primary outcome measures; Section 4 describes the results, and; Section 5 discusses the findings and reasons the intervention may have not been successful.

Intervention Background

Sample Selection

The experiments 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 being in the top 10% or 50% of the national distribution, respectively.[3] We

[3] 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.

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 track, high school) and survey responses on the SAT's student data questionnaire.[4] Each student was 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). For brevity, many aspects of the experiment are discussed more fully in Appendix 1.

Experimental Treatment Conditions

Treatment students were assigned to one of three broad interventions, though as we discuss below there were additional variations within these categories. Appendix 1 provides more details on experimental assignment and samples sizes (Appendix Table 1). 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.

[4] 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.

"Starter lists" consisted on 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.[5] 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 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 additional services 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 is "emails", which provided information through biweekly emails rather than mailers, including links that directed them to the College Board's BigFuture website where they could receive additional advice on the college application process. 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.[6] Altogether we generally present pooled results, the experiment can also be

[5] "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.

[6] For example, HALI students did not receive email treatments but focused on mailers or mailers plus to prioritize precision (i.e., having two treatment arms instead of three) and because partner organizations preferred to focus on these students due to their specific mission. In contrast, the size of the on-track group raised cost concerns that led them more often to receive the least expensive and intensive email treatments.

construed as 22 separate, smaller experiments, based on block randomization within the academic and income background of the student group interacted with the cohort year and one of three potential treatment conditions. Using median freshmen SAT as a sample outcome, power calculations for each experiment 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).[7]

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. 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.

[7] 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. Thus outcomes that rely on students having a value (e.g., median freshmen SAT) might have lower power that outcomes for which all students have a value (e.g., attend a four-year college).

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.[8]

The organization of the mailings was as follows:

- 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 students manage the application process.

[8] 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 final mailing detailed the steps required to complete the FAFSA and provided HALI students four college application fee waivers (CAFW) for RYCP colleges.

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, 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 OTLI students more free score sends and college application fee waivers (CAFW) 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 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. The 2016 cohort was significantly larger due to the identification by 10th grade PSAT, which was not done in 2017. HALIs, HAMIs, OTLIs, and OTMIs constituted 5%, 7%, 39%, and 48% of the sample; the remaining 2% were a small group of higher-income first-generation students also included in the 2016 experiment. A more detailed description of the randomization process is provided in Appendix Table 1, which shows all three distinct randomizations 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 HALI group to 93% of the OTMI group. This variation 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).

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 year *t*. As randomization occurred by year and academic-income group status we include these categories as "group" fixed effects (θ_{gt}). $Treatment_{igt}$ 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).

Our primary outcome measures are College Board data on SAT "score sends" and National Student Clearinghouse (NSC) data on postsecondary enrollment. Score sends are often required for application to four-year institutions, and can serve as a rough proxy for college applications (Smith, 2018). We examine the quantity and quality of score sends, using IPEDS data on the median SAT of the incoming freshmen class. We focus on the average college SAT and the maximum SAT (i.e., "best" college) in a student's score send portfolio.

NSC data identify students' initial postsecondary enrollment. We again use IPEDS data to create metrics of the quality of the college attended, using both average SAT and the college's six-year

(150% time) graduation rates.[9] 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).[10]

Thus, we focus primarily on 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 college enrollment:

1. The College Board's Realize Your College Potential (RYCP) campaign partnered with roughly 150 colleges with high graduation rates, for which some randomly assigned students received college application fee waivers (CAFW) for use at those institutions only. Sample fee waivers identifying these colleges are in the appendix.
2. Some partner organizations who offered students additional services (described below) are affiliated with the American Talent Initiative and the Aspen Institute's College Excellence Program, and we examine enrollment at the set of approximately 270 "Aspen" colleges.
3. 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).
4. Enrollment by Barron's selectivity as a broad measure of changes in institutional selectivity.

Results

[9] Alternate measures of institutional quality, such as expenditures per FTE, produce similar results.
[10] 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.

Overall impacts

Table 2 pools the 2016 and 2017 cohorts and shows results for SAT score sends and initial enrollment outcomes. First, the experiment led students to send more SAT scores, though these were directed to both higher and lower quality colleges. The first three columns of Table 2 shows that in the aggregate, the experiment led to an increase of 0.06 score sends (column 1), an increase of 1.7% given a baseline of 3.65 score sends per individual. There was no increase in 2016 but a sizeable increase of 0.14 score sends (3.8%) in 2017. 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 1.5 SAT points (on a 1600 point scale) and a decrease in the minimum SAT of -1.0 SAT points (columns 3 and 4, respectively). These changes were on the order of a 0.02 standard deviation increase in the spread of the score send portfolio, relative to the control group.

The second set of columns of Table 2 show no meaningful impacts of the intervention on postsecondary enrollment outcomes. There was no change in either two-year or four-year college enrollment, with estimates ruling out effects as large as one-half on one percentage point. Conditional on four-year college enrollment, we do not find any difference in any of our primary measures of college quality, including the college's average SAT scores or the graduation rate. (The one exception is a marginally significant effect on a college's six-year graduation rate in the 2016 cohort of 0.2 percentage points, a 0.01 standard deviation effect.) We also find no impact on college costs, whether measured as the full cost of attendance or the estimated net price for low-income students (i.e., students coming from families with annual incomes less than $48,000).

Appendix Table 3 shows that students did not shift college enrollment choices based on the composition of college lists. Students were not more likely to attend RYCP, Aspen, or higher ranked Barron's colleges. For the 2017 cohort, for which we have data, students were no more likely to attend one of the 12 institutions on their college starter list, whether considered reach, fit, safety, or the "best in-state college option".[11] The largest single point estimate was 0.3 percentage points.

Table 3 shows treatment effects separately for the email, mailer, and mailer plus groups within each cohort year. The only substantial increase in score sending behavior is found among mailer plus students in 2017, who sent their scores to both higher and lower quality schools on average (columns 3 and 4, respectively). These changes correspond to roughly a 0.08 standard deviation increase in the spread of the score send portfolio. As students in the mailer plus group were also the ones offered additional free score sends, we investigate these behavioral changes and how this might have impacted enrollment further below in Table 5. Appendix Table 4 examines potential changes in the sector of college enrollment, with almost every result smaller than 0.5 percentage points and statistically indistinguishable from zero.

We find no evidence that null impacts on average college characteristics mask important distributional effects in outcomes or for specific groups. Appendix Table 5 shows no impacts on enrollment based on deciles of college quality, as measured by their median freshmen SAT. Appendix Table 6 shows results on average median SAT for each of the 22 distinct experiments,

[11] The College Board created starter college lists for treated students in 2016 but did not have data on counterfactual lists for control students. In 2017 we created starter college lists for both treatment and control group students, even though control students never observed these lists, allowing us to test whether students were sensitive to the specific colleges listed.

and again finds no results. Using alternate college quality or college cost measures again shows no impacts (results omitted for brevity).

