NBER WORKING PAPER SERIES

EVALUATION OF THE COLLEGE POSSIBLE PROGRAM: RESULTS FROM A RANDOMIZED CONTROLLED TRIAL

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Working Paper 19562
http://www.nber.org/papers/w19562

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 2013

This paper was supported by a Spender Foundation grant. Jim McCorkell, Traci Kirtley, and Chris Mitchell worked tirelessly at College Possible to support this project. Christine Phillips, Dave Shawver, and Bob Ziomek at ACT made it possible to include ACT scores in this analysis. Special thanks to Mike McPherson, who originally suggested the possibility of this randomized trial and also provided useful comments and advice throughout the course of the work. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

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NBER Working Paper No. 19562
October 2013
JEL No. I23,I24

ABSTRACT

This paper reports the results of a randomized trial of the College Possible program, which provides two years of college preparatory work for high school juniors and seniors in Minneapolis and St. Paul. The trial involved 238 students, including 134 who were randomly selected for admission to the program. The results indicate that the College Possible program significantly increased both applications and enrollment to both four-year colleges and selective four-year colleges; we estimate that initial enrollment at four-year colleges increased by more than 15 percentage points for program participants, but find little evidence of any effect of the program on ACT performance or college enrollment overall.

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I. Introduction

A number of recent studies have documented two related phenomena. First, while it is common for most high school seniors in large urban school districts to indicate that they plan to go to college, actual college enrollment rates in these districts are relatively low (Avery and Kane (2004), Roderick et al. (2006)). Second, among the most academically qualified high school graduates, many do not attend colleges that match their qualifications, and some do not attend college at all (Roderick et al. (2008, 2009)). These patterns are particularly pronounced among students from families with relatively low incomes (Bowen, Chingos, McPherson, 2009; Hoxby and Avery, 2013).

One possible explanation for these phenomena is that many students lack adequate college counseling. The American School Counselor Association recommends a ratio of 250 students per counselor (which already seems high), but estimates that the average ratio in practice is more than 470 to 1.[1] Recent research supports the connection between counseling and college enrollment: Hurwitz and Howell (2013) estimate that the addition of a single additional counselor results in a 10 percentage point increase in four-year college enrollment for students in a given high school.

One natural response to the lack of school-based counselors is to provide counseling in after school settings. For example, the federal government's TRIO program incorporates counseling in both the Talent Search and Upward Bound programs. Mathematica conducted evaluations of the effects of both of these programs. Its randomized controlled study of Upward Bound found some evidence that the program induces students to shift from two-year to four-year colleges, but this result was not statistically significant (Seftor et al., 2006). Its evaluation of Talent Search using historical observational data to compare participants to similar students in nearby districts with no affiliation to Talent Search found statistically significant increases in college enrollment for participants (Constantine et al., 2009), but this result has yet to be validated in a randomized trial.

[1] http://www.schoolcounselor.org/content.asp?contentid=133

Two recent studies of demonstration programs conclude that near-peer college counseling can have a significant positive effect of college outcomes. Bos, Berman, Kane, and Tseng (2012) find that Los Angeles public school students who were offered advice on college choices by current college students were significantly more likely to enroll in four-year public colleges, to submit a FAFSA, and to receive scholarships or grants than were students in a control group. Carrell and Sacerdote (2013) provided New Hampshire public school students who had yet to apply to college late in high school with cash incentives, and advising from Dartmouth college undergraduates. They estimate that this intervention increased college enrollment by 15 percentage points for women, but had no effect on college enrollment for men.

The Expanding College Opportunities (ECO) project conducted by Caroline Hoxby and Sarah Turner provided college application fee waivers and semi-customized college advising in a letter sent to high-achieving low-income students. The ECO project only communicated with students by regular mail and thus is an extremely low-cost intervention. Hoxby and Turner (2013) reports the results of their randomized controlled trial and find significant increases in selective college enrollment as a result of the intervention. Similarly, Avery's pilot study of private college counseling for talented low-income students in New England and New York found a 9 percentage point increase in enrollment in colleges ranked "Most Competitive", though given a limited sample size, this result was not statistically significant (Avery, 2010).

