When "Low Touch" is Not Enough: Evidence from a Random Assignment College Access Field Experiment

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Abstract

Despite well-documented large and growing returns to attending college, youth from socioeconomically disadvantaged backgrounds continue to attend college at lower rates than their more-advantaged peers. This gap is not fully explained by differences in academic preparation, and college enrollment and completion appear to have become more dependent on family income in recent decades. This paper reports the results of a randomized field trial of the effects of two variants of V-SOURCE, a college-counseling intervention designed to address informational and social support barriers to college enrollment, as well as students' tendency to forget or procrastinate about deadlines. V-SOURCE served students from the spring of the junior year through the summer after high school graduation. The program was delivered "virtually" via the internet, phone, email, text message, and social networking platforms, making it relatively low-cost and scalable. We find that students took advantage of V-SOURCE services and found them helpful, and that the program had modest effects on the college application process, including the application portfolio. The program did not improve college enrollment outcomes on average, though it may have improved outcomes for Hispanic students who spoke Spanish at home. While some low-touch interventions have improved college outcomes in other studies, these effects may be dependent on the population served and context of the study.

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1 INTRODUCTION

Compared to their high school-educated counterparts, college-educated adults earn more, have better jobs, are healthier, have more stable families, and have children at later ages. A long literature suggests that this association between college-going and later-life advantages is at least partly causal, and the economic returns to a college education have increased in recent decades.[1] Despite these important benefits of a college education, youth from socioeconomically disadvantaged families are far less likely to attend college than their more advantaged peers. In 2012, for example, just over half of recent high school graduates from low income families enrolled in a two- or four-year college, compared to over 80 percent from high income families (Baum, Ma, and Payea, 2013). Similarly, in a nationally representative 2002 high school sophomore cohort, just over half of students with less educated parents (high school degree or less) had enrolled in college by 2006, compared to over 80 percent of students with college-educated parents (B.A. or more) (Bozick and Lauff, 2007).

Some low-income students do not enroll in college because they are academically unprepared. But differences in grades and test scores explain only about half of the socioeconomic gap in college-going (Bailey and Dynarski, 2011; Ellwood and Kane, 2000; Phillips, 2011). These large and persistent social class disparities in college attendance, even among students with similar academic preparation, suggest that other barriers may affect college attendance among low-SES students.

A large majority of American teenagers, including those from poor backgrounds, aspire to attend college (Ingels and Dalton, 2013; Jacob and Linkow, 2011), but many fewer actually enroll. The college and financial aid application process itself may present a significant barrier to college enrollment for some students. Successfully applying to college and for financial aid—and ultimately enrolling and persisting in college—is a complex process. Students need to learn where they might be competitive for admission. They must learn how to register for, pay for, and study for standardized tests; they need to get to a testing center. They need to understand how much attending college might cost, how they can pay for it, and how to apply for financial aid. Although colleges waive application fees for low-income students, students may still be deterred from applying if they don't know about the policy. Finally, students need to successfully complete both college applications and financial aid forms, the latter with the help of a parent.

To successfully apply to college, students must keep track of and complete many tasks by specific deadlines. This process is particularly unforgiving in California, the site of our study. College application deadlines are early, and no public four-year colleges have rolling admissions; students who fail to successfully submit their financial aid application by the first deadline are unlikely to receive aid. Middle- and higher-income students typically have considerable support in completing this process; they often grow up in environments rich with information about the benefits and possibilities of college; and their parents, schools, and communities provide information, reminders, support, and in many cases, help completing applications.

[1] For reviews of the literatures on the returns to education, including the extent to which returns vary across students, see Barrow and Malumud (2015), Card (2001), Hout (2012), and Oreopoulos and Petronijevic (2013).

The Virtual Student Outreach for College Enrollment (V-SOURCE) program is a 15-month college advising program designed to provide low-income students with more of the information, reminders, and support that higher-income students typically receive. The design of the V-SOURCE program drew both on earlier college access interventions, particularly the predecessor SOURCE program, and insights from the social and behavioral sciences to address a variety of information, motivation, and self-control problems students may encounter when applying to college and for financial aid. The program, described in more detail below, was delivered "virtually," making it logistically and financially easier to scale compared to many existing college access programs. Based on prior research, we expected students whose parents did not attend college or who spoke Spanish at home to benefit most from the program. The study's recruitment strategy ensured that a large share of participants met these criteria.

Over 6,500 students participated in the study and were randomly assigned to a "business as usual" control group or to one of two nested variants of the V-SOURCE treatment; the Milestones variant was fully-automated, while students in the Complete program also had access to a personal advisor. To our knowledge, this is the first randomized evaluation of an entirely virtual intervention designed to assist students with the college and financial aid application process.[2]

Students who were randomly assigned to the V-SOURCE program felt more informed and supported during the college and financial aid application process than students assigned to the control group. As expected, the effects on feeling supported were larger for students enrolled in the Complete variant (where they had a personalized advisor) compared to the Milestones variant. The point estimates indicate that both variants caused modest increases in the key intermediate outcomes the program targeted, though some of the estimates are only marginally statistically significant: registering for the SAT, taking the SAT, and submitting the financial paperwork on time. Program participants applied to more and more varied colleges, and these effects on the application portfolio were larger for V-SOURCE Complete, suggesting that personalized attention may be required for this part of the process.

Although V-SOURCE improved some these targeted intermediate outcomes, those improvements were moderate to modest, and did not translate to higher four-year college enrollment on average. The estimated average effects on enrollment are precise, and we can rule out increases in college four-year enrollment as small as 2.2 and 3.2 percentage points at the top of the 95 percent confidence interval for Milestones and Complete, respectively. The program did improve some college enrollment outcomes for Hispanic students who spoke Spanish at home—the same group that benefited most from the predecessor SOURCE program. Students assigned to either the Complete or the Milestones program were about 3 percentage points more likely to enroll and persist at a University of California (UC) campus, which tend to be more selective campuses (we see similar effects for enrollment and persistence at selective colleges). However, these estimates are not statistically significant after adjusting for multiple comparisons in the sub-group analysis, so we interpret these results with caution.

[2] Several programs use text messaging, sometimes in combination with in-person help, after the application process is complete (see Castleman and Page 2014 for a summary). These "Summer Melt" programs focus on helping students who have already successfully applied to college and plan to attend in the fall actually enroll in the fall.

2 BACKGROUND AND PRIOR LITERATURE

2.1 BARRIERS TO COLLEGE ENROLLMENT FOR DISADVANTAGED STUDENTS

Social class disparities in academic preparation are the single most important proximate cause of social class disparities in college enrollment and success, and these disparities emerge long before most college access programs begin (Klasik, 2012; Phillips, 2011). Yet socioeconomically disadvantaged students who are as well prepared academically as their more advantaged counterparts nonetheless attend college at substantially lower rates (Bailey and Dynarski, 2011; Ellwood and Kane, 2000; Klasik, 2012; Phillips, 2011). Theoretical perspectives from economics, sociology, and psychology provide a number of plausible explanations for these remaining disparities in college enrollment and thus suggest types of interventions that might help ameliorate these disparities (see Perna, 2006, for a review).

Becker's (1993) human capital model suggests that students will attend college if the perceived benefits exceed the perceived costs. This implies that socioeconomic disparities in college going could arise if the actual or perceived costs and benefits of college attendance differ by socioeconomic status. We are not aware of any studies that estimate the returns to education separately by socioeconomic status or of nationally representative data on the association between social class and high school students' estimates of the returns to college, economic or otherwise. Convenience samples suggest that students' perceptions of the economic returns to college do not differ by social class (see, e.g., Avery and Kane, 2004 and Rouse, 2004). Similarly, nationally representative survey data from the late 1990s suggest that lower-income and less-educated parents are as (in)accurate on average at estimating the gross cost of college as their higher-income and more-educated peers, although disadvantaged parents are less likely to provide estimates and their estimates tend to be more variable (Grodsky and Jones, 2007).

Students and parents from all backgrounds tend to overestimate the cost of college (Grodsky and Jones, 2007; Avery and Kane, 2004), which likely matters more for low-income students. Moreover, Dynarski and Scott-Clayton (2013) argue that it may be more difficult than in the past for low-income families to know how much college is likely to cost them because colleges' stated tuitions have been rising while financial aid has become more generous. The divergence between the "sticker price" and the "net cost" of college has been especially large for students from the most disadvantaged families. Although student loans are relatively available and the returns to college likely justify their use, credit constraints and debt aversion may also contribute to social class disparities in college-going (Dynarski and Scott-Clayton, 2013; Olson and Rosenfeld, 1984; Perna, 2008).

To understand these disparities, sociologists draw on the status attainment model which suggests students from disadvantaged family backgrounds complete less schooling in part because they have lower educational expectations and receive less support for college-going from their parents, peers, and teachers (see, e.g., Sewell and Hauser, 1972). Theories about the importance of social and cultural capital (Bourdieu, 1984; Coleman, 1988) also emphasize the role of families and schools in shaping students' sense of which educational paths are possible, reasonable, or assumed (Bourdieu and Passeron, 1977; Horvat, 2001; McDonough, 1997) as well as in providing personalized and detailed information about college and financial aid options and support with the process (see, e.g. Lareau and Weininger, 2008; Plank and Jordan, 2001).

According to these perspectives, middle class students are steeped in a college-going culture from an early age and take for granted that they will attend college (Grodsky and Riegle-Crumb, 2010). Typically, their parents, and often their grandparents, attended college and have the know-how to help them navigate the process. They are more likely to know that their children need to work hard—study for the SAT, rewrite essays, apply to more schools—to submit successful applications. They are also more likely to have the knowledge and social networks to help their children choose a college that is a good match, and have resources to hire professional test preparation assistance (Buchman, Condron, and Rocigno, 2010). More advantaged students are more likely to attend schools in which going to college and receiving help with the process are the norm. In contrast, disadvantaged students are more likely to attend schools with a weak college-going culture and overwhelmed counselors (McDonough, 2004; Roderick, Coca, and Nagaoka, 2011; Robinson and Roksa, 2016; Stephan and Rosenbaum, 2013). Many of their parents, having not attended college, did not navigate the college application process themselves, may have language barriers that make it difficult for them to seek help, and may lack information channels about college in their own social networks.

Finally, research in psychology and behavioral economics suggests that parental or institutional support for the college application process may be particularly useful because applying to college and for financial aid requires filling out complicated forms by firm deadlines, and improving one's chances of admission can require studying for the SAT or drafting multiple versions of college essays. Considering that adults often avoid unpleasant tasks that are in their best long-term interest, such as planning for retirement (Beshears, Choi, Laibson, & Madrian, 2008; Madrian & Shea, 2001; Laibson, 1997), and that adolescents are likely more myopic and have less self-control than adults (Steinberg et al., 2009), it would not be surprising if adolescents needed considerable encouragement and support in navigating the college application process successfully. Social class disparities may then arise if low-income adolescents face additional bureaucratic hurdles (such as the financial aid process) and have fewer sources of support for the process (Avery and Kane, 2004; Bettinger et al., 2012; Dynarski and Scott-Clayton, 2006).

2.2 College Access Interventions

Interventions designed to increase disadvantaged students' college enrollment rates aim to eliminate one or more of these presumed barriers. Some interventions focus primarily on alleviating barriers related to the application process itself by providing college and financial aid counseling; offering information about college and financial aid; helping students complete applications; providing fee waivers for college entrance exams and college applications; and offering information to families (see, e.g., Bettinger et al. 2012; Carrell and Sacerdote, 2017). Others are more comprehensive in that they also attempt to address gaps in students' academic preparation and course-taking and tend to intervene in earlier grades (see, e.g., Olsen et al. 2007). Programs also differ in their timing, duration, intensity, location, and mode of delivery. Finally, different college access programs serve different types of students and attempt (explicitly or implicitly) to operate on different margins; for example, some programs attempt to increase enrollment in any college, while others attempt to encourage students who might have enrolled in a two-year college or non-selective four-year to enroll in a four-year or selective college (see Page and Scott-Clayton (2016) for a detailed review of this literature).

A key question raised by our analysis is why we do not find effects of the V-SOURCE program on college enrollment, whereas other programs with similar features—including the predecessor SOURCE program

and some programs that are significantly less intensive—find positive, sometimes substantial, effects. We compare our findings with those of other college access programs, particularly with the relatively small set of studies that have been evaluated in random-assignment studies, in the discussion section.

3 THE V-SOURCE PROGRAM

V-SOURCE is a virtual version of the Student Outreach for College Enrollment (SOURCE) intervention, which itself was based conceptually on the Boston College Opportunity and Career Help (COACH) program.[3] EdBoost Education Corporation developed and implemented SOURCE in the Los Angeles Unified School District (LAUSD) in 2006-2007. It served students in LAUSD who had 2.5 GPAs or higher who were on track in terms of their course-taking and grades to be eligible for a four-year public university. EdBoost paired SOURCE participants with advisors who provided information and help with the college application process. Bos et al. (2012) reported that SOURCE increased enrollment at four-year colleges by 3.5 percentage points (significant at the 10 percent level). The effects were largest for students who spoke Spanish at home (about 10 percentage points) and for students whose parents did not attend college (about 6 percentage points). We targeted such students for the current study, as described below.

We collaborated with EdBoost to revise the full SOURCE program to make it less expensive, more easily scaled, and able to serve outlying communities where students do not have physical access to college student advisors. See Phillips and Reber (2017) for more detail on the V-SOURCE program and its implementation.

The new program, V-SOURCE (Virtual SOURCE), differs from SOURCE in three key ways. First, advisors found it difficult to meet with their advisees in person, and interactions in SOURCE often occurred by phone (Bos et al., 2012). In V-SOURCE, all interactions between participants and advisors were "virtual" by design. Students communicated with their advisors through the V-SOURCE website, phone, email, text message, and social networking sites. Second, many SOURCE students requested SAT help, but appropriate materials were not available.[4] Students in V-SOURCE had access to an on-line SAT curriculum (*Ready, SAT, Go!*) specially designed for students who score below the national average on any of the three sections of the SAT. Third, SOURCE advisors suggested that "nagging" students to meet the key college-application deadlines was important, but pushing procrastinating students to "pull the trigger" and execute milestones was a struggle for many advisors. In addition, recent research, albeit mostly in other contexts, suggests the potential utility of reminders and near-term rewards in helping people overcome procrastination and complete important tasks (e.g., Dulman, et al., 2007; Karlan, et al., 2014).[5] V-SOURCE therefore included text message and email reminders as well as small financial incentives for students to complete important milestones in the college application process.

[3] The COACH program brought Harvard students to three Boston high schools to help high school seniors with college and financial aid applications (Avery and Kane, 2004).

[4] Commercially available SAT preparation materials such as those produced by Princeton Review and Kaplan are designed for students with higher scores and proved difficult for SOURCE participants to use.

[5] In addition, some "summer melt" interventions have successfully used text messaging to remind students to complete tasks (see Castleman and Page 2014, for a summary), though those studies were not yet available at the

The intervention lasted from March of students' junior year in high school through the summer following their senior year.[6] For this evaluation, EdBoost implemented two variants of V-SOURCE so that the evaluation could distinguish the impact of having access to a personal (though virtual) advisor from a less expensive, fully-automated variant.