Table 4 explores heterogeneity in student outcomes based on background characteristics. The first rows focus on individual-level differences: high-achieving vs. on-track; ethnicity (Asian and white students compared to African-American and Hispanic students); and gender. The largest observed gains come from students often considered underrepresented in higher education, as African-American and Hispanic students increase the quality of their score sends and attend more selective colleges. For students in these two ethnicity groups, the increases in college SAT and average college-specific six-year bachelor's degree completion rate are 3.1 points and 0.3 percentage points, respectively, indicating gains of roughly 0.02 standard deviations (standard deviations omitted from table for brevity). There are no similar gains for Asian or white students. Otherwise, we find some marginal differences in score send behaviors across groups, though no statistically significant differences in college quality or net cost. Appendix Table 7 presents similar results on the sector of college enrollment, with marginal significant increases of 0.3 to 0.5 percentage points on the likelihood that African-American and Hispanic students attend RYCP or Aspen colleges, respectively, perhaps driven by the "reach" colleges being placed on their automated college lists.

One concern is overall treatment effects may not be accurate given variation in assignment to the mailers plus, mailers, and email treatments arising from variation in income and academic background status. Appendix Table 8 shows full results based on treatment arms, again consistently noting no real differences.

The bottom half of Table 4 focuses on high school characteristics, including urbanicity (as defined by high school geography) and whether a student attended a school with a relatively weaker

college-going culture. We define a strong college-going culture similar to "feeder" schools in Hoxby and Turner (2013), indicating 30 or more high-achieving (i.e., top 10%) students in a cohort (Hoxby & Avery, 2013). In neither case do we find evidence of impacts on college attendance outcomes.[12] Appendix Table 9 focuses on effects for just our four main groups (HALI, HAMI, OTLI, OTMI), with the top panel using all students and the bottom using just students in feeder schools, which most closely approximates Hoxby and Turner (2013). Although results are statistically insignificant, the results for HALI students in feeder schools comes close to prior results, with a positive impact on median SAT of the college attended of 2.7 SAT points, with a standard error of 2.7.

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 either did or did not provide data on the average earnings for each college based on the College Scorecard data. Appendix Table 10 shows that in general there were no differences in outcomes based on any of these treatment arms.

Impacts on student behaviors

Our intervention led to no major changes for three potential reasons: students received the information but did not change their application set of colleges; students changed their application set but were no more likely to be accepted or attend a new college, and/or; they were unaware of the intervention entirely, for example, if they simply discarded or ignored the mail or email

[12] Feeder school calculations described more fully in Appendix 1.

treatments. Although our data cannot fully distinguish between these three choices, overall the evidence points to students being aware of the intervention but the materials doing little to change their application set in a way that might substantially improve college enrollment outcomes. Statistical results are presented below, with further discussion in the conclusion.

We first revisit the changes in score sends, which we use as a rough proxy for college application patterns, and disaggregate score sends into whether they occurred (i) prior to the intervention, often as "registration" scores sends that occur immediately after students take the SAT, or (ii) or after receiving the intervention, often as "flex" score sends that students can elect to use at any time. For simplicity we prioritize results for the 2017 cohort, where there was significant variation in how many free score sends or college application fee waivers (CAFW) students received.

In the 2017 cohort, OTLI students identified through their SAT fee waiver usage were randomly assigned to either the mailer plus or control groups (48,000 and 9,981 students, respectively). In addition, those in the mailer plus group were randomly assigned to receive (i) two free score sends but no CAFW; (ii) two free score sends and two additional CAFW; (iii) eight free score sends and eight additional CAFW.[13] These offers are in addition to the baseline College Board policy that fee-waiver students receiver eight free SAT score sends and four CAFW.

The top panel of Table 5 examines differences for OTLI fee waiver students and finds that the free score sends drove the large differences in score sending behavior. As expected, there was no difference in score sending prior to receiving the intervention materials, whereas there was 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.

[13] Assignment for the three groups was 24,000, 18,000, and 6,000 students, respectively.

Students receiving free score sends appeared to take a scattershot approach, targeting both more and less selective schools but leaving the average quality of their portfolio unchanged. For example, students offered eight free score sends had a portfolio where the best school had a median SAT 17 points higher (column 7) but the worse school had a median SAT 16 points lower (column 6), with the portfolio average being unchanged from the control group (column 7); the change in highest and lowest quality college was roughly 0.12 standard deviations. Those offered two free score sends engaged in a similar but more muted pattern. An alternate method to examine the scattershot approach is to examine whether these score sends were allocated to reach, fit, or safety schools. Overall we find that 17% of the increase in score sends went to reach colleges, 48% to fit, and 35% to safety (regressions omitted for brevity).[14] Thus students predominately chose fit colleges but sent more scores to safety than more selective reach institutions.

As before, different score send portfolios led to no differences in average quality of the college attended, but further analysis shows that they also had little to no impact on the variance of college attended in the treatment group. We can examine the variation of college quality multiple ways, but column 9 presents results that regresses median college SAT via our main specification, calculates the absolute value of the residuals for each individual, and uses these residuals as the dependent variable in a second regression. In all three cases we see very small positive impacts on the variation in colleges attended, from about 1.0 to 2.5 SAT points (0.014 to 0.036 standard deviations), though only one case reaches statistical significance at the 0.05 level. Alternate

[14] About 4% went to schools for which we could not identify a type; given the small amount we remove these from the numerator and denominator for the purposes of this identification.

analyses produce similar, statistically weak results that point to little change in the distribution of colleges attended.[15]

There are two pieces of evidence that changes to score sends do indeed reflect changes to application behavior. First, we can directly compare the students who had two free score sends, where one received two free CAFW and one did not. In this case, those receive the CAFW sent 0.074 additional score sends, which is significant at the 0.05 level (results omitted for brevity, but are equivalent to a test of difference in coefficients of Table 5, column 4, between rows 1 and 2). Second, the middle panel of Table 5 revisits this analysis for HALI students, who were not offered additional score sends but did receive eight additional CAFW. We find that additional CAFW led students to 0.25 more score sends. Together these results point to changes in score sends as likely related to real though very small changes in college application behaviors; scaling these two results implies each additional CAFW increases the number of score sends by 3-4%. As above, HALI students show no statistical evidence of changes to the type of institutions attended, either in terms of average quality or variation in types of colleges attended.[16]

The bottom panel of Table 5 examines one last group, where we combine all students not offered free score sends or CAFW: OTLI students not identified through fee waiver usage, OTMI, and HAMI students. For these students we find no evidence of changes in score sends, targeted colleges, enrollment, or variation in enrollment patterns, with permutation tests of differences in

[15] Two other tests both support but also point to the general weakness of these results. First, we run covariate adjusted regressions and find essentially identical point estimates and standard errors. Second, we directly examine the distribution of the median SAT of college attended by calculating the difference in standard deviation between the two groups and running simple permutation tests (drawing 1000 distributions each time), and find similar results, with p-values of 0.01, 0.31, and 0.37 across the three groups, respectively. Examining all three treatment groups as one combined group produces marginally significant results, with p-values of 0.11 in the regression and 0.7 in the permutation test.