There are now many well-established regional and national programs designed to help minority and financially disadvantaged students gain admission and enroll in appropriate four-year colleges. But, despite a wealth of evidence of the success of demonstration programs, as described above, there is limited formal evidence of the effects of any of these ongoing college access programs. This paper aims to fill that gap by analyzing a randomized controlled trial of one such program -- the College Possible non-profit program for low-income high school juniors and seniors in the Minneapolis and St. Paul metro region. The results indicate that participation in the College Possible program had a statistically significant effect on four-year college enrollment; these results may be the

first statistically significant findings of positive effects of a non-profit college counseling program.

The paper proceeds as follows. Section 2 describes the College Possible program. Section 3 summarizes the results from a regression discontinuity analysis of historical observational data to assess the effects of the programs and explains how this analysis was used to guide the design of the randomized trial. Section 4 describes the details and provides descriptive statistics for the randomized trial. Section 5 analyzes the results of the trial, including separate analyses of the effects of the program on ACT scores, college applications, and college enrollment. Section 6 concludes.

II. The College Possible Program

College Possible is a 501(c)(3) nonprofit organization based in St. Paul. It is designed to serve low-income high school students who do not otherwise have the resources or the guidance to earn admission to a four-year college or university. College Possible provides a two-year after-school curriculum to high school juniors and seniors including SAT and ACT test preparation services, college admissions and financial aid consulting, and guidance in the transition to college.

Students apply as high school sophomores and enter the two-year program as juniors. The program is limited to students from families below the median city/county household income in city/county, with a suggested minimum GPA of 2.0 or above. Among current participants in the program, average family household income is $25,000, 91 percent are students of color and a vast majority (90 percent of those who responded to a recent survey) would be first-generation college students. Over the course of two years, each participant in the College Possible program receives a total of 320 hours of direct service.

There is no cost for students or their families to participate in the College Possible program, and currently no cost to partner high schools. In exchange for program services, all participating students perform at least eight hours of community service each

year. High schools provide College Possible coaches with office space Monday-Thursday for their fulltime office hours and classroom space after school in which to conduct lessons.

There are two natural ways that the College Possible program is hypothesized to increase college enrollment and persistence. First, the program provides extensive tutoring designed to help participants increase their ACT scores. Second, College Possible provides directed assistance with college choice and applications. Thus, participants in the program are hypothesized to be more ambitious in their college applications, more likely to be admitted to and more likely to enroll at four-year and selective colleges where in turn they are (presumably) more likely to persist and to complete BA degrees than in they enroll at two-year or non-selective four-year colleges.

III. Regression Discontinuity Analysis of Historical Data from College Possible

In preparation for a randomized trial, College Possible matched the records for three prior cohorts of students to the National Student Clearinghouse. All students who applied to join the College Possible program as 10th graders in the spring of 2005, 2006, and 2007 are included in the data matched to the National Student Clearinghouse.[2] These students graduated from high school in 2007, 2008, and 2009 and the matched data includes at least one year of college enrollment for each cohort.

College Possible staff members review and rate each application on a 1 to 3 scale. A rating of 1 is most attractive. Ratings of 2A and 2B are next most attractive, where 2B often indicates that the student is receiving substantial help from another organization. A rating of 3 indicates an applicant who does not meet the criteria for admission, either meaning that the student has a grade point average (well) below 2.0, cannot commit to attending program sessions regularly, or has a family income that is too high.

Program admissions decisions for these years were stratified by high school. By individualized prior agreements, each partner high school was assigned a number of slots

[2] All applicants to the program sign a consent form that provides College Possible with access to their future academic records.

in the program, where these numbers of slots vary by size of high school and past numbers of qualified applicants. Within each high school, students were admitted in rating order, with students rated "1" getting first priority.

Of particular note, the ratings are on an absolute rather than relative scale: on average a student with a rating of "1" at one high school should be viewed as similar in potential to succeed in the program as a student with a rating of "1" at a different high school. Since the rating scheme is consistent across schools, but the number of slots and applicants vary by school, the rating cutoffs for admission to the program also vary by school. At some participating high schools, admission to the program is sufficiently competitive that only students with ratings of "1" can be admitted, but at other high schools, it is common for students with ratings of 2A and 2B admitted to the program.