Students in the fully-automated Milestones variant received the following:

- Access to the V-SOURCE website, which included information on all aspects of the college and financial aid application process.
- Access to the online *Ready, SAT, Go!* Curriculum, which is targeted to lower-scoring students compared to existing SAT study programs.
- Information and reminders through email and text messages. By default, the messages were sent roughly weekly, and the content changed over the course of the program, depending on the phase of the college and financial aid application process.
- Milestone Rewards ($20 electronic gift cards) for completing the four key milestones in the process—registering for the SAT, taking the SAT, submitting two college applications to different systems, and submitting the FAFSA on time.

Students in the Complete program received everything in Milestones. In addition, they were assigned to an advisor who was available to help them personally with all aspects of the process.

Table 1 describes the components of these two variants of V-SOURCE.[7] In practice, many students did not use all of the program components, and use varied considerably across students. We summarize how students used the program below.

4 PARTICIPANT RECRUITMENT AND SAMPLE

The V-SOURCE program was designed to increase four-year college enrollment for socioeconomically disadvantaged students who were academically on track to be eligible for admission to a public four-year college in California. We developed the eligibility requirements and recruitment strategies with this target population in mind. We recruited students to the study via their schools and targeted schools where we expected to find large numbers of socioeconomically disadvantaged students.

time we developed V-SOURCE. We added a small summer melt extension to the V-SOURCE program, and randomly assigned a subset of treatment students to receive either a small number of additional message during the summer or a single message at the start of the summer containing all the same information. We will report on this sub-experiment in a separate study.

[6] We randomly varied the post-high school summer portion of the program so that for one third of students, the program concluded in June after high school graduation; another third received automated messages (and in the case of V-SOURCE Complete, access to help) about tasks they need to complete during the summer; and the final third received all of the information contained in the summer messages (and in the case of V-SOURCE Complete, an offer of access to help) in a single email at the start of the summer. All students continued to have access to the V-SOURCE website during the summer.

[7] Phillips and Reber (2017) provides additional detail.

We determined eligibility and EdBoost recruited participants at high schools in six California counties during the fall of the 2011-12 and 2012-13 school years.[8] We targeted comprehensive high schools where at least 60 percent of the students were African American and/or Hispanic/Latino (AA/HL) and at least 60 percent qualified for free or reduced-price meals (FRPM). We prioritized schools with more than 200 juniors, and recruiting staff attempted to contact all schools meeting these three criteria.[9] Some eligible schools did not respond to calls or declined to participate but the recruited schools are similar to the eligible pool on most key variables (see Phillips and Reber (2017) for more detail on school and participant recruitment procedures.)

V-SOURCE was designed for students who wanted to attend college, were likely to be academically eligible for a four-year college, and whose parents might be less able to provide sufficient information and support during the college and financial aid application process because they were unfamiliar with colleges and the application process in the U.S. or lacked the economic resources to hire paid college counselors. Table 2 shows that the study attracted students whose grade point averages were relatively high (about 75 percent reported B averages or above) and who had very high educational aspirations (nearly 80 percent aspired to a graduate degree). The program attracted more girls than boys (68 percent), consistent with women's significantly higher college-going rates, more Hispanics than any other ethnic group (approximately 70 percent of whom reported speaking Spanish with their parents), and mostly U.S.-born students whose parents were foreign-born. Just over half the students reported "using lunch tickets," which is probably an underestimate of actual subsidized meal eligibility because some schools have school-wide meal programs (so students don't use lunch tickets), students may choose not to report their lunch ticket use, and some who receive tickets do not use them. Approximately 60 percent of students had parents who had not attended college at all (though 23 percent had a parent with some college and another 15 percent had a parent with at least a four-year college degree).

EdBoost delivered V-SOURCE virtually, so students needed access to computers or smart phones to use the program effectively. Table 3 shows that students were relatively active users of the internet, email, and text messaging—the three key technologies used to deliver the program. Eighty-one percent reported using the internet at least a few times a week on their own computer, and 97 percent reported using the internet that often by some method. Eighty-one percent reported checking their email a few times a week, and 96 percent reported checking it at least a few times a month. Eighty-three percent reported text messaging at least a few times a week. Although technology use was slightly higher among students with more educated parents, the vast majority of students who participated in the study had access to the technologies they needed to use the V-SOURCE program.

[8] All counties are in Southern California, except Tulare, which is in Central California.

[9] Recruiting staff also contacted additional schools meeting slightly relaxed criteria at their discretion if it made logistical sense to recruit there: These included smaller schools meeting the 60 percent AA/HL and 60 percent FRPM thresholds; schools meeting either the AA/HL or FRPM cutoffs at a 50 percent threshold; and smaller "schools within schools" sharing a campus with an eligible school. In practice, the vast majority of research participants were enrolled in schools satisfying the first set of criteria.

5 DATA AND METHODS

5.1 SURVEY DATA

A key advantage of our study is that we not only have administrative data on college enrollment, but also rich survey data on baseline characteristics, intermediate outcomes, and students' self-reported experiences applying to college. We surveyed participants three times during the study.

- Application Survey. The program application contained a short, paper-based survey that asked about students' course-taking and grades (to determine their eligibility), demographic and family background, technology use, and self-perceptions.
- Baseline Survey. Prior to random assignment, we invited applicants to participate in a longer, online Baseline Survey that covered a wide range of topics, including demographic and family background, self-perceptions, and college knowledge and plans.
- Follow-up Survey. In the late spring/early summer of the senior year, we invited participants to take an online Follow-up Survey asking about their college preparation, college and financial aid applications, future plans, and, for students assigned to the program, their experiences with the program.[10]

Response rates varied across the cohorts and surveys, but were generally high. The Application Survey had a small number of items but nearly 100 percent response on most items. Defined as answering at least 80 percent of items, we obtained response rates to the Baseline Survey of 77 and 94 percent for cohorts 1 and 2, respectively (87 percent overall) and to the Follow-up Survey of 87 and 88 percent, respectively.[11]

5.2 COLLEGE ENROLLMENT ADMINISTRATIVE DATA

Our key outcomes of interest are whether and where students enrolled in college in the fall after expected high school graduation and whether they persisted to the second fall. We use administrative data from the National Student Clearinghouse (NSC) to construct college enrollment outcomes. The NSC is a non-profit organization that provides enrollment and degree-verification services. Participating colleges and universities report their students' enrollment to the NSC, and the NSC makes these data available to researchers (see Dynarski, Hemelt, and Hyman, 2013 for more details on the NSC match

[10] We also administered a short survey to the control group only during the summer between junior and senior year. This survey served two purposes: (1) to improve our chances of getting a response to the Follow-up Survey by maintaining contact with students and updating their contact information and (2) provide control group students an opportunity to receive a $20 gift card to reduce demoralization since some knew students in the intervention groups and may have been disappointed that they didn't have a chance to get a gift card. In addition to updating the contact information, we asked a few questions about how they spent their summers, but we do not analyze these data as part of the research.

[11] These response rates are for the main analysis sample. Response rates differ slightly for the full sample of students offered the survey, particularly for the Baseline Survey in cohort 2, because we excluded from random assignment some students we were unable to contact during the Baseline survey period.

process). The NSC matches students to their records based on name and date of birth.[12] The match is imperfect for a number of reasons: (1) participants with common names may match to multiple records, in which case NSC does not return a match, (2) participants may report a different name to us than they use to register for college, (3) colleges sometimes do not report undocumented students to the NSC even when they are enrolled in college, and (4) some institutions do not participate in the NSC, so participants attending those institutions will not return a match.[13] We constructed the data we provided to NSC for the match without regard to treatment status, using only data collected prior to random assignment. Thus, these matching imperfections likely affect treatment and control groups similarly and should not substantially bias our results. However, the tendency of NSC to under-report college enrollment could lead us to underestimate the effects on enrollment.[14]

We asked participants for their names and birthdates on both the Application and Baseline Surveys. Where the reported name or birthday differed (or the handwriting was unclear), we provided a range of name-DOB combinations to NSC for the match. This process generated many non-matches (because one of the combinations was wrong) but very few instances where different versions of the same participant matched to different colleges. We consider a participant matched if any name-DOB combination matched to one or more colleges in the fall after their expected graduation date. We link these colleges to data from the Integrated Postsecondary Education Data System (IPEDS) and construct indicators for attending and persisting in different types of colleges.

5.3 RANDOM ASSIGNMENT

The V-SOURCE Milestones treatment was less expensive compared to V-SOURCE Complete so would be cost effective with smaller treatment effects. Thus, to improve power to detect small treatment effects in the Milestones treatment and keep within our budget, we chose to assign fewer students to V-SOURCE Complete than the other two treatment arms. We planned to assign students to Complete, Milestones, and Control in a 2:3:3 ratio. However, we over-recruited slightly in cohort 2 and divided the extra students evenly between Milestones and Control (about 22 percent, rather than 25 percent, of cohort 2 students were assigned to Complete).[15]

[12] The NSC can, under some circumstances, match on students' Social Security Number. We did not collect SSNs for fear of deterring potential applicants and because we expected students' reports of their SSNs to be inaccurate.

[13] In some research using NSC data, NSC does not return a match for students who have opted to block disclosure of their directory information or for institutions that have blocked all of their students' directory information. Participants in our study consented to having their data matched, so NSC provided a consent-based match, so this is not a limitation in our study. (Cite this: http://nscresearchcenter.org/wp-content/uploads/Considerations-in-Using-NSC-STHS-Reports.pdf)

[14] It is also possible that the program induced participants into (or out of) schools that disproportionately report (or don't report) to the NSC, which could bias the estimates. The results using self-reported data on enrollment plans are similar, suggesting this is not an important source of bias.

[15] We excluded 59 students from the research prior to random assignment because they had poor contact information, so we had no way to reach them. To avoid problems in administering the program, we non-randomly assigned some students who were in the same household with another participant (typically twins) to the same

We used STATA to randomly assign students to a treatment arm within blocks created by fully interacting gender (2 categories: male and female), Parental Education (2 categories: at least one parent went to college (excluding vocational) and the complement), and a race/ethnicity-home language composite (3 categories: Hispanic/Latino and speaks Spanish at home, Hispanic/Latino and does not speak Spanish at home, and the complement). The interaction of these categorical variables generated 12 blocks; we put students who had missing data on any of these variables in a separate block.[16]

We randomly assigned participants rather than schools, despite concerns about within-school treatment diffusion, because school-level assignment would have required an extremely large sample to yield sufficient power. The Follow-up Survey included questions designed to assess the extent of treatment diffusion, which we discuss below.

Appendix Table A1 shows that participant characteristics measured prior to random assignment are balanced across the treatment and control groups in the analysis sample (excluding the 70 students who left the research after random assignment) on characteristics measured prior to random assignment, as expected.[17]

5.4 ESTIMATION

We estimate reduced-form treatment effects of assignment to V-SOURCE Complete or V-SOURCE Milestones, relative to the control group.

The most parsimonious specification for the treatment effect estimates is:

$$(1) \quad Y_{isb} = \beta_0 + \beta_1 MILESTONES_{isb} + \beta_2 COMPLETE_{isb} + \eta_b + \varepsilon_i$$

where Y_{isb} is an outcome measure for student *i* in school *s* in block *b* and *MILESTONES* and *COMPLETE* are treatment group indicators; the omitted category is the control group. η_b is a vector of dummy variables for each of the blocking groups (excluding 1 group) to account for blocking during random assignment; these blocking group fixed effects implicitly control for cohort since we blocked within cohort. ε_i is an individual-specific error term. The parameters of interest are β_1 and β_2, indicating the effects of each treatment relative to the control group.

The college-enrollment outcomes based on NSC data come from administrative data so are not subject to differential attrition. The intermediate outcomes related to students' experiences applying to college

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treatment arm as their household-mate. We exclude the non-randomly assigned students from the analysis. See Phillips and Reber (2017) for more detail.

[16] We coded the parental some college variable as 0, rather than missing, if the student reported that they didn't know their parent's education or didn't have that parent; this variable is coded as missing if the student didn't answer the question at all.

[17] We regressed each variable on indicators for being assigned to Milestones or Complete and a Cohort 2 indicator (since the probabilities of being assigned to each treatment arm are not the same across cohorts). The Control mean is reported in Column (1); the coefficients on the Milestones and Complete indicators, respectively, are reported in Columns (2) and (3). The p-value for the F-test of joint significance for the Milestones and Complete indicators is reported in Column (4). The only statistically significant difference is for the share of students who check their email at least a few times a week and the difference is substantively small.

and completion of key college application steps were self-reported on the Follow-up Survey. Although the response rate for the Follow-up Survey was high (about 87 percent), the response rate was about 3 percentage points higher in the control group than in the two treatment groups.[18] For this reason, and to improve power, we add controls for a flexible function (cubic) of each of two measures of GPA collected on the application to equation (1) for our main specification.[19] Recall that the blocking variables include the key demographic predictors of college-going outcomes, so by including indicators for the blocking variables, we are implicitly controlling flexibly for those variables as well. In practice, the results are largely unaffected by the inclusion of these controls.

We present estimates of heterogeneous treatment effects for the key demographic groups used to create the blocking groups for random assignment:

- Gender
    - Male
    - Female
- Highest level of Parental Education
    - Less than College (including "don't know")
    - Some College or more
- Race/ethnicity and Home Language
    - Hispanic and Spanish is Home Language
    - Hispanic and English is Home Language
    - All Others (including missing)

To estimate heterogeneous effects, we interact the treatment indicators with an exhaustive set of indicators for each category; we also include the indicators for each category separately. For example, the estimating equation for the analysis of treatment effects by gender is:

$$(2)\ Y_{isb} = \gamma_0 + \gamma_{1f} MILESTONES_{isb} \times FEMALE_{isb} + \gamma_{2f} COMPLETE_{isb} \times FEMALE_{isb} + \gamma_{1m} MILESTONES_{isb} \times MALE_{isb} + \gamma_{2m} COMPLETE_{isb} \times MALE_{isb} + \Psi \mathrm{X}_{isb} + \eta_b + \varepsilon_i$$

Where γ_{1f} is the treatment effect of Milestones for females, γ_{1m} is the treatment effect of Milestones for males, γ_{2f} is the treatment effect of Complete for females, and γ_{2m} is the treatment effect of Complete for males. (The *FEMALE* indicator is actually subsumed in the blocking variable indicators, but

[18] Differential response rates were even larger earlier in the survey administration window; response rates converged as we contacted the treatment groups more by email, text message, and eventually phone, to remind them to take the survey. We speculate that the treatment students were slower to respond because they had received a lot of communication from the V-SOURCE program during the prior 15 months, so were likely less attentive to an individual message from V-SOURCE (even if it came from the a different email address or phone number), particularly if they perceived the college application process to be over.

[19] On the Application Survey, students were asked "If you had to apply to college today, what would your GPA be? Make your best guess if you are not sure." We use this self-reported GPA. In addition, we asked them to report their grades in several classes and construct a GPA measure based on the grades reported in several key academic subjects.

we include it here for completeness and because that is not the case for all of the sub-groups we analyze.) X_{isb} is a vector of controls for GPA.

5.5 INFERENCE

Random assignment was at the individual level within the thirteen blocks as described above. In the tables below, we cluster the standard errors at the high school level to account for the clustering of students within schools.[20] We use stars to indicate statistical significance at conventional levels for individual coefficients.