[16] Although there were no statistically significant changes to minimum or maximum SAT scores, 51% of the increase in score sends went to reach institutions, with 33% to fit and only 16% to safety.

distributions confirming these findings. Similarly, there were no impacts on score sends to reach, fit, or safety colleges (regressions omitted).

In order to interpret these results, we first present evidence that our null effects are not simply due to students ignoring the mailers or emails. One piece of evidence is the change in score send utilization, as students could only change their behaviors if they engaged with the mailers by receiving free sends or CAFW. As a second piece of evidence, we have some limited ability to track students' usage of the BigFuture website for the 2017 cohort.[17] Appendix Table 11, column 1 shows that approximately 33 percent of treated students offered pre-populated college starter lists on the website clicked through to access those data, with the largest rates for mailer plus students (47%). (Control students were not offered this option). We also have a snapshot of the college lists in March 2017 that allows us to determine whether a student added a new college to their BigFuture list. 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 this still results in treated students being 17 percentage points more likely to engage with their lists, using an omnibus measure of engagement – either accessing the prepopulated list or adding a new school (column 3).

Conclusion

We find that offering information about the college application process to students transitioning into 12th grade produces no observable changes in college enrollment behavior. The one exception are positive impacts among African-American and Hispanic students, though these are extremely

[17] Individual-level, real-time data from BigFuture was generally not available when these experiments were running. For the 2017 cohort we can observe the final college list as of March 2017. No data were available for the 2016 cohort. 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.

small and not consistently found across outcome measures. Null results did not vary across the format of our delivery or whether we included financial incentives or reminders. 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. A few pieces of evidence suggest that students did not ignore the outreach. Treated students increased their use of free score sends overall, even more so when they received additional CAFW. All treated groups engaged more with the BigFuture website, and engagement was similar in size between the mailers only and email delivery treatments. 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 exams suggests students are not likely to dismiss this information out of hand.

Our evidence suggests that one key issue is students received the information but did not use it to consistently apply to colleges of higher quality. 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 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. College outreach or direct service programs, who 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 (Barr & Castleman, 2016; Gurantz et al., 2017; Howell, Hurwitz, & Smith, 2018; Page et al., 2017). 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. 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 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 and 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 (Appendix Table 9), so cannot fully explain differences in outcomes.

We believe there are four relevant differences between the two initiatives. First, ECO-C has a specific messaging and branding that may have been more appealing than what could be offered by the College Board or other similar organizations. Specifically, they offered information from a non-partisan organization that was foundation and government funded, which may have garnered more trust. Branding could also include small but potentially important differences in our outreach, such as our mailer design or use of a website for organizing college lists, relative to their tabbed, expandable brochure, particularly as their parents reported being less interested in typical college outreach materials. Second, they also utilized their own list selection process, which may have less

constraints on which types of colleges to promote than that of the College Board. Third, our sample was drawn from PSAT and SAT test-takers, while ECO 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.[18]

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 increase 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 efforts to provide informational interventions.[19] 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).[20] Thus general knowledge as to the existence of this issue, combined with work by schools, colleges, philanthropies, and other organizations, may have eliminated many of the

[18] 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.

[19] 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).

[20] 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.

compliers that might be influenced by an information-based intervention. This again suggests that more intensive services may be the next step for students facing strong obstacles to shifting their enrollment. Continued exploration on how best to serve the millions of students navigating their path to college is warranted.

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Table 1. Student characteristics by background status

Sample	(1) Full sample	(2) 2016 cohort only	(3) 2017 cohort only	(4) High-achieving Low-income (HALI)	(5) High-achieving Middle-income (HAMI)	(6) On-track Low-income (OTLI)	(7) On-track Middle-income (OTMI)
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. SAT score sending and postsecondary enrollment outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Score sends				Initial attendance		College quality		College cost	
	Total	Average SAT	Min SAT	Max SAT	Two-year	Four-year	College SAT	Six-year bachelor's rate	Cost of attendance	Net cost, family income <= $48K
Full sample	0.064**	0.298	-0.997+	1.492*	0.001	-0.000	0.329	0.000	-78.812	0.750
	(0.013)	(0.482)	(0.510)	(0.631)	(0.001)	(0.002)	(0.545)	(0.001)	(53.651)	(28.287)
2016 cohort	0.013	0.962	0.540	1.383+	0.000	0.001	1.037	0.002+	-42.764	33.344
	(0.018)	(0.645)	(0.681)	(0.837)	(0.002)	(0.002)	(0.705)	(0.001)	(71.585)	(37.705)
2017 cohort	0.139**	-0.567	-2.998**	1.633+	0.002	-0.003	-0.726	-0.001	-127.290	-43.086
	(0.021)	(0.725)	(0.770)	(0.962)	(0.002)	(0.003)	(0.862)	(0.001)	(80.424)	(42.489)
Baseline means	3.65	1256	1146	1360	11.6%	64.5%	1229	65.6%	$29,430	$13,073
Baseline means (2016)	3.65	1268	1158	1369	10.8%	65.1%	1240	67.1%	$30,113	$13,453
Baseline means (2017)	3.66	1240	1128	1348	13.0%	63.6%	1212	63.3%	$28,415	$12,509
Baseline st. dev.	4.19	121	123	146	32.1%	47.9%	132	17.6%	$12,733	$6,334
Baseline st. dev. (2016)	4.39	124	124	147	31.0%	47.7%	134	17.6%	$13,142	$6,438
Baseline st. dev. (2017)	3.86	115	119	144	33.6%	48.1%	127	17.4%	$12,030	$6,134
N	785752	441384	441384	441384	785752	785752	443903	467271	515153	514598
N (2016)	536533	283096	283096	283096	536533	536533	298546	313192	342401	342054
N (2017)	249219	158288	158288	158288	249219	249219	145357	154079	172752	172544