We make use of this historical variation in rating cutoffs for admission by school and year to craft a regression discontinuity approach that yields a local estimate of the effect of the program on college enrollment. Specifically, we examine the results for 142 students who had application ratings of 1 (highest rating) but who were not admitted to the program to the results for 203 students had application ratings of 2A and were admitted to the program when they applied in 2005, 2006 or 2007. Under the assumption that application ratings follow a consistent absolute scale across high schools and time, then in this restricted sample, each student admitted to the program was rated as less promising than each student excluded from the program.

Table 1 presents results from regression analysis with matriculation to a (two-year or four-year) college in the fall after high school graduation as the dependent variable.[3] Each row in the table reports a more expansive regression specification. Row 1 reports the estimated coefficient for program participation in a regression specification that includes dummy variables for gender, application year, and application rating. Rows 2 through 4

[3] Using "Intent to Treat" as the basis for identification of the treatment group, we include all students who were admitted to College Possible in the program participation dummy variable even though some of these students dropped out of the program (often because they transferred to high schools not associated with College Possible) before high school graduation.

report the same coefficient after the sequential addition of independent variables. The estimated coefficients indicate an increase of 19 to 21 percentage points in probability of college enrollment as a result of program participation. Every estimated coefficient is statistically significant at the 5% significance level.

Table 1: Regression Discontinuity Estimates of Historical Program Effects

Control Variables	Enrolling in College	Enrolling in a Four-Year College
Demographics and Application Ratings	.192** (.056)	.179** (.053)
AND Other Program	.193** (.056)	.179** (.053)
AND Race/Ethnicity	.214** (.071)	.173** (.069)
AND High School Dummy Variables	.213** (.082)	.210** (.078)
	342	342

* = significant at the 10% level; ** = significant at the 5% level.
Each entry represents the coefficient on the "Admitted to Program" dummy variable in a Probit specification, translating that coefficient into estimated change in probability for an applicant with all explanatory variables at their sample mean values. The standard errors associated with each coefficient are reported in parentheses. Three students were excluded from analysis because of missing values for "Male".

In initial discussions about the possibility of a randomized trial, College Possible administrators indicated that the organization typically receives applications from 900 qualified applicants for the 800 places in its program. Further, these administrators indicated that they viewed the last 200 qualified applicants based on their rankings of student applications to be roughly equivalent from the perspective of the program. This naturally suggested a design with a randomized selection among these last 200 qualified applicants for 100 places in the program.

The estimates from Table 1 seem directly applicable to this design because they apply to students who were presumably on the borderline between admission or rejection from the College Possible program -- students were only included in the historical analysis if they were admitted to the program with a relatively poor application rating or excluded from the program despite having a relatively strong application rating. A two-sample t-test of proportions of college enrollment with 100 students in the treatment group and 100 students in the control group would yield a standard error of at most 7.1 percentage points

(under the conservative assumption of a 50% rate of enrollment in each group). Then, a difference of 13.9 percentage points in enrollment rates between the two groups would be required for statistical significance. This difference translates into statistical power of approximately .81 if the program actually increases enrollment by 20 percentage points. Although it was somewhat optimistic to assume that the historical regression discontinuity analysis accurately estimated the effects of the program, this power calculation suggested that it was plausible to go ahead with a randomized trial given historical application patterns to the program.

IV. Logistics of the Randomized Controlled Trial

In the spring of 2010, College Possible initiated a randomized trial designed to produce an unbiased estimate of the effects of the program. As mentioned above, program administrators projected a total of 900 applications from qualified students (i.e. students with ratings of 1, 2A and 2B) for the 800 spots in the program that it could offer. Thus, College Possible decided to fill its first 700 spots using ordinary program procedures and to follow a randomized procedure to choose the last 100 students to enroll.