We are testing many comparisons, so considering each test separately will lead us to reject the null hypothesis too frequently, conditional on the chosen significance threshold.[21] Following Kling, Liebman, and Katz (2007), we construct indices of related outcomes to reduce the number of outcomes we are examining, particularly for the outcomes related to students' self-reported levels of information and support for applying to college, which are based on a large number of survey questions. However, many of our key outcomes have an intuitive scale (for example, SAT taking, college application, and college enrollment), and we want to examine the effects of the program on different margins, so we do not combine these in an index.

We differentiate between confirmatory and exploratory analyses (see, e.g., Bloom and Michalopoulos (2010) and Schochet (2008)). For the confirmatory analyses, we use the Benjamini-Hochberg (1995) method to control the false discovery rate within each domain, consistent with the IES *What Works Clearinghouse* (2014) guidelines. We divide our outcomes into the following domains:

- Application Experiences (3 outcomes)
- Milestone Completion (4 outcomes)
- College Application Portfolio (5 outcomes)
- College Acceptances (5 outcomes)
- College Enrollment (5 outcomes)
- College Persistence (5 outcomes)

We apply the adjustment separately within each domain for the average treatment effects and separately within each domain across all the subgroups when we analyze heterogeneous treatment

[20] Abadie et al. (2017) argue that this clustering on high school may not be appropriate in this case because random assignment was at the individual level. In practice, this makes little difference.

[21] Specifying outcomes and sub-groups as part of a pre-analysis plan is common in medicine and increasingly common in economics. We began this work in 2011 and did not register a pre-analysis plan. The outcomes and sub-groups we consider for our confirmatory analyses are the ones we "pre-specified" as of interest in our choice of blocking variables and largely what we identified in our grant application: "To examine whether the treatment is more effective for particular sub-groups, we will also interact the treatment variables with the moderating variables described above, including gender, parental education, parental language, and time preferences, although power considerations will limit our ability to divide the sample too finely." Subsequent to writing the grant application but before conducting the analysis, we decided to focus on demographic sub-groups only in the confirmatory sub-group analysis and use the baseline data we collected on a range of psychological constructs, including time preference, to explore mechanisms.

effects. For example, the "Application Experiences" domain has three outcomes. For the analysis of average treatment effects in this domain, we adjust for 6 comparisons (two treatments by three outcomes); in the analysis of heterogeneous treatment effects, we adjust for 42 comparisons (two treatments, three outcomes, 7 subgroups). In the tables, we denote with a dagger coefficients that are significant at the 5 percent level after applying the adjustment for multiple comparisons.

6 PROGRAM IMPACTS: AVERAGE EFFECTS

This section describes students' use of the program and its average effects on a number of intermediate outcomes and on students' four-year college enrollment and persistence.

6.1 TAKE-UP AND PROGRAM USE

6.1.1 Take-Up

We cannot estimate a traditional "first stage" effect of assignment to the intervention on enrollment in the intervention for two reasons: first, students did not have to actively enroll in the program, and they could receive some treatment components (the automated emails and text messages) without interacting directly with the program in a way we could observe. Second, we cannot measure program use by control students because, for example, if they logged into the website using a V-SOURCE participant's credentials, we will attribute that use to the participant assigned to V-SOURCE rather than to the control student.

Nonetheless, Table 4 shows three (imperfect) measures of program take-up, all of which suggest that most of the students assigned to the two variants of the program participated at least a little. Column (1) indicates that nearly all students—92 percent of those assigned to Milestones and 99 percent of those assigned to Complete—had at least one confirmed contact with V-SOURCE.[22] Column (2) shows that a lower percentage of students—72 percent of those assigned to Milestones and 97 percent of students assigned to Complete—were active participants in the program after the introductory period (i.e., visited a substantive page on the V-SOURCE website, claimed a Milestone Reward, or interacted with their advisor any time after the first three months of the program). But this measure understates program participation for Milestones students because all students received a substantial amount of information via email and text messages. Column (3) shows that nearly all (96 percent) of students assigned to Complete had a least one interaction with their advisor after the introductory period.

[22] This variable is equal to 1 if the student ever actively interacted with the program, including replying to an email or text message, claiming a Milestone Reward gift card, interacting with their advisor or a program coordinator, or logging into the website (even if only to visit an administrative page). In addition, several weeks after we informed students that they were in the program, we did an "outreach" campaign to confirm that students assigned to V-SOURCE Complete or Milestones knew that they had access to the program. We first sent automated emails and text messages asking for a confirmation reply; advisors and program staff then reached out by phone to students who did not respond to the email and text messages. "Any Confirmed Contact" is also equal to 1 for students who confirmed they knew they had access to the program during this outreach.

6.1.2 Program Use

Table 5 describes the average "dose" of the program received by students who were assigned to Milestones and Complete. V-SOURCE sent students in both programs an average of four automated emails and three to four automated text messages per month. Students assigned to Complete visited the website on 8.3 distinct days compared to 5.6 distinct days for Milestones. These results suggest that advisors may have encouraged students to use the V-SOURCE website and also that the typical participant did not visit the website a lot (especially considering that students had access to website for about 15 months, and many of the V-SOURCE emails and text messages included website links intended to push students to the website for additional information).

Students assigned to V-SOURCE Complete, and thus to an advisor, texted or emailed back-and-forth with their advisor about eleven times during the program, on average. They talked to their advisor by phone nearly twice, on average, and received about 50 group emails sent by the advisor and another eight sent just to that student.

We also surveyed program participants in the late spring of senior year about how much they used the program components and the extent to which they found them helpful. The self-reported data on program use show patterns that are broadly consistent with the administrative data, but students report more program use than the administrative data show. Overall, students found the most common components of the program helpful; more than 75 percent of participants in both Milestones and Complete found the V-SOURCE website and emails "helpful" or "very helpful," and a similarly large percentage of those in Complete found their advisor "helpful" or "very helpful" (see Table 6).

6.2 Application Experiences: Information and Support

Most students assigned to V-SOURCE knew they were in the program and used some of the services. However, if students had access to other sources of college application information and support, V-SOURCE may simply have substituted for or "crowded out" other similar services, and thus not increased information and support overall. For example, many students reported participating in other college access programs at baseline and they could get some of the same services V-SOURCE provides from school counselors, teachers, or other college access programs. Based on our analyses of the Follow Up Survey (results not shown), participation in V-SOURCE did not crowd out participation in other college access programs (i.e., students assigned to V-SOURCE were as likely as those assigned to the control group to report on the Follow-up Survey that they participated in other college access programs). However, it is possible that students assigned to V-SOURCE participated less intensively than the control group in these other college access programs, and it is also possible that V-SOURCE substituted for other ways in which students otherwise would have received college access-related help.

To assess how much V-SOURCE increased the overall amount of information and support students had during the college and financial aid application process, we included a number of questions on the Follow-up Survey. These questions were not specifically aligned with the V-SOURCE program content and were intended to capture the extent to which students sought out information about the college application process, felt informed about various aspects of the process, and felt supported during the process (see Appendix Table A2 for the list of items). We combined these items into three indices measuring each of these constructs —"Sought Information," "Had Information," and "Had Support"—

and used the indices, rather than separate items, as measures of students' experiences of the college application process.[23]

Table 7 reports the effects of being assigned to V-SOURCE Milestones or Complete on these indices. V-SOURCE did not affect—in either direction—the extent to which students sought information about applying to college or for financial aid. These estimates are reasonably precise: the 95 percent confidence interval rules out effects as large as 0.08 standard deviations. V-SOURCE did, however, increase the extent to which students felt informed and supported, by 0.086 and 0.080 standard deviations, respectively, for Milestones and by 0.109 and .151 standard deviations, respectively, for Complete.

These results suggest that the Milestones components—the website and automated messages—made students in both treatment groups feel more informed and supported, though the estimated effects on feeling supported were almost twice as large for students assigned to the Complete program (0.151 standard deviations) as for those assigned to Milestones (.080 standard deviations). It is perhaps surprising that Milestones had any positive effect on the "Had Support" construct, given that the questions underlying that measure asked whether the student *had someone* who would help them with various tasks, and students in the Milestones program did not have an advisor. This positive effect may imply that students thought that the automated messages and website text were written by humans who intended to be supportive.

Although these results suggest that both variants of the V-SOURCE program improved students' experiences of the college and financial aid application process, it is also possible that the treated students may have inflated their reports of feeling informed and supported to please the research team (either consciously or unconsciously). Students knew that the survey was coming from the V-SOURCE research team, so we cannot rule out the possibility that what researchers term "demand effects" (Orne, 1962; Zizzo, 2010) or "reactivity" (Webb et al., 1966) may have biased these effects upward.

6.3 Milestone Completion, College Application, and College Acceptance

V-SOURCE encouraged students to complete key milestones in the application process by providing information on the importance of these steps, sending reminders, providing Milestone Rewards when students successfully completed key milestones, and for students in V-SOURCE Complete, providing personalized assistance as needed.

Table 8 shows the effects of assignment to V-SOURCE on the four milestones for which students could receive Milestone Rewards: registering for the SAT or ACT, taking the SAT or ACT, submitting college

[23] Before constructing these indices, we conducted exploratory factor analyses of the items. Those analyses provided support for a two factor solution (in which "Had Information" and "Had Support" items could be combined) and a three factor solution in which they remained distinct. We opted for the three factor solution based on the content of the questions (face validity) and hypotheses about different effects for V-SOURCE Milestones and Complete. We expected, for example, that differences between Milestones and Complete might be larger on the "Had Support" construct than on the "Had Information" construct because V-SOURCE Complete students received an advisor who could provide personalized support, and investigating that hypothesis required keeping those indices separate. The "Had Information" and "Had Support" indices are highly correlated (.68). The "Sought Information" index is less highly correlated with the other two indices (.30 with each).

applications, and submitting the FAFSA (or DREAM Act Application).[24] The effects are small and positive but only marginally significant in some cases (and many are not significant at the 5 percent level after adjusting for multiple comparisons). The control means are also relatively high: for example, 83 percent of the control group reported taking the SAT or ACT, and 86 percent reported submitting FAFSA.

Table 9 reports effects of assignment to V-SOURCE on *where* students applied to college. Each outcome is an indicator for having reported applying to at least one college of that type: (1) any four-year college, (2) any selective four-year college, which we define as having a 2013 Barron's classification of "very competitive plus" to "most competitive," (3) any college in the California State University (CSU) system, and (4) any college in the University of California (UC) system. The program encouraged students to apply broadly to four-year colleges, and to include selective colleges if appropriate given their academic record. Most of the coefficients in Table 9 are positive and statistically significant (even after adjusting for multiple comparisons), indicating that V-SOURCE increased the number of applications participants submitted. These effects are relatively small, however, with the largest point estimate implying that V-SOURCE Complete increased students' applications to a UC by 4.4 percentage points.

Table 10 shows that students' increased applications to four-year colleges did not necessarily translate into acceptances. The coefficients on self-reported acceptances are smaller and statistically insignificant. These results suggest that at least some students did not have the academic record to be admitted to more selective colleges to which they applied.

6.4 College Enrollment and Persistence

The goal of the V-SOURCE program was to increase enrollment and persistence in four-year colleges. Tables 11 and 12 show that the effects on enrollment and persistence are small and statistically insignificant.[25] The estimated effect of Milestones on enrolling in UC is 1.7 percentage points and statistically significant at the 5 percent level, but it is not significant after adjusting for multiple comparisons. The point estimates suggest a shift from CSU to UC, though the change in CSU enrollment is not statistically significant.

These effects are reasonably precisely estimated, allowing us to rule out effects on any four-year college enrollment larger than about 2.2 and 3.2 percentage points for Milestones and Complete, respectively. These results are perhaps unsurprising in light of the small effects on college application and statistically insignificant effects on acceptances to more selective colleges. Although in theory V-SOURCE could have

[24] We measure all these outcomes using students' self-reports on the Follow-up survey.

[25] We use the NSC matches to construct indicators for the enrollment outcomes for the same categories as applications and acceptances: (1) any four-year college, (2) any selective 4-year college, (3) any CSU, and (4) any UC. The enrollment measure is equal to 1 if a student enrolled in the specified category in the first fall after expected on-time graduation from high school. The measures of persistence are equal to one if a student met the criteria in both the first and second falls after expected on-time high school graduation. For example, the two-year persistence measure for attending a 4-year college is equal to one if the student attended a 4-year college in both the first fall and the second fall, even if it was not the same institution or enrollment was not continuous. Note that because a small number of students were matched to multiple colleges, we constructed alternative codings of the key outcome variables, and the findings did not change.

helped students make a better college match and thus persist at a higher rate even without increasing first fall enrollment, the effects on persistence (Table 12) are also small and statistically insignificant.

7 HETEROGENEOUS EFFECTS

Based on the results from the SOURCE evaluation, we expected the program to be more effective for those whose parents did not attend college and who spoke Spanish at home; in practice, these groups overlap substantially. We also present results separately by gender because other evaluations of college access interventions have found larger effects for women (Carrell and Sacerdote, 2017).

We present the estimates for the sub-group analysis graphically and show the full results in the Appendix. For race/ethnicity and home language, the figures show results only for Hispanic Spanish-speaking students and other Hispanic students because the group of Non-Hispanic students is small and the estimates associated with it are noisy. Note, however, that we show results for all the groups in the appendix tables and count all groups in the multiple comparison adjustments.

Figure 1a shows the estimates for the intermediate outcomes—that is, the experience constructs (Panel A) and the milestone outcomes (Panel B)—separately by gender. Figure 1b shows the college outcomes—application, acceptance, enrollment, and persistence for the different sectors—separately by gender. We repeat these two figures by race/ethnicity and home language (Figures 2a and 2b) and parental education (Figures 3a and 3b).

The estimates in the subgroup analysis are generally not precise enough to detect statistically significant differences between the treatment effects for different groups, so we discuss the patterns of point estimates with that in mind. We do not see a consistent pattern suggesting that females or males benefited more from the program (Figures 1a and 1b). Likewise for the estimates by parental education (Figures 3a and 3b), though the effects on college applications are somewhat larger for those whose parents did not attend college.

The estimates by race/ethnicity and language suggest small positive (but not statistically significant) effects on four-year college enrollment and persistence for the sub-group where we expected the largest effects—Hispanic students who spoke Spanish at home (Figure 2b). The estimated effects on enrollment and persistence in Any Selective College and Any UC (these are overlapping) for this group are statistically significant before adjusting for multiple comparisons, but not after; both Milestones and Complete increased two-year persistence in a UC by 3.5 percentage points, modest in absolute terms but large relative to the control mean of 9 percent.

These point estimates suggest that the program encouraged Hispanic students who spoke Spanish at home to apply more broadly and to attend a UC conditional on acceptance, and that the marginal students induced into enrolling at a UC then persisted at UC. The estimated effects on overall four-year persistence (2.5 and 3.0 percentage points for Milestones and Complete, respectively) suggest that V-SOURCE increased four-year enrollment and persistence overall, rather than simply shifting students to UC from other four-year colleges, but the estimates are not precise enough to draw strong conclusions.

Although the effects of V-SOURCE on both intermediate and college-enrollment outcomes is more consistently positive and statistically significant for Hispanic students who reported speaking Spanish at home, these effects are mostly statistically indistinguishable from the estimates for the other

race/language subgroups and the estimated effects on enrollment and persistence are not statistically significant after adjusting for multiple hypotheses, so we caution readers not to over-interpret these findings.