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Table 3. SAT score sending and postsecondary enrollment outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Score sends				Initial attendance		College Quality		College cost	
	Total	Average SAT	Min SAT	Max SAT	Two-year	Four-year	College SAT	Six-year bachelor's rate	Cost of attendance	Net cost, family income <= $48K
2016 cohort										
Mailers Plus	0.007	1.433	1.654+	1.745	0.003	-0.002	1.222	0.003+	-63.915	17.393
	(0.028)	(0.951)	(1.004)	(1.235)	(0.003)	(0.004)	(1.046)	(0.001)	(112.263)	(59.121)
Mailers	0.012	1.366	1.278	1.667	0.003	-0.003	0.848	0.001	-82.074	9.452
	(0.024)	(0.877)	(0.925)	(1.138)	(0.002)	(0.003)	(0.957)	(0.001)	(98.840)	(52.058)
Email	0.016	0.354	-0.728	0.937	-0.003	0.006+	1.074	0.001	-5.578	57.419
	(0.023)	(0.886)	(0.936)	(1.151)	(0.002)	(0.003)	(0.974)	(0.001)	(94.607)	(49.833)
Baseline means	3.65	1268	1158	1369	10.8%	65.1%	1240	67.1%	$30,113	$13,453
Baseline st. dev.	4.39	124	124	147	31.0%	47.7%	134	17.6%	$13,142	$6,438
N	536533	283096	283096	283096	536533	536533	298546	313192	342401	342054
2017 cohort										
Mailers Plus	0.344**	-0.617	-5.278**	4.448**	0.003	-0.004	-0.192	-0.001	-136.728	-96.461
	(0.035)	(1.073)	(1.140)	(1.423)	(0.003)	(0.005)	(1.352)	(0.002)	(130.735)	(69.058)
Mailers	0.006	-0.006	-0.361	-0.868	0.001	-0.004	-1.147	-0.001	-246.300*	-82.306
	(0.030)	(1.130)	(1.201)	(1.499)	(0.003)	(0.004)	(1.287)	(0.002)	(118.056)	(62.376)
Email	0.038	-0.830	-1.504	-0.657	0.002	-0.001	-1.059	-0.001	-57.105	26.478
	(0.027)	(1.037)	(1.102)	(1.376)	(0.003)	(0.004)	(1.177)	(0.002)	(106.527)	(56.285)
Baseline means	3.66	1240	1128	1348	13.0%	63.6%	1212	63.3%	$28,415	$12,509
Baseline st. dev.	3.86	115	119	144	33.6%	48.1%	127	17.4%	$12,030	$6,134
N	249219	158288	158288	158288	249219	249219	145357	154079	172752	172544

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Table 4. SAT score sending and postsecondary enrollment outcomes, heterogeneous outcomes

		(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Score sends				Initial attendance		College quality		College cost	
	N	Total	Average SAT	Min SAT	Max SAT	Two-year	Four-year	College SAT	Six-year bachelor's rate	Cost of attendance	Net cost, family income <= $48K
High-achieving	92640	0.061	0.997	0.814	0.942	0.002	-0.004	0.263	0.001	-253.962*	-48.913
		(0.037)	(0.921)	(1.048)	(1.014)	(0.001)	(0.003)	(1.068)	(0.001)	(128.148)	(57.984)
On-track	680639	0.072**	-0.019	-1.975**	1.914*	0.001	0.000	0.489	0.000	-19.366	17.459
		(0.015)	(0.592)	(0.616)	(0.801)	(0.002)	(0.002)	(0.669)	(0.001)	(61.789)	(33.433)
Ethnicity: White or Asian	472834	0.027	0.110	-0.091	0.809	0.002	-0.001	-0.547	-0.000	-80.639	29.772
		(0.017)	(0.608)	(0.640)	(0.796)	(0.002)	(0.002)	(0.650)	(0.001)	(69.151)	(36.309)
Ethnicity: African-American or Hispanic	254231	0.127**	0.281	-2.765**	2.528*	0.001	-0.003	3.005**	0.003*	14.533	-13.657
		(0.024)	(0.866)	(0.918)	(1.127)	(0.002)	(0.003)	(1.078)	(0.001)	(93.033)	(49.173)
Female	428144	0.070**	0.654	-1.010	2.364**	0.001	0.000	0.463	0.000	-79.966	6.262
		(0.019)	(0.646)	(0.677)	(0.854)	(0.002)	(0.002)	(0.737)	(0.001)	(73.723)	(38.595)
Male	355654	0.058**	-0.148	-1.023	0.462	0.001	-0.001	0.180	0.001	-78.412	-5.291
		(0.019)	(0.725)	(0.774)	(0.937)	(0.002)	(0.003)	(0.810)	(0.001)	(77.946)	(41.491)
HS type: Feeder[a]	200548	0.061*	0.059	-0.731	0.642	0.001	-0.002	0.207	0.001	-228.197*	-7.472
		(0.029)	(0.809)	(0.902)	(1.018)	(0.002)	(0.003)	(0.955)	(0.001)	(102.678)	(53.213)
HS type: Non-feeder	585204	0.061**	0.290	-1.238*	1.800*	0.001	0.000	0.282	0.000	-19.921	6.005
		(0.015)	(0.595)	(0.616)	(0.793)	(0.001)	(0.002)	(0.658)	(0.001)	(62.848)	(33.411)
Location: City or suburb	544892	0.068**	0.201	-1.304*	1.430*	0.001	-0.001	-0.050	-0.000	-128.081*	-17.691
		(0.016)	(0.549)	(0.590)	(0.711)	(0.001)	(0.002)	(0.628)	(0.001)	(62.463)	(33.038)
Location: Town or rural	182874	0.042+	0.439	0.405	1.131	0.003	-0.002	0.691	0.002	20.620	51.394
		(0.024)	(1.096)	(1.108)	(1.509)	(0.003)	(0.004)	(1.135)	(0.002)	(106.687)	(56.669)

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 come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Table 5. SAT score sending and postsecondary enrollment outcomes for 2017 cohort