A total of 239 students from eight high schools were included in the randomization in May 2010; College Possible provided individualized information for these students including (1) gender; (2) race/ethnicity; (3) family income; (4) grade-point average (GPA) and (5) internal program rating. Based on this information, each student was matched to a group of two to four similar students from the same school, and then 101 students were admitted to the program on a randomized group-by-group basis designed to admit a predetermined number to admit from each high school.[4] The remaining students were placed on a wait list (except for one student who asked to be removed from the

[4] To try to balance the groups of admitted and not admitted students, we alternated between admitting the student with lower GPA and admitting the student with higher GPA within each group of two students. We followed similar alternation rules for admission of students from groups with three and four students.

study), and 33 were admitted in a separate randomization procedure to fill new spots in the program on a school-by-school basis in Fall 2010.[5]

Table 2: Descriptive Statistics for Treatment and Control Groups

	Control Group	Treatment Group		Treatment Group 1	Treatment Group 2
Male	41.3%	41.0%		40.6%	42.4%
Hmong	58.7%	61.9%		58.4%	72.7%
GPA	3.043	3.015		3.033	2.959
Rank 1	56.7%	61.2%		57.4%	72.7%
Family Income	$26,770	$25,863		$27,347	$21,321
Number of Students	104	134		101	33

Table 2 presents descriptive statistics for the treatment and control groups in the randomized trial. Approximately 60% of students in the original sample were women, approximately 60% were from the Hmong racial group, and approximately 60% were given application ratings of "1" by College Possible. There are some differences in the mean values for these quantitative variables across the groups. In particular, students in Treatment Group 2 have lower average incomes and are more likely to be ranked #1 as applicants by College Possible by comparison to students in the Control Group and in Treatment Group 1. However, Treatment Group 2 includes a quite small sample of students. None of the differences shown in Table 2 between Control Group and (either) Treatment Group is statistically significant at the 5% level.

Throughout all of the analysis below, we include each of the variables in Table 2 as control variables to account for the possible effect of difference in the compositions of the treatment and control groups on each outcome of interest.

Table 3 summarizes the average level of program activity for students in each treatment group for the first year of the program. Almost all of the students who were selected in the first round in Spring 2010 participated in the program the next fall. By contrast,

[5] These 33 students included 5 who were ineligible for the program because they had transferred to new high schools; based on the "Intent to Treat" evaluation rule, we make the conservative choice of including these five students in the second treatment group even though they never participated in the program.

relatively few of the students selected from the wait list in the second round in Fall 2010 actually participated in the program, and those who did participate did so much less intensively on average than students who were admitted to the program in the first round of randomization. Conditional on attending at least one program session, students admitted initially attended an average of 42.2 sessions whereas students admitted from the wait list in the second round of randomization attended an average of 27.8 sessions.

Table 3: Junior Year Participation Rates in the College Possible Program

	Attended At Least 1 Program Session	**Average Number of Sessions Attended**
Treatment Group 1	96 of 101 (95.1%)	42.0
Treatment Group 2	14 of 33 (42.4%)	11.8
Control Group	0 of 104 (0.0%)	0.0

Five of the 33 students selected to join the program in the second round of randomization were ineligible for the program as they were no longer attending high schools affiliated with College Possible. We continue to include these five students in the Treatment Group (based on an "Intent to Treat" criterion), but none of them received services of any sort from College Possible. In addition, a number of the other students selected from the wait list for the program were formally eligible but did not choose to participate.

With this as background, we use two separate approaches for evaluating the effects of the program. First, using the "Intent to Treat" criterion, we simply compare outcomes for the 134 students in the Treatment Group to outcomes for the 104 students in the Control Group, using a dummy variable in a regression framework while controlling for other observable variables. Second, we use the two different sources of random assignment to treatment (Spring 2010 and Fall 2010) as instrumental variables for participation in the program in order to estimate the local average treatment effect of the program. Then we code any student who attended at least one session of the program as a "Program Participant". In a first stage regression, we use two separate treatment indicators (one for students selected in Spring 2010 and another to identify students selected from the wait list in Fall 2010) to isolate the variation in program participation as a function of

exogenous treatment assignment. In a second stage regression, we use predicted values for program participation from the first stage to identify the causal effect of "Program Participation" on ACT scores, college application choices, and college enrollment.