8 DISCUSSION

Although theory and past research suggest that providing additional information and support to disadvantaged students during the college and financial aid application process can improve students' college enrollment outcomes, our randomized evaluation found that a program designed to provide such information and support *virtually* did not increase students' likelihood of enrolling or persisting in college, for the average student who participated in the study.

We discuss these results in light of potential threats to the internal validity and then compare our study to others to highlight potential explanations for our results.

8.1 DIFFUSION AND DEMORALIZATION

We used person-level random assignment, despite concerns about the potential for treatment diffusion and control group demoralization, because a school-level randomized trial would have required a very large sample of schools to have enough statistical power to detect small to moderate effects. Yet, this design probably biased our effects downward in two ways.

First, all the components of Milestones other than the Milestone Rewards could be easily shared within students' social networks, and students' self-reports from the Follow-up survey indicate that some students in the treatment group shared their V-SOURCE emails, text messages, and website access with control group students. About a third of control group students reported that they knew someone who was participating in the V-SOURCE program, about a quarter reported that a treatment student told them what they were learning from V-SOURCE, and nearly a quarter reported receiving forwarded emails from a V-SOURCE participant. Almost 13 percent of the control group said a program student provided a username and password for the V-SOURCE website. Although we suspect that few to no control group students received the same dose of the automated intervention as treatment students—on the Follow-up survey, between 60 and 70 percent of the control students reported learning "nothing" or "very little" from the V-SOURCE website, emails and text messages, and other students in the program, and only 4 to 7 percent reported learning "a lot of things"—diffusion probably biases our estimates of the effects of V-SOURCE toward zero.[26]

Second, to limit diffusion to the control group, EdBoost implemented the program differently than it would have in the absence of a randomized trial. These efforts to limit diffusion may have reduced the dose of the intervention received by students assigned to the treatment and may have reduced the program's overall effectiveness. For example, to prevent control group students from accessing the website, EdBoost required program students to login. But the login process may have deterred some

[26] We did not block on high school, so the share of *study participants* (which will differ from the share of juniors, depending on how many juniors participated in the study) who are assigned to treatment varies randomly across schools. We do not find differential treatment effects depending on the share assigned to treatment, but these estimates are imprecise; most of the variation comes from schools with small numbers of participants.

treatment students from using the website as much as they otherwise might have.[27] In addition, EdBoost attempted to prevent information from spreading in school and through social networks, by keeping Facebook groups closed, for example. Outside the context of a randomized trial, the program would have instead tried to magnify its messages by deliberately using students' social networks (especially since students seemed to find the information valuable enough to share it).

In contrast to diffusion, if control group students were disappointed when they were not assigned to V-SOURCE and this made them less likely to apply to and attend college, this demoralization effect would lead to upward bias in the estimates. We made every effort to limit the possibility of demoralization and emphasized from the application stage that selection into the program was random, so that students did not interpret assignment to the control group as a negative signal about their college-going potential. At the same time we offered the program to the treatment group, we congratulated the control group on being assigned to the "Research Group," and emphasized that they would have the opportunity to earn gift cards by taking surveys about their experiences. We asked students on the Follow-up survey how they felt when they learned of their treatment status, and nearly half of control students reported that they were "very happy" when they found out they were assigned to the control group; less than 2 percent reported they were "somewhat" or "very disappointed" (results not shown). While we cannot rule it out, we do not think demoralization is likely to be a big problem in this study.

8.2 Comparison to Studies of Other College Access Interventions

V-SOURCE differed from other college access interventions that have found positive effects on college enrollment in many ways, including the population served, services offered and service delivery mode, as well as the time periods and postsecondary context. Although it is difficult to determine what explains these divergent findings, understanding differences among programs has become increasingly important as more experimental and quasi-experimental studies of college access programs have become available.

8.2.1 Comparison to SOURCE

By design, V-SOURCE most closely resembled SOURCE. The two programs served similar populations of students, delivered similar content, in a similar postsecondary context, during a similar period in students' lives (spring of junior year through end of senior year). SOURCE served students from the Los Angeles Unified School District during 2006-2007 who were academically eligible for a four-year college. It had moderate, statistically significant positive effects on SAT taking, college application, and financial aid receipt, and increased enrollment at four-year colleges by a marginally significant 3.5 percentage points. The effects on four-year college enrollment were larger for students who spoke Spanish at home and for students whose parents had not attended college, 10 and 6 percentage points, respectively.

V-SOURCE was broader in its geographic reach than SOURCE (65 percent of V-SOURCE students came from LAUSD while the rest were from other California school districts), was implemented more recently (2012-2014), and included additional content (in particular, more information on financial aid, extensive SAT preparation materials, and gift cards rewards for completing key college access-related milestones).

[27] About 17 percent of treated students reported that they did not use the website more because they had trouble logging in.

Most important, V-SOURCE differed from SOURCE in its delivery method—it was entirely virtual and thus less expensive per student[28] and more scalable.

Despite differences in the time period and geographic coverage, SOURCE and V-SOURCE participants were similar (see Appendix Table 9). Consistent with the recruitment strategy for the current study, V-SOURCE students were more likely to report Spanish as the home language and less likely to have at least one parent who attended college; if anything, these differences should have led us to find larger effects in V-SOURCE, because those were the groups that most benefited from SOURCE. V-SOURCE students had somewhat higher GPAs and somewhat lower educational expectations but these differences are not that large and may be attributable to differences in the data sources across the studies. [29]

The type of information V-SOURCE provided—about important deadlines, how to apply, how to study for the SAT, and where to find more information—is more readily available now than in 2006-2007, when the SOURCE program operated. For example, at the time, SOURCE compiled information about the UC and CSU applications from each system, because such information was not readily available online (even if students had access to the internet), and provided it to students in printed format. All of this information is now readily available online. It is also possible that the in-person component of SOURCE was important, and that virtual advisors are not as effective.

Although we do not find effects of V-SOURCE on college enrollment overall, we do find some evidence of positive treatment effects for the group that benefited most from SOURCE—students who spoke Spanish at home, but the estimates are smaller and on a different margin (UC enrollment rather than any four-year college enrollment). Arguably, both studies suggest that students who speak Spanish at home benefit from this type of intervention, though the benefit may have declined over time or may be lower for a virtual program than an in-person program. The gap in four-year college enrollment in the control group between students who spoke Spanish at home and others was almost twice as large in SOURCE, so the declining effectiveness of a program like V-SOURCE over time may be related to improvements in the control condition among students who speak Spanish at home.

8.2.2 Comparison to Other Interventions

A number of other recent studies suggest that interventions that provide information and support for the application process can improve college enrollment outcomes (Carrell and Sacerdote, 2017; Avery, 2013; Bettinger et al., 2013; Hoxby and Turner, 2013), including some "Summer Melt" programs that also use text message reminders (Castleman and Page, 2014). It is worth noting that some of these studies find positive and statistically significant effects only for certain sub-groups.

[28] We estimate costs of $84 and $529 per student for V-SOURCE Milestones and Complete, respectively, compared to about $1,200 (adjusted for inflation) for SOURCE (Bos et al. 2012)

[29] The GPA information comes from students' self-reports in V-SOURCE and administrative data in SOURCE and an extensive literature indicates that self-reported GPAs tend to be higher than administratively-reported GPAs (see, e.g., Rosen, Porter, and Rogers, 2017). The SOURCE educational expectations question asked "How much education do you think you will complete by age 25?" In contrast, the V-SOURCE question first asked about educational aspirations ("If there were not barriers, how far in school would you want to go?) and then asked "As things stand now, how far in school do you think you will actually get?"

Several factors may explain divergent findings across studies. First, the availability of alternative services (the control condition) may have changed over time and may vary across place, and control students in our study may have had more access to similar services and information compared to the control groups in other studies.

Second, the population served—in terms of both demographics and academic achievement—varies substantially across studies. While our study targeted students who were on track to be eligible for admissions to the CSU system, academic preparation was probably still a barrier for some students; in contrast, the Hoxby and Turner (2013) intervention served a quite high achieving population (the top 10 percent of SAT/ACT-takers) for whom information, rather than academic preparation, is more likely to be the key barrier.

Third, the higher education context differs across studies. California's application process is particularly unforgiving—application and financial aid deadlines are early and there are no late or open admissions four-year colleges in the state; this may make it more important, but also more difficult, to help students navigate the process.

Fourth, how students select into the study might influence an intervention's effectiveness; students in V-SOURCE chose to enroll in the study (this was also true in SOURCE), and it is possible that students who actively enrolled in the study would have accessed other resources in its absence. In contrast, Carrell and Sacerdote (2017) targeted students identified by school counselors as college ready but who had not taken steps to apply by January of their senior year; this approach would not be possible in California, because California's public four-year universities would no longer be accepting students.

Finally, the details and delivery of the interventions themselves differ. V-SOURCE was virtual by design, whereas most of the previous studies used in-person counselors. Hoxby and Turner (2013) is an exception-- they sent information by mail. Virtual advising may be less effective than in-person help; for example, Carrell and Sacerdote (2017) and Bettinger et al. (2013) emphasize that actually helping students complete college and financial aid-related paperwork was important.

Ultimately, we cannot say conclusively why the null finding here differs from studies of related programs, but our findings suggest that the context and details of college access interventions likely influence their effectiveness and that many socioeconomically disadvantaged students face other barriers to college enrollment that are not easily addressed with a low cost, scalable intervention focused on the college and financial application process.

9 CONCLUSION

This paper reports the results from a random assignment field experiment of two virtual college access interventions targeted to students who were on track to be academically eligible for admission to the California State University (CSU) system. The interventions were designed to provide information and support during the college and financial aid application process and to help students avoid procrastinating about key deadlines. We use a range of data sources—both administrative and self-reported—to show that the program increased the extent to which students felt they were supported and had access to information when applying to college and that program participation moderately increased the completion of key milestones in the application process. However, increased college

applications did not necessarily translate to more college acceptances, and the program did not increase college enrollment or persistence on average. We find suggestive evidence that the program was effective at increasing enrollment and persistence at more selective and University of California (UC) campuses for Hispanic students who spoke Spanish at home, the same group that benefited most from the predecessor SOURCE program; these results suggest that this group may still be in need of college application help. However, these estimates are not statistically significant after adjusting for multiple comparisons, and in any case, they are modest and on a different margin relative to the previous intervention.

While previous studies have suggested that relatively low cost "low touch" interventions focused on the college application process can yield large increases in college enrollment, this study suggests that the details of the intervention, context, and population served are important. Moreover, many students face academic, financial, and other barriers to college enrollment that cannot be easily addressed by interventions focused solely on the college and financial aid application process.

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Figure 1a. Intermediate Outcomes, by Gender