	Prior to intervention		Post intervention					College quality	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
OTLI fee-waiver students	Any score sends	Total score sends	Any score sends	Total score sends	Average SAT	Min SAT	Max SAT	Mean SAT	Standard deviation SAT
Two free score sends and no CAFW	0.005	0.020	0.011*	0.246**	-0.946	-5.577**	3.261	0.420	2.489*
	(0.006)	(0.028)	(0.005)	(0.045)	(1.617)	(1.720)	(2.071)	(1.883)	(1.092)
Two free score sends and two CAFW	-0.003	-0.005	0.010*	0.321**	-0.665	-6.204**	6.029**	1.593	0.958
	(0.006)	(0.027)	(0.005)	(0.043)	(1.545)	(1.643)	(1.978)	(1.798)	(1.042)
Eight free score sends and eight CAFW	0.006	0.029	0.014*	0.884**	0.618	-16.398**	16.937**	0.096	1.049
	(0.008)	(0.037)	(0.007)	(0.059)	(2.108)	(2.242)	(2.699)	(2.459)	(1.425)
Baseline means	0.31	1.20	0.77	3.52	1222	1120	1321	1193	98.1
Baseline st. dev.	0.46	2.26	0.42	3.46	113	120	143	120	69.9
N	57981	57981	57981	57981	43080	43080	43080	37789	37789
HALI students									
Mailers plus	-0.000	-0.001	0.025**	0.246**	-4.294	-4.247	-2.272	-3.538	-2.008
	(0.010)	(0.052)	(0.008)	(0.095)	(2.727)	(3.163)	(3.005)	(3.013)	(1.717)
Baseline means	0.24	0.79	0.48	2.02	1226	1140	1311	1200	91.8
Baseline st. dev.	0.43	1.71	0.50	3.17	118	121	147	120	67.7
N	10746	10746	10746	10746	8393	8393	8393	8401	8401
All other students (OTLI no fee waiver, HAMI, OTMI)									
Mailers	0.000	-0.002	0.001	0.008	0.359	-0.116	-0.290	-1.147	0.958
	(0.004)	(0.014)	(0.004)	(0.026)	(1.306)	(1.374)	(1.711)	(1.242)	(1.042)
Emails	0.005	0.020	0.001	0.018	-0.277	-0.870	-0.063	-1.059	1.049
	(0.003)	(0.013)	(0.004)	(0.023)	(1.201)	(1.264)	(1.573)	(1.136)	(1.425)
Baseline means	0.38	1.51	0.79	4.59	1343	1221	1437	1306	108.4
Baseline st. dev.	0.48	2.53	0.41	4.50	118	138	129	132	74.6
N	180492	180492	180492	180492	80175	80175	80175	99167	99167

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Appendix Table 1. Treatment assignment by background status

Year	Background	Timing	Control	Treatment	Treatment assignment		
					Mailers plus	Mailers	Email
2016	HALI: High-achieving, low-income	Spring	4046	4045	0	4045	0
		Fall	5000	13599	6799	6800	0
	HAMI: High-achieving, middle-income	Spring	5997	21113	15112	6001	0
		Fall	5000	9596	4798	0	4798
	OTLI: On-track, low-income	Spring	5996	16990	4996	11994	0
		Fall	8000	163347	0	5000	158347
	OTMI: On-track, middle-income	Spring	9996	24989	4996	19993	0
		Fall	8000	218346	0	0	218346
	First-generation	Fall	6000	6473	0	0	6473
2017	HALI: High-achieving, low-income	Spring	3582	7164	7164	0	0
	HAMI: High-achieving, middle-income	Spring	2700	10798	0	10798	0
	OTLI: On-track, low-income (Tagged)	Spring	10000	42807	0	16000	26807
	OTLI: On-track, low-income (SAT fee waiver)	Spring	9981	48000	48000	0	0
	OTMI: On-track, middle-income	Spring	10000	104187	0	15999	88188

Notes. OTLI students in 2017 were identified through having used a SAT fee waiver or were "tagged" through the income prediction algorithm.

Appendix Table 2. Randomized control trial balance checks

	(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	52.5%	9.0%	16.1%	22.5%	44.9%	7.5%	34.5%	85.1%	549.5	532.8	517.1	71.4%	590.5	592.5	84.7%	8.7%	34.1%	38.4%	7.0%	13.8%
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 come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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. Sector of postsecondary attendance

	(1)	(2)	(3)	(4)	(5)
			Barrons' selectivity category[a]		
	RYCP	Aspen	Top 1	Top 2	Top 3
All	0.000	0.001	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
2016 cohort	0.002	0.003	0.000	-0.000	-0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
2017 cohort	-0.003	-0.001	-0.001	-0.000	-0.001
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Baseline means	14.7%	26.8%	4.4%	10.0%	17.0%
Baseline means (2016)	16.5%	29.2%	5.3%	11.5%	18.7%
Baseline means (2017)	11.9%	22.8%	2.8%	7.6%	14.2%

	Attend college on starter list (2017 cohort only)				
	Any	Reach	Fit	Safety	BISPO[b]
2017 cohort	-0.000	0.000	0.000	-0.001	-0.001
	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)
Baseline means (2017)	34.7%	7.3%	19.8%	5.2%	7.5%

Notes. + p<0.1, * p<0.05, ** p<0.01. [a] Barron's selectivity categories 1, 2, and 3 refer to "most competitive", "highly competitive plus", and "highly competitive", respectively. [b] BISPO refers to the "best in-state public option", as defined in the text. Estimates come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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 785,752, 536,533, and 249,219 in the full sample, 2016, and 2017 cohorts, respectively.

Appendix Table 4. Sector of postsecondary attendance, by treatment arm

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Barrons' selectivity category[a]			Attend college on starter list (2017 cohort only)				
	RYCP	Aspen	Top 1	Top 2	Top 3	Any	Reach	Fit	Safety	BISPO[b]
2016 treatments										
Mailers Plus	0.008**	0.003	-0.000	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)	16.5%	29.2%	5.3%	11.5%	18.7%	--	--	--	--	--
2017 treatments										
Mailers Plus	-0.002	-0.001	-0.001	0.001	-0.003	-0.005	0.001	-0.006	-0.002	-0.001
	(0.003)	(0.004)	(0.001)	(0.002)	(0.003)	(0.005)	(0.003)	(0.004)	(0.002)	(0.002)
Mailers	-0.004	-0.001	-0.001	-0.001	0.001	0.002	-0.001	0.005	-0.002	-0.000
	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)
Emails	-0.002	0.000	-0.001	-0.000	0.000	0.003	-0.001	0.003	-0.001	-0.001
	(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.001)	(0.002)
Control means (2017)	11.9%	22.8%	2.8%	7.6%	14.2%	34.7%	7.3%	19.8%	5.2%	7.5%

Notes. + p<0.1, * p<0.05, ** p<0.01. [a] Barron's selectivity categories 1, 2, and 3 refer to "most competitive", "highly competitive plus", and "highly competitive", respectively. [b] BISPO refers to the "best in-state public option", as defined in the text. Estimates come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Appendix Table 5. Postsecondary enrollment outcomes by deciles of freshmen SAT

	Deciles									
	1	2	3	4	5	6	7	8	9	10
Mailers plus	-0.001	-0.000	-0.000	0.000	0.000	-0.000	-0.002	-0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Mailers	-0.001+	-0.001*	-0.000	-0.000	-0.000	0.003*	-0.001	0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Emails	-0.001+	-0.001	0.000	0.000	0.001	0.001	0.002	0.001	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Baseline means	1.9%	2.1%	2.1%	3.2%	4.3%	5.5%	7.9%	7.3%	13.3%	13.9%

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates come from a linear regression of randomly-assigned treatment status on deciles of freshmen SAT. Baseline means and standard deviations calculated from control group students who did not receive treatment. Sample restricted to 785,752 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.