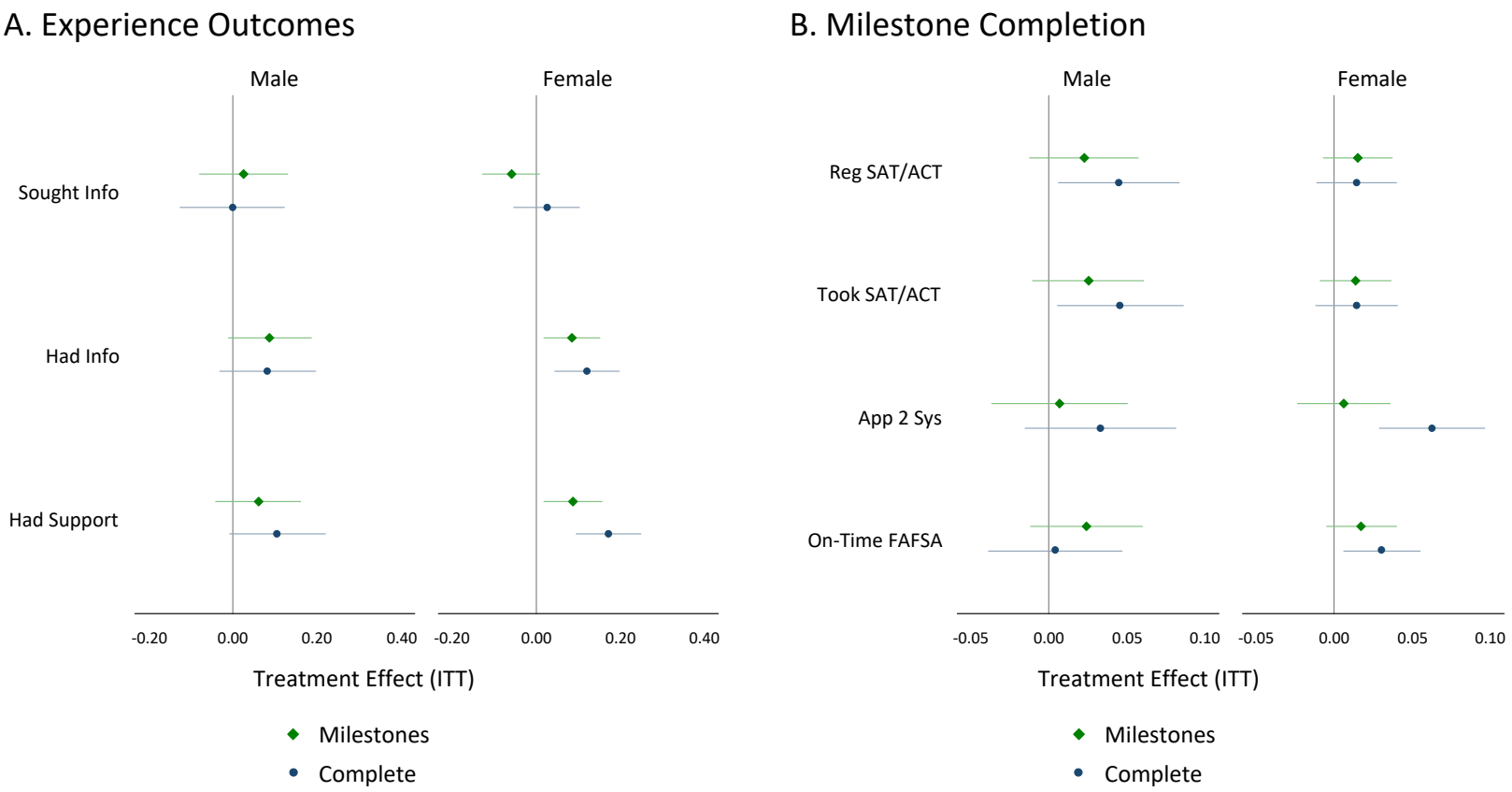


Figure 1b. College Outcomes, by Gender

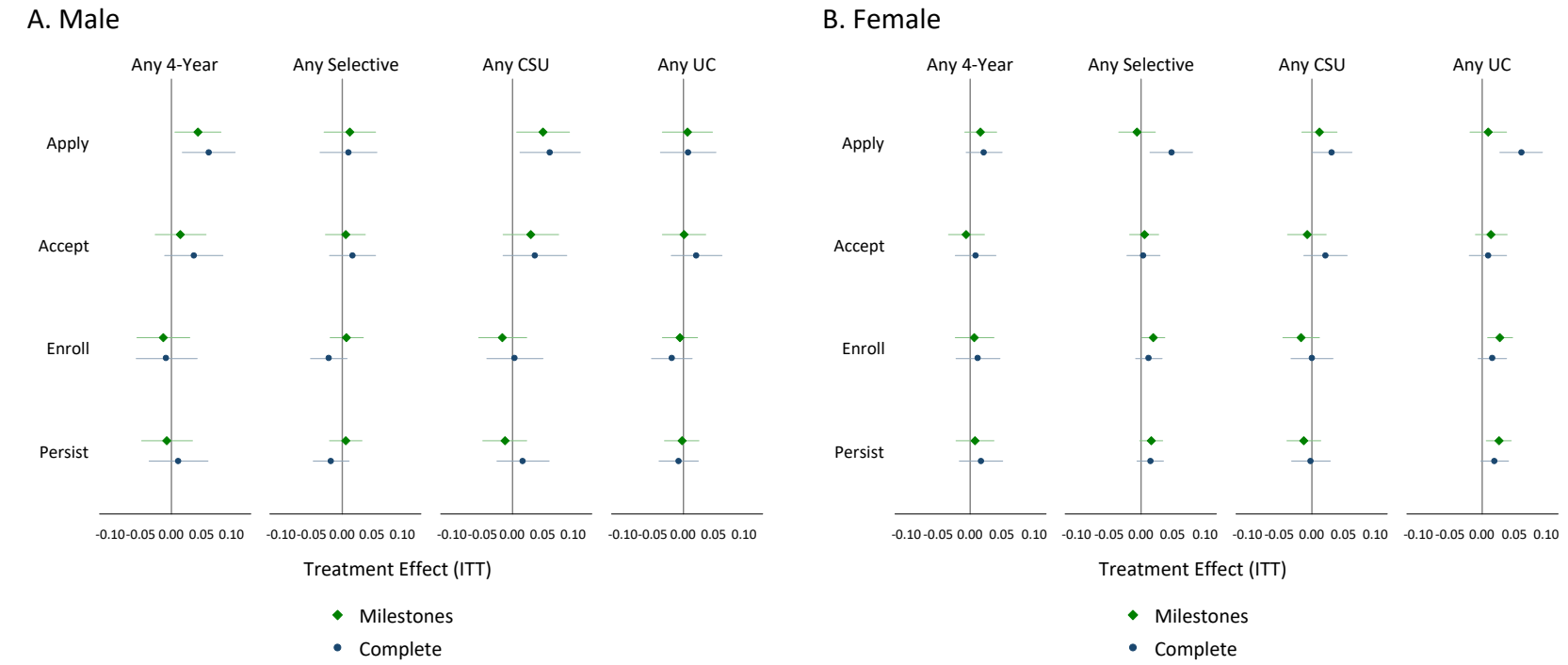


Figure 2a. Intermediate Outcomes, by Race/Ethnicity & Language

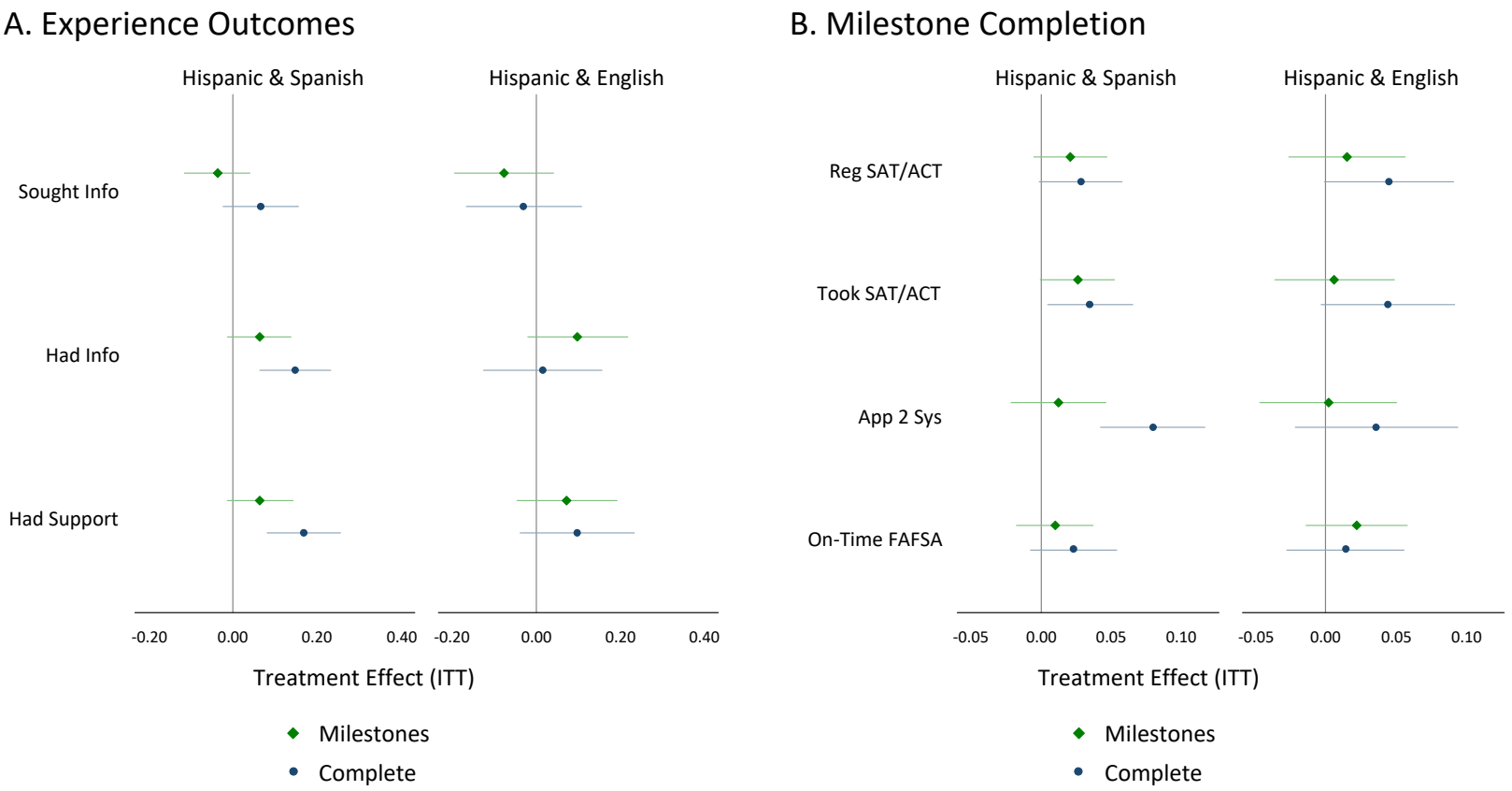


Figure 2b. College Outcomes, by Race/Ethnicity & Language

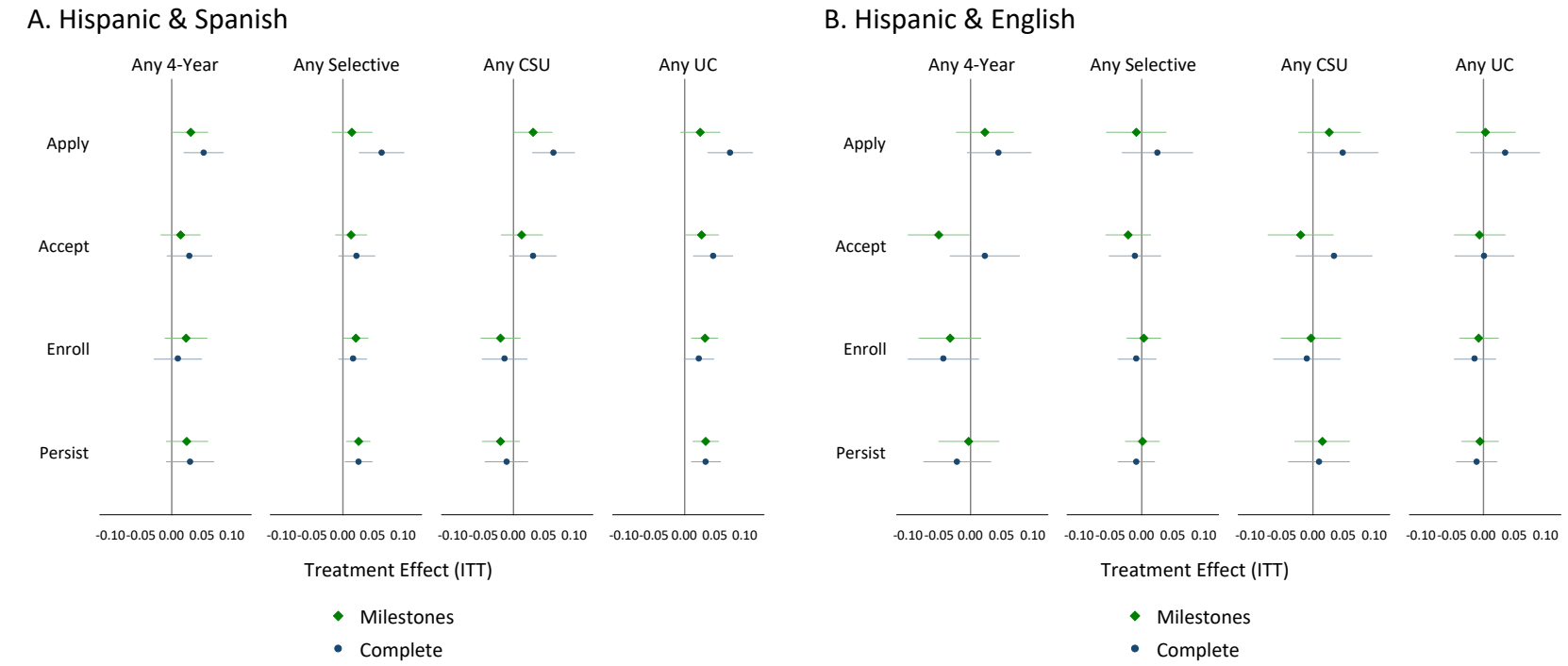


Figure 3a. Intermediate Outcomes, by Parental Education

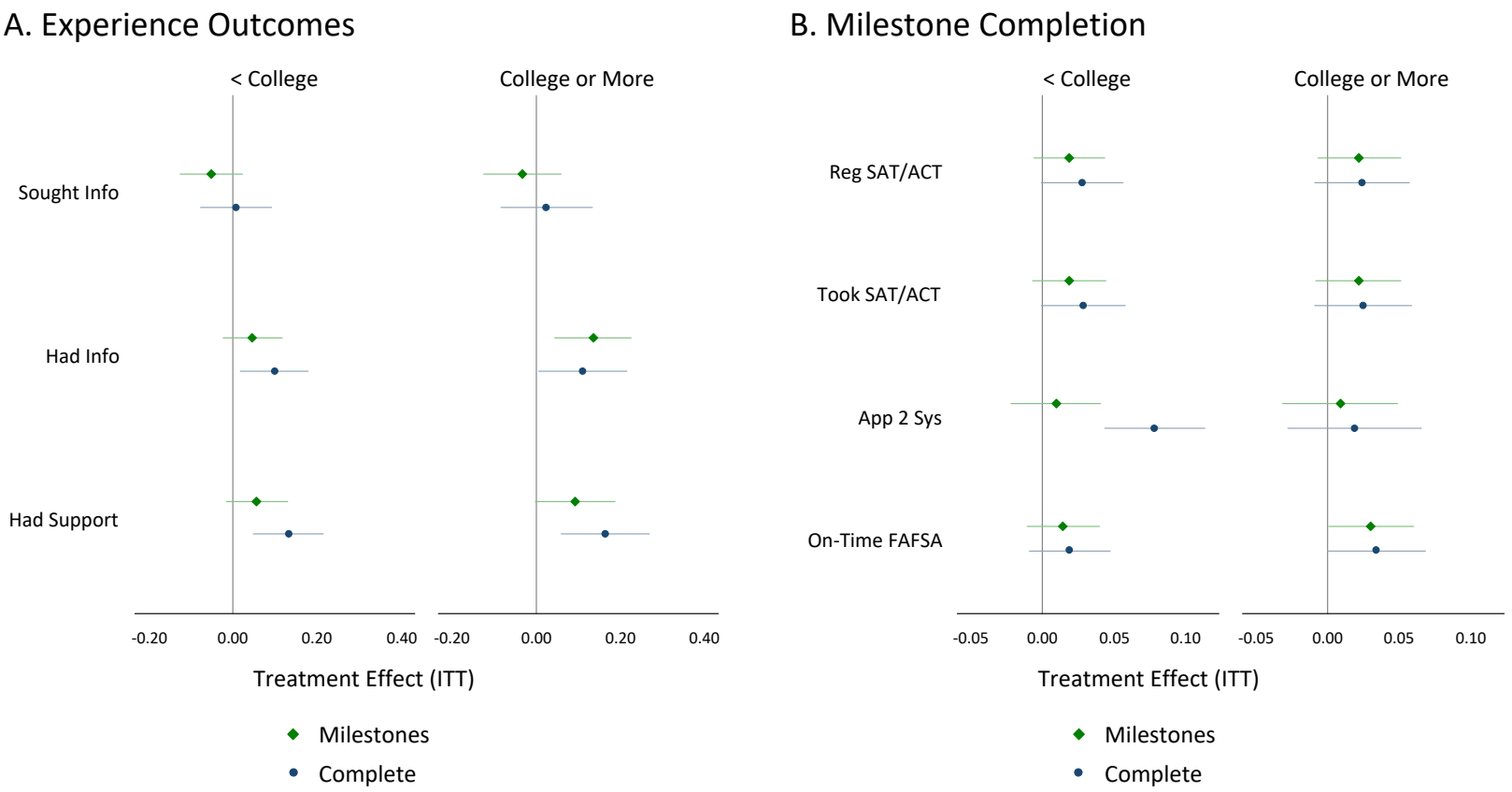


Figure 3b. College Outcomes, by Parental Education

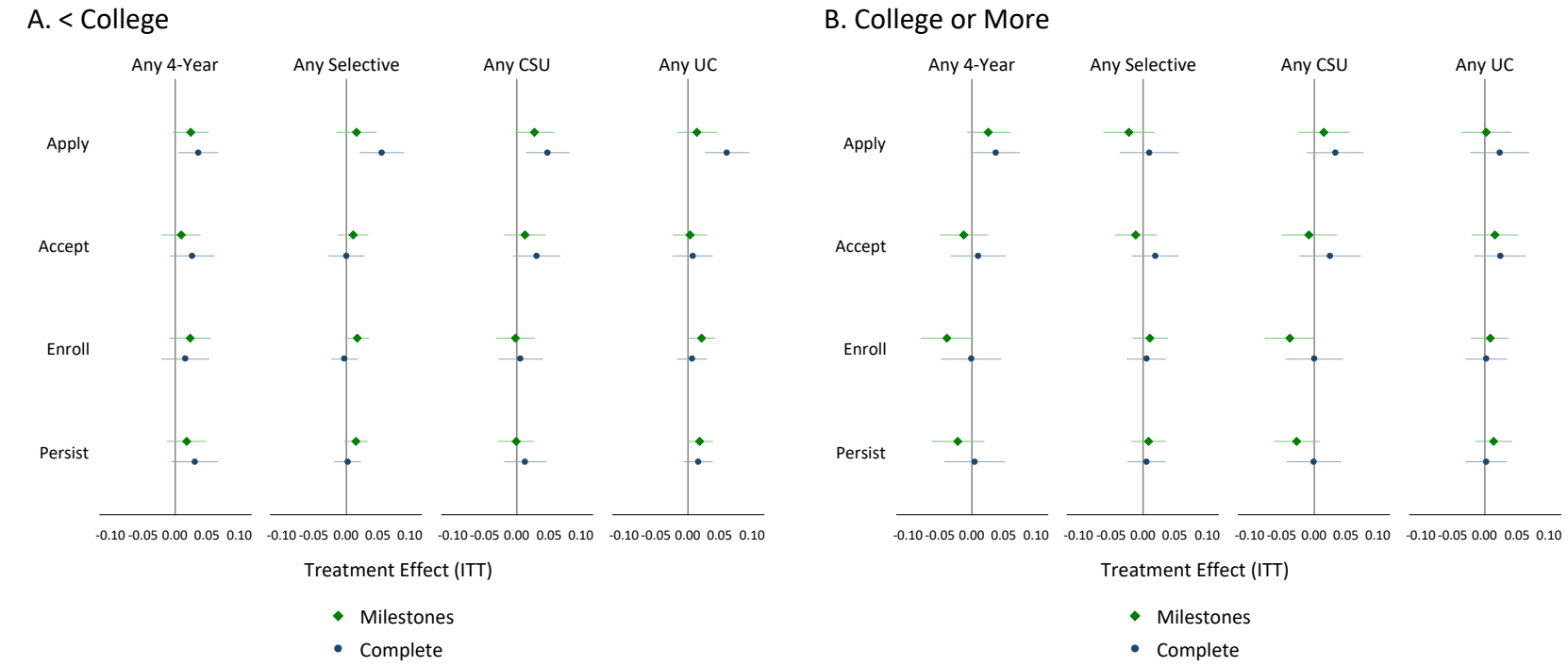


Table 1. V-SOURCE Program Components

SAT/ACT	Milestones	Complete
Automated email and text deadline reminders about SAT registration	X	X
Automated email and text deadline reminders about SAT test deadlines	X	X
$20 gift card for registering for SAT or ACT	X	X
$20 gift card for taking SAT or ACT	X	X
Automated email and text information and encouragement about the SAT/ACT	X	X
Automated email and text references/links to SAT prep on V-SOURCE website	X	X
Web-based 12-week SAT curriculum developed specifically for students scoring below national median	X	X
Personalized V-Track pages on the website where students could track their SAT prep progress and view completed prep, scores, and additional prep, including review quizzes that directed students to lessons they needed.	X	X
Website information about the SAT/ACT, including step-by-step instructions on how to register	X	X
Provision of SAT fee waivers for qualifying students	X	X
Personalized advice and help from advisor with registering for SAT/ACT		X
Personalized advice and help from advisor with preparing for the SAT		X
College Application		
Automated email and text reminders about upcoming college application deadlines	X	X
$20 gift card for applying to two four-year college systems (e.g., UC and CSU)	X	X
Interactive, month-by-month checklists of tasks to stay on track for college admission	X	X
Personalized V-Track pages on the website where students could track their personal progress through interactive college application materials and worksheets (building "apply to" lists, creating essays, writing resumes, etc.)	X	X
Automated email and text information and encouragement related to college applications	X	X
Access to website that addresses common college application/attendance obstacles; describes types of colleges and suggestions about how to make an "apply to" list; provides worksheets so students can review their classes and grades and figure out the best way to meet CSU and UC course eligibility requirements (known as the A-G requirements); provides brainstorming exercises for essays, with results emailed back to the user; describes how to create information packets to give to recommendation letter writers; offers step-by-step instructions on how to fill out online college applications	X	X
Monitored "comment" sections on all web pages where students could ask specific questions	X	X
Personalized advice and help from advisor with compiling college “apply to” lists, brainstorming and proofreading essays, compiling “brag sheets” and resumes, answering parents' questions, finding and completing applications, choosing among college acceptances		X

Table 1 (cont). V-SOURCE Program Components

Financial Aid Application		
Automated email and text reminders about upcoming financial aid application deadlines	X	X
$20 gift card for submitting the FAFSA by the CalGrant deadline	X	X
Automated email and text information and encouragement related to applying for financial aid	X	X
Regular email and text information about upcoming scholarship deadlines	X	X
Website pages containing lists of scholarships with abstracts and links, organized by student grade, citizenship status, and other demographics	X	X
Detailed online slideshows that walked students and parents through each page and section of the FAFSA, Dream Act Application, and CSS Profile, describing what students and parents should enter in different areas, ways to solve common problems (e.g., what to do if parents do not have social security numbers), what assets to report (e.g., not the family home, small family business), and advice on how to deal with larger issues (e.g., parents who will not provide financial information).	X	X
Website containing information on who qualifies for financial aid, different types of grants and loans, how to check Cal Grant status, why students should apply for scholarships, how work study works, how to read financial aid offers, how to interpret financial aid offers, common financial aid traps to avoid	X	X
Information to help students and parents find free/affordable tax preparation so that they could complete their taxes and complete their financial aid documents	X	X
Personalized advice and help from advisor with the financial aid application process, communicating with parents, finding scholarships that fit the student, and choosing among financial aid offers		X

Table 2. Characteristics of V-SOURCE Research Participants

	Cohort 1	Cohort 2	Total
Gender			
Female	0.674	0.691	0.684
N	2706	3936	6642
Subsidized Lunch Status			
Uses Lunch Tickets	0.609	0.496	0.537
N	2056	3672	5728
Race/Ethnicity and Language			
Hisp, Sp in Home	0.526	0.512	0.518
Hisp, Oth Lang	0.208	0.260	0.239
White, NH	0.042	0.048	0.046
Black, NH	0.069	0.054	0.060
Asian/PI, NH	0.125	0.099	0.109
Other NH or Missing	0.030	0.026	0.028
N	2706	3936	6642
Parental Education			
Missing/DK	0.041	0.025	0.032
Less than HS	0.400	0.389	0.393
High School (incl Vocational)	0.189	0.205	0.198
Some College	0.220	0.234	0.229
Four-Year College or More	0.150	0.147	0.148
N	2706	3936	6642
GPA			
Less than 2.0	0.012	0.009	0.010
2 to 2.99	0.248	0.236	0.241
3 to 3.49	0.330	0.315	0.321
3.5+	0.411	0.440	0.428
N	2619	3844	6463
Educational Aspirations			
Less than BA	0.038	0.042	0.040
BA	0.151	0.173	0.165
Masters	0.261	0.251	0.255
PhD, MD, JD, etc	0.550	0.534	0.540
N	1942	3629	5571
Immigration Status			
US Born	0.826	0.853	0.843
Foreign Born Mom	0.806	0.758	0.775
Foreign Born Dad	0.800	0.766	0.778
US Born Parent	0.236	0.293	0.273
N	1766	3106	4872
Number of Schools	59	80	84

Authors' tabulations from Application and Baseline Surveys. All reported data were collected prior to random assignment. Full analysis sample includes everyone who remained in the study to the Follow Up Survey (70 students left the research); the actual analysis sample varies depending on availability of outcome data. Response rate for the Application Survey was near 100%. Response rate for Baseline Survey (based on 80% item response rate) was 87% (cohort 1:77%; cohort 2: 94%). Free lunch status is based on self-reported use of 'lunch tickets.' Respondents checking 'Hispanic' are coded as Hispanic regardless of other race/ethnicity variables checked; otherwise, respondents who checked more than one race-ethnicity are included in the 'Other' category.

Table 3. Self-Reported Pre-Program Use of Technology among V-SOURCE Research Participants, by Parental Education

	Total	Less than High School	High School	Some College	Four-Year College or More
Use the internet at least a few times a week by...					
Phone	0.627	0.633	0.628	0.649	0.596
Own Computer	0.809	0.782	0.812	0.802	0.899
At School	0.306	0.311	0.300	0.300	0.312
At a Friend's	0.074	0.069	0.070	0.071	0.088
At the Library	0.084	0.091	0.076	0.080	0.089
Any Method	0.965	0.956	0.967	0.973	0.980
N	6611	2600	1315	1511	980
Check email...					
At least a few times a week	0.805	0.788	0.809	0.808	0.841
At least a few times a month	0.957	0.944	0.965	0.965	0.974
N	6582	2585	1307	1502	983
Text Message...					
At least a few times a week	0.830	0.801	0.854	0.849	0.864
At least a few times a month	0.849	0.824	0.866	0.867	0.884
N	6576	2592	1298	1504	975

Authors' tabulations based on Application Survey.

Table 4. Take-Up: Effects of Assignment to V-SOURCE on Use of V-SOURCE Program

	(1) Any Confirmed Contact	(2) Active after Intro	(3) Interacted w/ Advisor after Intro
Milestones	0.915***	0.717***	-0.000
	(0.006)	(0.013)	(0.000)
Complete	0.991***	0.968***	0.955***
	(0.003)	(0.005)	(0.005)
Observations	6,642	6,642	6,642
Control Mean	0.000	0.000	0.000

By construction, all outcomes are zero for control students; outcomes for treated students are constructed based on administrative data collected by the program. 'Any Confirmed Contact' is equal to 1 if the student interacted with the program in any way indicating they knew they were in the program (e.g. responded to an email or text message, claimed a Milestone Reward, logged into the website, interacted with their advisor); 'Active' is equal to 1 if the student visited a substantive webpage or interacted with their advisor after the introductory period; 'Interacted with Advisor' is equal to 1 if the student interacted with their advisor after the introductory period. Note that we cannot determine whether students received or read automated emails or text messages, so we cannot incorporate that part of the treatment into these take-up indicators. Standard errors, clustered on school, are reported in parentheses.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 5. Average Program Use, by Treatment Arm

	Milestones	Complete	Total
Administrative Data			
Automated emails (monthly average)	4.0	4.0	4.0
Automated text messages (monthly average)	3.6	3.5	3.5
Total unique days visited website	5.6	8.3	6.6
Total unique days visited SAT pages	2.7	3.5	3.0
Total rewards claimed	1.4	1.8	1.6
Message conversations w/ advisor	0.0	10.8	4.1
Phone conversations w/advisor	0.0	1.7	0.6
Group emails from advisor	0.0	50.4	19.1
Individual emails from advisor	0.0	8.1	3.1
Emails Sent to advisor	0.0	7.6	2.9
Total two-way interactions w/ advisor	0.0	20.1	7.6
N	2554	1552	4106
Percent reporting ... at least a few times a month			
Received text message from V-SOURCE	68.4	77.8	71.9
Received email from V-SOURCE	87.7	93.2	89.8
Visited the V-SOURCE website	57.8	58.8	58.2
Read V-SOURCE Facebook or Twitter	26.9	47.9	34.7
Received phone call from V-SOURCE	24.6	41.6	31.0
Sent email to V-SOURCE	25.9	55.0	36.8
Sent text message to V-SOURCE	19.7	48.2	30.4
Posted on V-SOURCE Facebook	16.3	25.3	19.7
Called V-SOURCE	15.4	23.2	18.3
N	2021	1209	3230

Authors' tabulations of administrative data collected by the V-SOURCE program and self-reported data from Follow Up Survey.

Table 6. Summary of Perceived Helpfulness of Program Components

	Milestones	Complete	Total
Percent reporting found ... program component helpful or very helpful			
V-SOURCE Website	76.8	76.0	76.5
Text Messages	68.5	72.2	69.9
Emails	82.8	84.0	83.2
Gift Card Rewards	87.2	87.1	87.2
Facebook Page	32.3	51.5	39.5
Twitter	27.6	28.5	28.0
Advisor (Complete Only)	--	86.3	32.4
N	2123	1273	3396

Author's tabulations from Follow Up Survey.

Table 7. Effects of Assignment to V-SOURCE on Self-Reported Experiences Applying to College and for Financial Aid: Main Experience and Support Constructs

	(1) Sought Information	(2) Had Information	(3) Had Support
Milestones	-0.033	0.086**†	0.080**†
	(0.027)	(0.026)	(0.026)
Complete	0.018	0.109***†	0.151***†
	(0.031)	(0.030)	(0.027)
Observations	5,987	5,994	5,932
Control Mean	0.000	0.000	0.000

Data are self-reported on Follow Up Survey. Each variable is standardized to have mean 0 and standard deviation 1 in the control group. Standard errors, clustered on school, are reported in parentheses.
† Statistically significant at the 5% level after adjustment for multiple comparisons.
* $p < .05$, ** $p < .01$, *** $p < .001$

Table 8. Effects of Assignment to V-SOURCE on Self-Reported Milestone Completion

	(1) Registered SAT/ACT	(2) Took SAT/ACT	(3) Applied 2 systems	(4) Submitted FAFSA
Milestones	0.018	0.017	0.006	0.020*
	(0.011)	(0.011)	(0.013)	(0.009)
Complete	0.024*	0.024*	0.053***†	0.023
	(0.011)	(0.010)	(0.013)	(0.012)
Observations	6,046	6,044	5,987	5,955
Control Mean	0.842	0.829	0.489	0.864

Data are from Follow Up Survey. These are the college-related tasks for which V-SOURCE students could receive Milestones Rewards; the table is based on self-reports for both treatment and control, not administrative data based on reward-claiming. Standard errors, clustered on school, are reported in parentheses.
† Statistically significant at the 5% level after adjustment for multiple comparisons.
* $p < .05$, ** $p < .01$, *** $p < .001$

Table 9. Effects of Assignment to V-SOURCE on Self-Reported College Application Outcomes

	(1) Any 4-Year	(2) Any Selective	(3) Any CSU	(4) Any UC
Milestones	0.025*†	-0.000	0.024*†	0.009
	(0.010)	(0.012)	(0.011)	(0.011)
Complete	0.034**†	0.036**†	0.041**†	0.044***†
	(0.011)	(0.013)	(0.013)	(0.012)
Observations	5,987	5,987	5,987	5,987
Control Mean	0.779	0.476	0.727	0.445

Data are from Follow Up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.
† Statistically significant at the 5% level after adjustment for multiple comparisons.
* $p < .05$, ** $p < .01$, *** $p < .001$

Table 10. Effects of Assignment to V-SOURCE on Self-Reported College Acceptance Outcomes

	(1) Any 4-Year	(2) Any Selective	(3) Any CSU	(4) Any UC
Milestones	0.000	0.005	0.004	0.010
	(0.011)	(0.011)	(0.013)	(0.010)
Complete	0.017	0.008	0.026	0.013
	(0.013)	(0.011)	(0.014)	(0.010)
Observations	5,987	5,987	5,987	5,987
Control Mean	0.673	0.234	0.616	0.295

Data are from Follow Up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 11. Effects of Assignment to V-SOURCE on College Enrollment Outcomes

	(1) Any College	(2) Any 4-Year	(3) Any Selective	(4) Any CSU	(5) Any UC
Milestones	0.005	0.000	0.016	-0.016	0.017*
	(0.013)	(0.011)	(0.008)	(0.011)	(0.008)
Complete	0.006	0.006	0.001	0.001	0.005
	(0.013)	(0.013)	(0.009)	(0.012)	(0.009)
Observations	6,640	6,640	6,640	6,640	6,640
Control Mean	0.707	0.435	0.118	0.250	0.128

Data are from the National Student Clearinghouse (NSC). College enrollment reflects any enrollment in the fall (September 1 to December 31) following on-time high school graduation. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 12. Effects of Assignment to V-SOURCE on College Persistence Outcomes

	(1) Any College	(2) Any 4-Year	(3) Any Selective	(4) Any CSU	(5) Any UC
Milestones	0.009	0.003	0.013	-0.012	0.017*
	(0.014)	(0.011)	(0.008)	(0.011)	(0.008)
Complete	0.018	0.016	0.004	0.005	0.011
	(0.015)	(0.012)	(0.009)	(0.011)	(0.009)
Observations	6,640	6,640	6,640	6,640	6,640
Control Mean	0.634	0.369	0.109	0.205	0.116