Appendix Table 6. Postsecondary enrollment outcomes by treatment assignment

						College-level freshmen median SAT		
Year	Background	Timing	Control	Treatment	N	Mailers plus	Mailers	Email
2016	HALI: High-achieving, low-income	Spring	4046	4045	6334		0.824	
							(3.271)	
		Fall	5000	13599	14873	0.549	3.754	
						(2.556)	(2.563)	
	HAMI: High-achieving, middle-income	Spring	5997	21113	20729	2.396	2.227	
						(2.307)	(2.771)	
		Fall	5000	9596	11267	1.498		-2.085
						(2.836)		(2.840)
	OTLI: On-track, low-income	Spring	5996	16990	12713	-0.285	-5.598*	
						(3.104)	(2.562)	
		Fall	8000	163347	88358		0.545	2.143
							(2.864)	(1.819)
	OTMI: On-track, middle-income	Spring	9996	24989	17975	-0.187	2.269	
						(2.821)	(1.975)	
		Fall	8000	218346	118200			2.587
								(1.733)
	First-generation	Fall	6000	6473	8097			-1.465
								(2.513)
2017	HALI: High-achieving, low-income	Spring	3582	7164	8401	-3.538		
						(3.013)		
	HAMI: High-achieving, middle-income	Spring	2700	10798	10284		-2.944	
							(2.978)	
	OTLI: On-track, low-income (tagged)	Spring	10000	42807	25321		0.883	0.218
							(2.149)	(1.975)
	OTLI2: On-track, low-income (SAT fee waiver)	Spring	9981	48000	37789	0.964		
						(1.659)		
	OTMI: On-track, middle-income	Spring	10000	104187	63562		-1.996	-1.592
							(1.832)	(1.515)

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates come from a linear regression of randomly-assigned treatment status on college-level freshmen SAT. Sample restricted to 785,752 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.

Appendix Table 7. SAT score sending and postsecondary enrollment outcomes, heterogeneous outcomes

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Barrons' selectivity category[a]			Attend college on starter list (2017 cohort only)				
	N	RYCP	Aspen	Top 1	Top 2	Top 3	Any	Reach	Fit	Safety	BISPO[b]
High-achieving	92640	-0.000	-0.001	-0.002	-0.002	-0.003	-0.004	-0.001	-0.003	-0.002	-0.004
		(0.003)	(0.004)	(0.002)	(0.003)	(0.003)	(0.007)	(0.003)	(0.006)	(0.005)	(0.005)
On-track	680639	0.000	0.002	-0.000	0.000	0.000	0.000	0.000	0.001	-0.001	-0.001
		(0.001)	(0.002)	(0.000)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)
Ethnicity: White or Asian	472834	-0.001	-0.000	-0.001	-0.001	-0.001	-0.004	-0.004+	0.000	-0.001	-0.002
		(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)
Ethnicity: African-American or Hispanic	254231	0.003+	0.005+	0.001	0.002	0.001	0.002	0.005+	-0.002	-0.002	-0.001
		(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)
Female	428144	-0.001	-0.000	0.000	0.001	0.002	0.001	0.002	0.000	-0.002	-0.003
		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)
Male	355654	0.001	0.003	-0.001	-0.002	-0.004*	-0.002	-0.002	0.000	0.000	0.001
		(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)
HS type: Feeder[c]	200548	-0.003	-0.001	-0.002	-0.000	-0.002	0.009+	0.001	0.006	-0.001	0.002
		(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.005)	(0.003)	(0.005)	(0.002)	(0.003)
HS type: Non-feeder	585204	0.001	0.002	-0.000	-0.000	0.000	-0.004	-0.000	-0.002	-0.001	-0.002
		(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.003)	(0.001)	(0.002)
Location: City or suburb	544892	-0.001	0.000	-0.001	0.000	-0.000	0.000	-0.001	0.002	-0.001	-0.001
		(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)	(0.002)
Location: Town or rural	182874	0.001	0.002	-0.001	-0.003+	-0.002	-0.003	0.004	-0.005	-0.001	-0.003
		(0.002)	(0.003)	(0.001)	(0.002)	(0.003)	(0.006)	(0.003)	(0.005)	(0.003)	(0.003)

Notes. + p<0.1, * p<0.05, ** p<0.01. a Barron's selectivity categories 1, 2, and 3 refer to "most competitive", "highly competitive plus", and "highly competitive", respectively. b BISPO refers to the "best in-state public option", as defined in the text. [c] Feeder schools are either (i) magnet schools or (ii) had 30 or more high-achieving (top 10%) SAT students in the 2015 cohort. cEstimates come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Appendix Table 8. SAT score sending and postsecondary enrollment outcomes, heterogeneous outcomes