Data are from the National Student Clearinghouse (NSC). College persistence reflects enrollment in the specified college type in the first fall (September 1 to December 31) after on-time high school graduation AND in the same college type in the second fall. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A1a. Balance Test for Analysis Sample

	Control Mean	Milestones coeff	Complete coeff	p-value joint F
Gender				
Female	0.684	-0.001	0.004	0.958
Subsidized Lunch Status				
Uses Lunch Tickets	0.537	-0.006	0.005	0.765
Race/Ethnicity and Language				
Hisp, Sp in Home	0.519	-0.003	-0.002	0.974
Hisp, Oth Lang	0.237	0.003	0.005	0.934
White, NH	0.041	0.009	0.004	0.267
Black, NH	0.063	-0.007	0.001	0.375
Asian/PI, NH	0.116	-0.009	-0.013	0.339
Other NH or Missing	0.024	0.007	0.005	0.304
Parental Education				
Missing/DK	0.033	0.002	-0.009	0.119
Less than HS	0.387	0.009	0.012	0.714
High School (incl Vocational)	0.203	-0.010	-0.004	0.527
Some College	0.234	-0.011	-0.005	0.705
Four-Year College or More	0.143	0.010	0.006	0.649
Self-Reported Cumulative GPA				
Less than 2.0	0.007	0.002	0.007	0.258
2 to 2.99	0.236	-0.003	-0.002	0.963
3 to 3.49	0.303	0.014	0.015	0.366
3.5+	0.425	-0.009	-0.018	0.546
Missing GPA	0.029	-0.005	-0.002	0.630
Educational Aspirations				
Less than BA	0.040	0.000	0.001	0.995
BA	0.158	0.011	0.012	0.381
Masters	0.250	0.008	0.006	0.816
PhD, MD, JD, etc	0.552	-0.020	-0.019	0.332
Immigration Status				
US Born	0.843	-0.012	0.002	0.216
Foreign Born Mom	0.763	0.003	-0.004	0.825
Foreign Born Dad	0.777	0.001	-0.002	0.951
US Born Parent	0.277	-0.003	0.006	0.769
Observations	2536	2554	1552	6642

Authors' tabulations from Application and Baseline Surveys. All reported data were collected prior to random assignment. For each variable, we regressed the variable on the treatment indicators and a cohort fixed effect: column (1) is the control mean, columns (2) and (3) report the coefficients on the Milestones and Complete treatment indicators, respectively; column (4) reports the p-value for the test of joint significance for the Milestones and Complete coefficients. The sample is limited to analysis sample (those who remained in the study to the Follow-up Survey). Where Missing is not reported as a separate category, missing values were assigned the mean for the sample.

Appendix Table A1b. Balance Test for Analysis Sample

	Control Mean	Milestones coeff	Complete coeff	p-value joint F
Use internet at least a few times a week by...				
Phone	0.628	0.002	-0.003	0.946
Own Computer	0.818	-0.014	-0.019	0.213
At School	0.304	0.008	-0.006	0.656
At a Friend's	0.080	-0.010	-0.012	0.178
At the Library	0.086	-0.004	0.000	0.863
Any Method	0.964	0.001	0.002	0.936
Check email...				
At least a few times a week	0.799	0.022	-0.010	0.019
At least a few times a month	0.961	-0.007	-0.005	0.376
Text Message...				
At least a few times a week	0.838	-0.012	-0.015	0.395
At least a few times a month	0.858	-0.013	-0.016	0.319
Responded to Baseline Survey				
Clicked on Survey	0.907	-0.018	-0.013	0.064
Responded to 80% items	0.879	-0.015	-0.008	0.237
Observations	2536	2554	1552	6642

Authors' tabulations from Application and Baseline Surveys. All reported data were collected prior to random assignment. For each variable, we regressed the variable on the treatment indicators and a cohort fixed effect: column (1) is the control mean, columns (2) and (3) report the coefficients on the Milestones and Complete treatment indicators, respectively; column (4) reports the p-value for the test of joint significance for the Milestones and Complete coefficients. The sample is limited to analysis sample (those who remained in the study to the Follow-up Survey). Where Missing is not reported as a separate category, missing values were assigned the mean for the sample.

Appendix Table 2. Items in Experience and Support Measures

a. Sought Information

How often did you do the following things?

- Visited a college campus
- Attended a college fair
- Talked with the counselor at my school about financial aid or applying to college
- Talked to my teacher(s) about financial aid or applying to college
- Talked with someone from a college access program or organization about financial aid or applying to college
- Visited websites to learn about financial aid or applying to college
- Read books or other printed information about financial aid or applying to college
- Visited specific colleges' websites
- Read brochures or booklets about specific colleges
- Talked about a specific college with someone who attends (or attended) that college
- Read printed, emailed, or text messaged information about college or financial aid provided by a college access program or organization
- Talked with someone my family paid to help me with the college application process
- Talked with someone in my family about whether or where I should go to college
- Talked with someone in my family about how much college costs or how I would pay for college

b. Had Information

In general, how well-informed did you feel throughout the college application process and as you made your decisions about college?

How true were the following things about you?

- I knew when SAT deadlines were coming up
- I knew when ACT deadlines were coming up
- I knew when college application deadlines were coming up
- I knew how to find and fill out college applications
- I knew when financial aid application deadlines were coming up
- I knew how to find and fill out financial aid applications

It was easy for me to get information about:

- How to improve my SAT score
- How to use a calculator for the SAT
- How to write a better SAT essay
- Which questions to skip on the SAT
- How to improve my GPA for college applications
- Non-academic ways to increase my chances of getting into a good college
- The colleges I would probably be able to get into
- Which colleges I should apply to
- How to find and fill out college applications
- How to write a good application essay
- How to find and fill out financial aid forms
- The scholarships I should apply for
- What my financial aid offers meant
- How to choose which college to attend

Appendix Table 2 (cont). Items in Experience and Support Measures

c. Had Support

I had someone who:

- Kept me motivated to do the work needed to apply to college
- Helped me sign up for the SAT
- Helped me study for the SAT
- Helped me decide which high school courses to take to meet college requirements
- Helped me choose colleges to apply to
- Encouraged me to apply to better colleges than I initially thought I would apply to
- Helped me write/rewrite college application essays
- Helped me fill out college applications
- Helped me fill out financial aid forms
- Helped me find and apply for scholarships
- Reminded me to turn in college applications
- Reminded me to turn in financial aid applications
- Made sure I turned in college applications
- Made sure I turned in financial aid applications
- Helped me choose which college to enroll in
- Helped me convince my parents to let me go to the college I wanted to go to

Appendix Table A3a. Effects of Assignment to V-SOURCE on Self-Reported Experiences Applying to College and for Financial Aid, by Gender

	(1) Sought Information	(2) Had Information	(3) Had Support
Milestones			
Female	-0.059	0.084*†	0.088**†
	(0.034)	(0.033)	(0.031)
Male	0.026	0.088	0.061
	(0.046)	(0.046)	(0.047)
Complete			
Female	0.025	0.120**†	0.172***†
	(0.039)	(0.039)	(0.032)
Male	0.000	0.083	0.106*
	(0.062)	(0.057)	(0.052)
Observations	5,987	5,994	5,932
Control Mean			
Overall	0.000	0.000	0.000
Female	0.077	0.007	0.006
Male	-0.172	-0.016	-0.013

Data are self-reported on Follow-up Survey. Each variable is standardized to have mean 0 and standard deviation 1 in the control group. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A3b. Effects of Assignment to V-SOURCE on Self-Reported Experiences Applying to College and for Financial Aid, by Race/Ethnicity and Language

	(1) Sought Information	(2) Had Information	(3) Had Support
Milestones			
Hisp&Span	-0.036	0.063	0.065
	(0.035)	(0.036)	(0.033)
Hisp&Engl	-0.076	0.098	0.073
	(0.059)	(0.056)	(0.056)
Other	0.015	0.123*	0.119
	(0.065)	(0.057)	(0.061)
Complete			
Hisp&Span	0.067	0.148***†	0.168***†
	(0.045)	(0.037)	(0.047)
Hisp&Engl	-0.029	0.016	0.098
	(0.057)	(0.075)	(0.061)
Other	-0.041	0.113	0.167**†
	(0.066)	(0.068)	(0.063)
Observations	5,987	5,994	5,932
Control Mean			
Overall	0.000	0.000	0.000
Hisp&Span	-0.040	0.006	0.021
Hisp&Engl	-0.057	-0.030	-0.028
Other	0.143	0.016	-0.019

Data are self-reported on Follow-up Survey. Each variable is standardized to have mean 0 and standard deviation 1 in the control group. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A3c. Effects of Assignment to V-SOURCE on Self-Reported Experiences Applying to College and for Financial Aid, by Parental Education

	(1) Sought Information	(2) Had Information	(3) Had Support
Milestones			
<College	-0.051	0.047	0.057
	(0.034)	(0.039)	(0.036)
Some Coll+	-0.032	0.135***†	0.092*
	(0.048)	(0.037)	(0.039)
Complete			
<College	0.008	0.099*	0.132**†
	(0.039)	(0.046)	(0.044)
Some Coll+	0.025	0.110	0.164**†
	(0.057)	(0.058)	(0.049)
Observations	5,822	5,827	5,768
Control Mean			
Overall	0.000	0.000	0.000
<College	-0.019	0.005	0.002
Some Coll +	0.048	0.011	0.015

Data are self-reported on Follow-up Survey. Each variable is standardized to have mean 0 and standard deviation 1 in the control group. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A4a. Effects of Assignment to V-SOURCE on Self-Reported Milestone Completion, by Gender

	(1) Registered SAT/ACT	(2) Took SAT/ACT	(3) Applied 2 systems	(4) Submitted FAFSA
Milestones				
Female	0.015	0.014	0.006	0.017
	(0.011)	(0.011)	(0.014)	(0.012)
Male	0.022	0.025	0.007	0.024
	(0.020)	(0.021)	(0.024)	(0.021)
Complete				
Female	0.015	0.015	0.063***†	0.031*
	(0.013)	(0.012)	(0.016)	(0.014)
Male	0.045*	0.045*	0.033	0.004
	(0.018)	(0.020)	(0.023)	(0.022)
Observations	6,046	6,044	5,987	5,955
Control Mean				
Overall	0.842	0.829	0.489	0.864
Female	0.850	0.838	0.498	0.872
Male	0.825	0.808	0.469	0.845

Data are from Follow-up Survey. These are the college-related tasks for which V-SOURCE students could receive Milestones Rewards; the table is based on self-reports for both treatment and control, not administrative data based on reward-claiming. Data are from Follow-up Survey. These are the college-related tasks for which V-SOURCE students could receive Milestones Rewards; the table is based on self-reports for both treatment and control, not administrative data based on reward-claiming. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A4b. Effects of Assignment to V-SOURCE on Self-Reported Milestone Completion, by Race/Ethnicity and Language

	(1) Registered SAT/ACT	(2) Took SAT/ACT	(3) Applied 2 systems	(4) Submitted FAFSA
Milestones				
Hisp&Span	0.021	0.026*	0.012	0.010
	(0.013)	(0.012)	(0.015)	(0.015)
Hisp&Engl	0.015	0.006	0.002	0.022
	(0.023)	(0.025)	(0.024)	(0.020)
Other	0.013	0.009	-0.002	0.039*
	(0.022)	(0.023)	(0.025)	(0.017)
Complete				
Hisp&Span	0.028	0.035*	0.080***†	0.023
	(0.015)	(0.013)	(0.018)	(0.017)
Hisp&Engl	0.045*	0.044	0.036	0.014
	(0.023)	(0.024)	(0.030)	(0.022)
Other	-0.003	-0.016	0.015	0.031
	(0.019)	(0.022)	(0.031)	(0.025)
Observations	6,046	6,044	5,987	5,955
Control Mean				
Overall	0.842	0.829	0.489	0.864
Hisp&Span	0.841	0.823	0.458	0.857
Hisp&Engl	0.807	0.798	0.449	0.881
Other	0.879	0.871	0.595	0.862

Data are from Follow-up Survey. These are the college-related tasks for which V-SOURCE students could receive Milestones Rewards; the table is based on self-reports for both treatment and control, not administrative data based on reward-claiming. Data are from Follow-up Survey. These are the college-related tasks for which V-SOURCE students could receive Milestones Rewards; the table is based on self-reports for both treatment and control, not administrative data based on reward-claiming. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A4c. Effects of Assignment to V-SOURCE on Self-Reported Milestone Completion, by Parental Education

	(1) Registered SAT/ACT	(2) Took SAT/ACT	(3) Applied 2 systems	(4) Submitted FAFSA
Milestones				
<College	0.019	0.019	0.009	0.015
	(0.013)	(0.014)	(0.016)	(0.012)
Some Coll+	0.022	0.022	0.009	0.030*
	(0.015)	(0.016)	(0.023)	(0.015)
Complete				
<College	0.028*	0.029*	0.078***†	0.019
	(0.012)	(0.012)	(0.018)	(0.016)
Some Coll+	0.024	0.025	0.019	0.034
	(0.017)	(0.017)	(0.024)	(0.017)
Observations	5,880	5,878	5,821	5,790
Control Mean				
Overall	0.842	0.829	0.489	0.864
<College	0.832	0.817	0.457	0.861
Some Coll +	0.860	0.849	0.543	0.867

Data are from Follow-up Survey. These are the college-related tasks for which V-SOURCE students could receive Milestones Rewards; the table is based on self-reports for both treatment and control, not administrative data based on reward-claiming. Data are from Follow-up Survey. These are the college-related tasks for which V-SOURCE students could receive Milestones Rewards; the table is based on self-reports for both treatment and control, not administrative data based on reward-claiming. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A5a. Effects of Assignment to V-SOURCE on Self-Reported College Application Outcomes, by Gender

	(1) Any 4-Year	(2) Any Selective	(3) Any CSU	(4) Any UC
Milestones				
Female	0.016	-0.006	0.012	0.009
	(0.012)	(0.014)	(0.013)	(0.014)
Male	0.043*	0.013	0.050*	0.007
	(0.020)	(0.024)	(0.021)	(0.021)
Complete				
Female	0.021	0.047**	0.032	0.061***†
	(0.014)	(0.016)	(0.017)	(0.016)
Male	0.062**†	0.011	0.062**†	0.008
	(0.020)	(0.024)	(0.021)	(0.022)
Observations	5,987	5,987	5,987	5,987
Control Mean				
Overall	0.779	0.476	0.727	0.445
Female	0.793	0.475	0.748	0.445
Male	0.749	0.476	0.681	0.447

Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A5b. Effects of Assignment to V-SOURCE on Self-Reported College Application Outcomes, by Race/Ethnicity and Language