			(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Score sends				Initial attendance		College quality		College cost	
	N		Total	Average SAT	Min SAT	Max SAT	Two-year	Four-year	College SAT	Six-year bachelor's rate	Cost of attendance	Net cost, family income <= $48K
High-achieving	92640	Mailers plus	0.084+	0.724	0.786	0.899	0.002	-0.001	0.163	0.001	-160.752	3.558
			(0.044)	(1.077)	(1.226)	(1.187)	(0.002)	(0.003)	(1.251)	(0.002)	(150.113)	(67.917)
		Mailers	0.045	1.718	1.545	1.185	0.002	-0.008*	1.052	0.002	-366.798*	-114.112
			(0.048)	(1.201)	(1.367)	(1.323)	(0.002)	(0.004)	(1.373)	(0.002)	(165.639)	(74.946)
		Emails	0.003	-0.479	-2.002	0.180	0.001	-0.002	-2.742	-0.001	-278.716	-55.770
			(0.091)	(2.188)	(2.491)	(2.410)	(0.004)	(0.007)	(2.624)	(0.003)	(307.880)	(139.313)
On-track	680639	Mailers plus	0.167**	0.339	-3.535**	4.486**	0.003	-0.006	0.918	0.001	-135.742	-102.726+
			(0.027)	(0.982)	(1.020)	(1.328)	(0.003)	(0.004)	(1.173)	(0.002)	(110.670)	(59.872)
		Mailers	0.038+	0.216	-0.842	1.088	0.001	-0.001	-0.058	-0.000	-64.084	-0.859
			(0.020)	(0.807)	(0.839)	(1.092)	(0.002)	(0.003)	(0.892)	(0.001)	(82.144)	(44.446)
		Emails	0.051**	-0.345	-1.606*	0.796	-0.001	0.003	0.551	-0.000	52.785	78.822*
			(0.017)	(0.728)	(0.757)	(0.984)	(0.002)	(0.003)	(0.799)	(0.001)	(73.152)	(39.582)
Ethnicity: White or Asian	472834	Mailers plus	0.074**	0.554	0.471	1.884	0.002	-0.001	0.182	0.000	-169.541	-31.040
			(0.027)	(0.877)	(0.924)	(1.148)	(0.002)	(0.004)	(0.959)	(0.001)	(106.948)	(56.150)
		Mailers	0.006	0.667	0.789	0.725	0.002	-0.004	-0.185	-0.000	-121.190	10.127
			(0.022)	(0.809)	(0.852)	(1.059)	(0.002)	(0.003)	(0.855)	(0.001)	(91.500)	(48.043)
		Emails	0.014	-0.681	-1.223	-0.017	0.002	0.001	-1.359	-0.001	-0.438	79.420+
			(0.021)	(0.806)	(0.849)	(1.055)	(0.002)	(0.003)	(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+	1.876	0.003	111.272	19.870
			(0.038)	(1.256)	(1.330)	(1.633)	(0.004)	(0.005)	(1.608)	(0.002)	(145.336)	(76.796)
		Mailers	0.083*	0.600	-1.380	1.665	0.002	-0.003	2.773+	0.003	-98.244	-97.737
			(0.032)	(1.220)	(1.292)	(1.587)	(0.003)	(0.004)	(1.488)	(0.002)	(127.432)	(67.356)
		Emails	0.084**	0.438	-1.583	1.714	-0.002	0.000	4.148**	0.004*	8.143	10.286
			(0.030)	(1.163)	(1.232)	(1.513)	(0.003)	(0.004)	(1.416)	(0.002)	(118.527)	(62.654)
Female	428144	Mailers plus	0.132**	1.844+	-0.509	4.244**	0.001	-0.003	1.481	0.002	-56.428	-14.414
			(0.030)	(0.945)	(0.991)	(1.250)	(0.003)	(0.004)	(1.112)	(0.002)	(116.619)	(61.042)
		Mailers	0.065**	0.922	-0.434	2.438*	0.001	0.001	0.581	0.000	-89.304	0.759
			(0.025)	(0.881)	(0.924)	(1.165)	(0.002)	(0.003)	(0.987)	(0.001)	(99.017)	(51.839)
		Emails	0.036	-0.532	-1.816*	0.721	0.001	0.002	-0.358	-0.001	-88.937	22.115
			(0.023)	(0.848)	(0.889)	(1.121)	(0.002)	(0.003)	(0.948)	(0.001)	(91.852)	(48.086)
Male	355654	Mailers plus	0.121**	-1.129	-2.387*	0.741	0.004	-0.002	-0.605	0.000	-170.190	-61.709
			(0.030)	(1.030)	(1.099)	(1.331)	(0.003)	(0.004)	(1.170)	(0.002)	(118.259)	(62.939)
		Mailers	0.008	0.432	0.224	-0.358	0.002	-0.006+	-0.286	0.000	-224.898*	-79.806
			(0.025)	(0.972)	(1.037)	(1.255)	(0.002)	(0.003)	(1.071)	(0.002)	(103.233)	(54.947)
		Emails	0.051*	0.338	-0.693	0.835	-0.002	0.002	1.234	0.002	84.892	84.717
			(0.024)	(0.975)	(1.041)	(1.260)	(0.002)	(0.003)	(1.079)	(0.002)	(99.360)	(52.896)

Appendix Table 8. SAT score sending and postsecondary enrollment outcomes, heterogeneous outcomes (continued)

			(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Score sends				Initial attendance		College quality		College cost	
	N		Total	Average SAT	Min SAT	Max SAT	Two-year	Four-year	College SAT	Six-year bachelor's rate	Cost of attendance	Net cost, family income <= $48K
HS type: Feeder[a]	200548	Mailers plus	0.070+	-0.330	-0.933	1.002	0.003	-0.003	-0.616	-0.000	-302.645*	-70.395
			(0.042)	(1.119)	(1.248)	(1.408)	(0.003)	(0.005)	(1.330)	(0.002)	(149.457)	(77.450)
		Mailers	0.052	0.201	-0.014	0.306	0.003	-0.004	-0.155	-0.000	-328.646*	-40.361
			(0.037)	(1.072)	(1.196)	(1.349)	(0.003)	(0.004)	(1.253)	(0.002)	(135.692)	(70.329)
		Emails	0.060	0.353	-1.166	0.557	-0.003	-0.000	1.398	0.002	-88.572	70.619
			(0.038)	(1.134)	(1.265)	(1.427)	(0.003)	(0.004)	(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	1.109	0.002	-27.585	-20.035
			(0.024)	(0.880)	(0.912)	(1.173)	(0.002)	(0.003)	(1.007)	(0.001)	(100.551)	(53.445)
		Mailers	0.023	0.718	-0.347	1.329	0.001	-0.003	0.163	0.000	-84.474	-34.320
			(0.020)	(0.815)	(0.844)	(1.086)	(0.002)	(0.003)	(0.883)	(0.001)	(84.227)	(44.774)
		Emails	0.033+	-0.466	-1.468+	0.712	0.000	0.003	-0.217	-0.001	21.337	44.260
			(0.018)	(0.772)	(0.799)	(1.028)	(0.002)	(0.003)	(0.837)	(0.001)	(77.624)	(41.267)
Location: City or suburb	544892	Mailers plus	0.115**	0.106	-1.912*	2.293*	0.003	-0.004	-0.279	-0.000	-209.951*	-83.647+
			(0.025)	(0.782)	(0.840)	(1.012)	(0.002)	(0.003)	(0.914)	(0.001)	(95.003)	(50.240)
		Mailers	0.043+	0.161	-0.733	0.598	0.001	-0.003	-0.372	-0.001	-201.308*	-41.965
			(0.022)	(0.749)	(0.804)	(0.969)	(0.002)	(0.003)	(0.841)	(0.001)	(83.867)	(44.360)
		Emails	0.053*	0.323	-1.132	1.198	-0.001	0.002	0.389	0.000	-22.318	45.370
			(0.021)	(0.741)	(0.796)	(0.959)	(0.002)	(0.003)	(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	2.537	0.005+	183.758	132.676
			(0.041)	(1.691)	(1.710)	(2.328)	(0.005)	(0.007)	(1.806)	(0.003)	(179.199)	(95.179)
		Mailers	0.016	2.078	2.354	2.216	0.004	-0.007	1.244	0.003	-64.465	-20.153
			(0.031)	(1.451)	(1.467)	(1.998)	(0.004)	(0.005)	(1.487)	(0.002)	(139.793)	(74.244)
		Emails	0.016	-1.787	-1.338	-1.844	0.003	0.001	-0.654	-0.000	-4.385	55.432
			(0.029)	(1.362)	(1.377)	(1.875)	(0.003)	(0.005)	(1.398)	(0.002)	(127.994)	(67.987)

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 come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Appendix Table 9. SAT score sending and postsecondary enrollment outcomes, heterogeneous outcomes

		(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Score sends				Initial attendance		College quality		College cost	
	N	Total	Average SAT	Min SAT	Max SAT	Two-year	Four-year	College SAT	Six-year bachelor's rate	Cost of attendance	Net cost, family income <= $48K
All students											
High-achieving, low-income (HALI)	26752	0.067	2.541	2.880	1.982	-0.003	0.001	1.755	0.003	-277.733	-62.377
		(0.069)	(1.628)	(1.883)	(1.740)	(0.002)	(0.005)	(1.862)	(0.002)	(240.956)	(110.156)
High-achieving, middle-income (HAMI)	41992	0.011	1.537	0.646	2.249	0.003	-0.004	1.083	0.003	-190.644	4.217
		(0.057)	(1.435)	(1.615)	(1.588)	(0.002)	(0.005)	(1.647)	(0.002)	(194.799)	(86.752)
On-track, low-income (OTLI)	207282	0.046	-0.588	-1.475	-0.253	-0.004	0.009*	-0.435	0.000	67.966	162.281*
		(0.031)	(1.240)	(1.290)	(1.652)	(0.003)	(0.004)	(1.390)	(0.002)	(131.986)	(71.201)
On-track, middle-income (OTMI)	361871	0.001	0.653	-0.173	1.636	0.002	-0.005	2.057+	0.001	-5.730	2.008
		(0.023)	(0.986)	(1.021)	(1.329)	(0.002)	(0.003)	(1.061)	(0.002)	(98.726)	(53.259)
Feeder schools only											
High-achieving, low-income (HALI)	14228	0.106	1.423	3.059	0.965	-0.000	0.001	2.661	0.003	-456.394	-61.827
		(0.088)	(2.407)	(2.709)	(2.649)	(0.003)	(0.008)	(2.691)	(0.003)	(319.250)	(151.403)
High-achieving, middle-income (HAMI)	25528	-0.009	1.007	-0.453	2.213	0.003	-0.005	-0.930	-0.000	-224.189	-17.562
		(0.066)	(1.977)	(2.130)	(2.263)	(0.003)	(0.006)	(2.193)	(0.003)	(238.231)	(110.416)
On-track, low-income (OTLI)	151175	0.050	-0.471	-0.655	-0.475	-0.002	0.012*	1.307	0.002	202.037	202.888*
		(0.035)	(1.530)	(1.567)	(2.063)	(0.004)	(0.005)	(1.688)	(0.002)	(157.573)	(84.927)
On-track, middle-income (OTMI)	285571	0.001	0.521	-0.872	2.284	0.001	-0.002	0.969	-0.000	21.238	21.735
		(0.025)	(1.162)	(1.184)	(1.586)	(0.003)	(0.004)	(1.220)	(0.002)	(112.195)	(60.611)

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 come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Appendix Table 10. SAT score sending and postsecondary enrollment outcomes for 2017 cohort high-achieving and on-track non-waiver students, by variation in brochure messaging campaign

	(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Score sends				Initial attendance		College quality		College cost	
	Total	Average SAT	Min SAT	Max SAT	Two-year	Four-year	College SAT	Six-year bachelor's rate	Cost of attendance	Net cost, family income <= $48K
Variations in brochure messaging										
Group: Tagged HAMI, OTLI, OTMI students										
Cost 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 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 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 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	14.4%	58.7%	1200	61.4%	$27,341	$12,480
Baseline st. dev.	3.52	110	113	143	35.1%	49.2%	120	17.2%	$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 come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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.

Appendix Table 11. Utilization of Big Future website, 2017 cohort

	(1)	(2)	(3)
	Accessed pre-populated college starter list	Added at least one school to college starter list	Accessed 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	0.1%	25.7%	25.8%

Notes. + p<0.1, * p<0.05, ** p<0.01. Estimates come from a linear regression of randomly-assigned treatment status on the outcomes listed. 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 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 being in the top 10% or 50%, 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).[21] 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 waiver are identified. The College Board supplements fee waiver information by developing a

[21] 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.

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 on 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. Match 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 selected were identified 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 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.[22] 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 CAFW for RYCP colleges. Sample mailers and fee waivers for 2016 are shown in Appendix 2.

[22] 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).[23]

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 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.

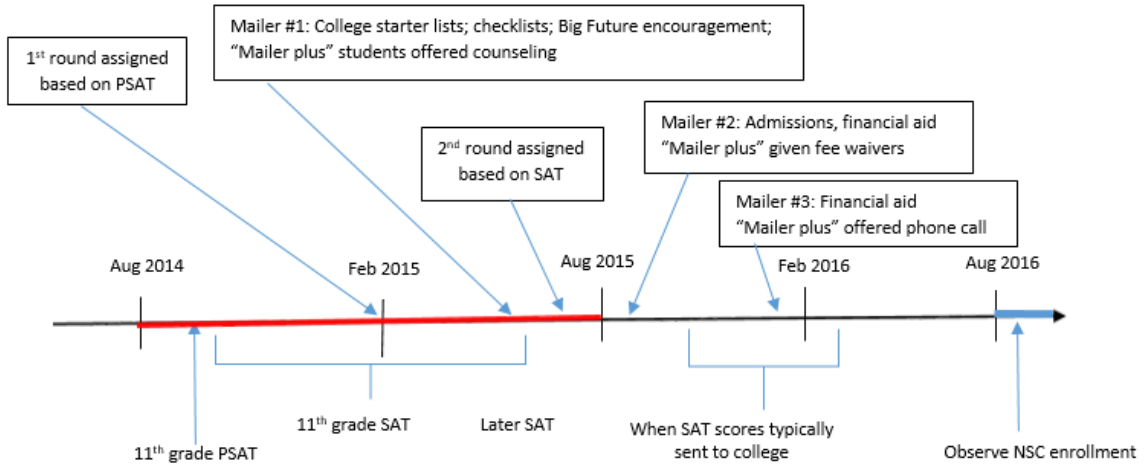
There were four key differences between the intervention materials deployed to the 2016 and 2017 cohorts. First, the College Board sent two mailers, not three. The first mailer focused on choosing a broad set of colleges and knowing key deadlines (similar to 2016 mailer one) and the second on financial 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.[24] 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.

[23] 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.

[24] 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



= 11th grade
= 12th grade
= College

2017 cohort timeline