	(1) Any 4-Year	(2) Any Selective	(3) Any CSU	(4) Any UC
Milestones				
Hisp&Span	0.031*	0.016	0.032*	0.026
	(0.012)	(0.016)	(0.015)	(0.015)
Hisp&Engl	0.023	-0.009	0.027	0.004
	(0.021)	(0.025)	(0.020)	(0.025)
Other	0.013	-0.025	0.003	-0.024
	(0.017)	(0.022)	(0.020)	(0.023)
Complete				
Hisp&Span	0.053***†	0.064***†	0.066***†	0.075***†
	(0.015)	(0.018)	(0.017)	(0.017)
Hisp&Engl	0.045	0.025	0.049	0.035
	(0.024)	(0.031)	(0.026)	(0.031)
Other	-0.015	-0.013	-0.016	-0.012
	(0.023)	(0.028)	(0.032)	(0.029)
Observations	5,987	5,987	5,987	5,987
Control Mean				
Overall	0.779	0.476	0.727	0.445
Hisp&Span	0.777	0.448	0.741	0.418
Hisp&Engl	0.739	0.425	0.685	0.393
Other	0.823	0.586	0.736	0.555

Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A5c. Effects of Assignment to V-SOURCE on Self-Reported College Application Outcomes, by Parental Education

	(1) Any 4-Year	(2) Any Selective	(3) Any CSU	(4) Any UC
Milestones				
<College	0.024	0.016	0.027	0.014
	(0.014)	(0.016)	(0.015)	(0.015)
Some Coll+	0.025	-0.022	0.016	0.002
	(0.015)	(0.019)	(0.017)	(0.020)
Complete				
<College	0.036*†	0.056***†	0.048**†	0.061***†
	(0.014)	(0.016)	(0.017)	(0.015)
Some Coll+	0.037	0.009	0.033	0.023
	(0.021)	(0.023)	(0.022)	(0.023)
Observations	5,821	5,821	5,821	5,821
Control Mean				
Overall	0.779	0.476	0.727	0.445
<College	0.766	0.439	0.728	0.421
Some Coll +	0.809	0.537	0.735	0.489

Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A6a. Effects of Assignment to V-SOURCE on Self-Reported College Acceptance Outcomes, by Gender

	(1) Any 4-Year	(2) Any Selective	(3) Any CSU	(4) Any UC
Milestones				
Female	-0.006	0.005	-0.007	0.014
	(0.012)	(0.013)	(0.015)	(0.012)
Male	0.015	0.006	0.030	0.001
	(0.021)	(0.016)	(0.022)	(0.016)
Complete				
Female	0.008	0.004	0.022	0.009
	(0.016)	(0.013)	(0.017)	(0.013)
Male	0.037	0.017	0.036	0.022
	(0.022)	(0.017)	(0.021)	(0.020)
Observations	5,987	5,987	5,987	5,987
Control Mean				
Overall	0.673	0.234	0.616	0.295
Female	0.688	0.229	0.637	0.291
Male	0.639	0.246	0.568	0.303

Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A6b. Effects of Assignment to V-SOURCE on Self-Reported College Acceptance Outcomes, by Race/Ethnicity and Language

	(1) Any 4-Year	(2) Any Selective	(3) Any CSU	(4) Any UC
Milestones				
Hisp&Span	0.015	0.014	0.014	0.028
	(0.016)	(0.016)	(0.018)	(0.015)
Hisp&Engl	-0.052*	-0.022	-0.019	-0.007
	(0.025)	(0.017)	(0.027)	(0.016)
Other	0.020	0.012	0.006	-0.014
	(0.020)	(0.020)	(0.024)	(0.020)
Complete				
Hisp&Span	0.029	0.023	0.032	0.047**
	(0.021)	(0.017)	(0.022)	(0.014)
Hisp&Engl	0.023	-0.011	0.034	0.001
	(0.029)	(0.024)	(0.031)	(0.024)
Other	-0.011	-0.008	0.008	-0.049
	(0.023)	(0.022)	(0.030)	(0.028)
Observations	5,987	5,987	5,987	5,987
Control Mean				
Overall	0.673	0.234	0.616	0.295
Hisp&Span	0.662	0.210	0.627	0.266
Hisp&Engl	0.644	0.207	0.574	0.253
Other	0.725	0.314	0.630	0.398

Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A6c. Effects of Assignment to V-SOURCE on Self-Reported College Acceptance Outcomes, by Parental Education

	(1) Any 4-Year	(2) Any Selective	(3) Any CSU	(4) Any UC
Milestones				
<College	0.009	0.011	0.012	0.003
	(0.015)	(0.014)	(0.016)	(0.013)
Some Coll+	-0.012	-0.011	-0.008	0.015
	(0.019)	(0.017)	(0.023)	(0.016)
Complete				
<College	0.026	0.000	0.031	0.007
	(0.017)	(0.015)	(0.019)	(0.013)
Some Coll+	0.010	0.019	0.024	0.024
	(0.023)	(0.017)	(0.022)	(0.019)
Observations	5,821	5,821	5,821	5,821
Control Mean				
Overall	0.673	0.234	0.616	0.295
<College	0.658	0.215	0.619	0.286
Some Coll +	0.710	0.275	0.622	0.317

Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from Follow-up Survey. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A7a. Effects of Assignment to V-SOURCE on College Enrollment Outcomes, by Gender

	(1) Any College	(2) Any 4-Year	(3) Any Selective	(4) Any CSU	(5) Any UC
Milestones					
Female	0.012	0.007	0.019*	-0.016	0.028**
	(0.015)	(0.013)	(0.009)	(0.013)	(0.010)
Male	-0.008	-0.013	0.008	-0.017	-0.006
	(0.022)	(0.020)	(0.015)	(0.018)	(0.014)
Complete					
Female	0.019	0.012	0.012	0.000	0.016
	(0.017)	(0.017)	(0.011)	(0.015)	(0.011)
Male	-0.025	-0.008	-0.022	0.003	-0.019
	(0.026)	(0.023)	(0.017)	(0.020)	(0.016)
Observations	6,640	6,640	6,640	6,640	6,640
Control Mean					
Overall	0.707	0.435	0.118	0.250	0.128
Female	0.708	0.442	0.112	0.260	0.120
Male	0.706	0.420	0.131	0.229	0.146

Data are from the National Student Clearinghouse (NSC). College enrollment reflects any enrollment in the fall (September 1 to December 31) following on-time high school graduation. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from the National Student Clearinghouse (NSC). College enrollment reflects any enrollment in the fall (September 1 to December 31) following on-time high school graduation. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A7b. Effects of Assignment to V-SOURCE on College Enrollment Outcomes, by Race/Ethnicity and Language

	(1) Any College	(2) Any 4-Year	(3) Any Selective	(4) Any CSU	(5) Any UC
Milestones					
Hisp&Span	0.025	0.024	0.022	-0.022	0.033*
	(0.019)	(0.018)	(0.011)	(0.016)	(0.013)
Hisp&Engl	-0.004	-0.033	0.003	-0.003	-0.007
	(0.023)	(0.025)	(0.014)	(0.027)	(0.014)
Other	-0.027	-0.016	0.013	-0.017	0.007
	(0.023)	(0.027)	(0.020)	(0.026)	(0.019)
Complete					
Hisp&Span	0.025	0.010	0.017	-0.015	0.024*
	(0.020)	(0.019)	(0.012)	(0.020)	(0.012)
Hisp&Engl	-0.027	-0.044	-0.008	-0.009	-0.014
	(0.026)	(0.029)	(0.017)	(0.028)	(0.018)
Other	-0.003	0.047	-0.023	0.048	-0.016
	(0.027)	(0.031)	(0.022)	(0.031)	(0.026)
Observations	6,640	6,640	6,640	6,640	6,640
Control Mean					
Overall	0.707	0.435	0.118	0.250	0.128
Hisp&Span	0.660	0.394	0.094	0.261	0.105
Hisp&Engl	0.749	0.452	0.101	0.252	0.115
Other	0.767	0.507	0.185	0.225	0.191

Data are from the National Student Clearinghouse (NSC). College enrollment reflects any enrollment in the fall (September 1 to December 31) following on-time high school graduation. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from the National Student Clearinghouse (NSC). College enrollment reflects any enrollment in the fall (September 1 to December 31) following on-time high school graduation. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A7c. Effects of Assignment to V-SOURCE on College Enrollment Outcomes, by Parental Education

	(1) Any College	(2) Any 4-Year	(3) Any Selective	(4) Any CSU	(5) Any UC
Milestones					
<College	0.017	0.023	0.017	-0.002	0.021
	(0.014)	(0.015)	(0.011)	(0.014)	(0.012)
Some Coll+	-0.012	-0.039	0.011	-0.038*	0.008
	(0.023)	(0.022)	(0.013)	(0.018)	(0.014)
Complete					
<College	0.017	0.016	-0.002	0.005	0.006
	(0.016)	(0.018)	(0.010)	(0.017)	(0.011)
Some Coll+	-0.010	-0.001	0.005	0.001	0.002
	(0.022)	(0.021)	(0.018)	(0.020)	(0.017)
Observations	6,459	6,459	6,459	6,459	6,459
Control Mean					
Overall	0.707	0.435	0.118	0.250	0.128
<College	0.668	0.402	0.105	0.244	0.116
Some Coll +	0.769	0.495	0.141	0.265	0.149

Data are from the National Student Clearinghouse (NSC). College enrollment reflects any enrollment in the fall (September 1 to December 31) following on-time high school graduation. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from the National Student Clearinghouse (NSC). College enrollment reflects any enrollment in the fall (September 1 to December 31) following on-time high school graduation. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A8a. Effects of Assignment to V-SOURCE on College Persistence Outcomes, by Gender

	(1) Any College	(2) Any 4-Year	(3) Any Selective	(4) Any CSU	(5) Any UC
Milestones					
Female	0.012	0.007	0.016	-0.012	0.026**
	(0.017)	(0.014)	(0.008)	(0.014)	(0.010)
Male	0.003	-0.007	0.006	-0.013	-0.003
	(0.024)	(0.021)	(0.014)	(0.017)	(0.015)
Complete					
Female	0.026	0.017	0.015	-0.001	0.019
	(0.018)	(0.016)	(0.011)	(0.013)	(0.011)
Male	-0.002	0.011	-0.018	0.017	-0.008
	(0.028)	(0.022)	(0.016)	(0.020)	(0.016)
Observations	6,640	6,640	6,640	6,640	6,640
Control Mean					
Overall	0.634	0.369	0.109	0.205	0.116
Female	0.642	0.377	0.103	0.215	0.108
Male	0.617	0.353	0.121	0.183	0.131

Data are from the National Student Clearinghouse (NSC). College persistence reflects enrollment in the specified college type in the first fall (September 1 to December 31) after on-time high school graduation AND in the same college type in the second fall. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from the National Student Clearinghouse (NSC). College persistence reflects enrollment in the specified college type in the first fall (September 1 to December 31) after on-time high school graduation AND in the same college type in the second fall. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A8b. Effects of Assignment to V-SOURCE on College Persistence Outcomes, by Race/Ethnicity and Language

	(1) Any College	(2) Any 4-Year	(3) Any Selective	(4) Any CSU	(5) Any UC
Milestones					
Hisp&Span	0.020	0.025	0.026*	-0.021	0.035**
	(0.021)	(0.017)	(0.011)	(0.014)	(0.012)
Hisp&Engl	0.020	-0.003	0.001	0.015	-0.006
	(0.024)	(0.025)	(0.014)	(0.024)	(0.014)
Other	-0.025	-0.039	-0.003	-0.021	0.000
	(0.021)	(0.023)	(0.018)	(0.023)	(0.019)
Complete					
Hisp&Span	0.031	0.030	0.026*	-0.012	0.035**
	(0.022)	(0.020)	(0.011)	(0.018)	(0.011)
Hisp&Engl	-0.001	-0.021	-0.009	0.010	-0.011
	(0.030)	(0.026)	(0.016)	(0.024)	(0.016)
Other	0.010	0.023	-0.030	0.035	-0.020
	(0.030)	(0.030)	(0.022)	(0.026)	(0.026)
Observations	6,640	6,640	6,640	6,640	6,640
Control Mean					
Overall	0.634	0.369	0.109	0.205	0.116
Hisp&Span	0.596	0.334	0.083	0.220	0.090
Hisp&Engl	0.646	0.354	0.093	0.186	0.103
Other	0.705	0.459	0.180	0.190	0.183

Data are from the National Student Clearinghouse (NSC). College persistence reflects enrollment in the specified college type in the first fall (September 1 to December 31) after on-time high school graduation AND in the same college type in the second fall. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from the National Student Clearinghouse (NSC). College persistence reflects enrollment in the specified college type in the first fall (September 1 to December 31) after on-time high school graduation AND in the same college type in the second fall. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table A8c. Effects of Assignment to V-SOURCE on College Persistence Outcomes, by Parental Education

	(1) Any College	(2) Any 4-Year	(3) Any Selective	(4) Any CSU	(5) Any UC
Milestones					
<College	0.006	0.018	0.015	-0.002	0.018
	(0.016)	(0.016)	(0.011)	(0.014)	(0.011)
Some Coll+	0.017	-0.022	0.009	-0.026	0.013
	(0.025)	(0.021)	(0.012)	(0.017)	(0.012)
Complete					
<College	0.022	0.031	0.002	0.013	0.016
	(0.019)	(0.018)	(0.010)	(0.016)	(0.011)
Some Coll+	0.018	0.004	0.005	0.000	0.002
	(0.025)	(0.019)	(0.018)	(0.018)	(0.016)
Observations	6,459	6,459	6,459	6,459	6,459
Control Mean					
Overall	0.634	0.369	0.109	0.205	0.116
<College	0.597	0.334	0.096	0.196	0.103
Some Coll +	0.692	0.426	0.131	0.218	0.137

Data are from the National Student Clearinghouse (NSC). College persistence reflects enrollment in the specified college type in the first fall (September 1 to December 31) after on-time high school graduation AND in the same college type in the second fall. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Data are from the National Student Clearinghouse (NSC). College persistence reflects enrollment in the specified college type in the first fall (September 1 to December 31) after on-time high school graduation AND in the same college type in the second fall. Selective colleges are those with Barron's ratings of very competitive plus to most competitive. Standard errors, clustered on school, are reported in parentheses.

† Statistically significant at the 5% level after adjustment for multiple comparisons.

* $p < .05$, ** $p < .01$, *** $p < .001$

Appendix Table 9. Comparison of V-SOURCE Students to SOURCE Students

	SOURCE	V-SOURCE	Diff
Demographics			
Female	0.692	0.688	-0.011
Spanish in the Home	0.441	0.518	0.067
High Par Ed: <HS	0.359	0.407	0.047
High Par Ed: Some Coll	0.452	0.389	-0.064
Hispanic/Latino	0.612	0.761	0.139
White	0.111	0.084	-0.018
Asian/Pacific Islander	0.121	0.125	0.003
Black/African American	0.132	0.082	-0.046
N	2253	6406	9141
Grades			
GPA (Jr Year)	3.096	3.291	0.173
Avg 5 Common Grades	3.174	3.146	-0.071
Algebra I Grade	3.129	3.208	0.050
Geometry Grade	2.836	2.880	0.021
Eng 9 Grade	3.308	3.188	-0.164
Eng 10 Grade	3.235	3.206	-0.058
10th Gr Hist/World Hist	3.200	3.163	-0.083
10th Gr Sci/Chem/Bio	2.998	2.964	-0.082
N	1792	5215	9141
Educational Expectations			
Expects BA or Higher	0.924	0.846	-0.077
Expects Grad Degree	0.483	0.489	0.006
N	2499	5726	9141

Authors' tabulations from V-SOURCE Application and Baseline Surveys and SOURCE data. All reported data were collected prior to random assignment. Some variables are defined differently than in other tables for comparability with SOURCE data.