V. Data and Results

As part of its application process, College Possible collects demographic information from each student, including race/ethnicity and family income for each student along with each student's cumulative GPA for the first two years of high school. College Possible matched its records to the data from one partner school district to compile the list of college applications for each of the students for the four high schools from that district that participated in the study. In addition, ACT and the National Student Clearinghouse matched all of the students in the study to their respective databases to provide standardized test scores and enrollment information for the anonymized version of the database used for the analysis in the study. Data provided by these two organizations match very well – though not perfectly – with internal tracking data compiled separately by College Possible for students in the Treatment Group. The analysis below uses only the data provided by ACT and separately by the National Student Clearinghouse rather than ACT score and college enrollment data compiled separately by College Possible.

A. ACT Scores

College Possible provides extensive ACT training and tracks the performance of student participants from an initial pretest through a series of subsequent tests and ultimately to each student's actual ACT score. It usually observes an improvement of 3-4 points during its program, with average ACT composite score of about 18 for its participants on the actual test.

Table 4 provides descriptive statistics for students in the Control Group and each treatment group. Although College Possible strongly encourages participants to take the

ACT, it is not surprising that the ACT data indicates less than universal participation for Treatment Group students. First, the ACT database match is likely imperfect, as some students may be listed under slightly different names in the College Possible and ACT data. Second, not all students in the Treatment Group formally participated in the College Possible program (since we are using the "Intent to Treat" criterion for evaluation purposes), and those who were selected but who did not complete the College Possible program may be disproportionately unlikely to take the ACT.

Comparing test scores across the groups for the students who are matched with ACT scores, Treatment Group students have slightly lower average scores on each component of the ACT than did Control Group students, with differences ranging from about 1/4 to 3/4 points. Treatment Group 1 (the main treatment group) students actually had comparable ACT scores to students in the Control group, while Treatment Group 2 students scored about 2 points less on each section of the test. Interestingly, the performance of the Treatment Group students broadly matches the historical performance of College Possible students in prior years. That is, the Treatment Group students improved their scores from pretest to the actual ACT as expected, but apparently the baseline performance level of Control Group students also improved from the start of 11th grade to the time of the actual ACT test.

Table 4: Average ACT Scores for Treatment and Control Groups

	Control Group	Treatment Group		Treatment Group 1	Treatment Group 2
Took ACT	72.1%	71.6%		74.3%	63.6%
ACT Comp	18.35	17.85		18.28	16.33
ACT E	16.68	16.38		16.95	14.33
ACT M	19.12	18.83		19.36	16.95
ACT R	18.11	17.30		17.80	15.52
ACT S	18.85	18.33		18.53	17.62
Observations	104	134		101	33

Table 5 reports results of regression analysis to assess the effect of the program on ACT scores after controlling for demographic variables and academic achievement variables for students prior to the start of the program. Column 1 reports the results for regressions

with a single dummy variable to identify the 134 students who were ever randomly selected for admission to the program. Columns 2 and 3 report the coefficients for a different set of regressions with two dummy variables, where Treatment Group 1 refers to the 101 students admitted in the initial randomization and Treatment Group 2 refers to the 33 students admitted from the wait list the following fall.

Table 5: "Intent to Treat" Regression Analysis of ACT Results

	Any Treatment		Treatment Group 1	Treatment Group 2
Took ACT	0.004 (0.063)		0.037 (0.067)	-0.105 (0.104)
ACT Comp	-0.113 (0.553)		0.093 (0.573)	-1.059 (0.904)
ACT E	0.305 (.724)		0.565 (0.751)	-0.888 (1.185)
ACT M	0.069 (.542)		0.426 (0.556)	-1.577 * (0.877)
ACT R	-0.379 (0.693)		-0.144 (0.720)	-1.460 (1.135)
ACT S	-0.298 (0.581)		-0.027 (0.606)	-0.410 (0.956)

* = significant at the 10% level; ** = significant at the 5% level.
Each entry represents the coefficient on the "Admitted to Program" dummy variable in a regression analysis with additional control variables for race, gender, prior GPA, family income, College Possible application ranking, as well as dummy variables for each participating high school. We use an OLS specification for all dependent variables except "Took ACT". We use a Probit specification to predict the dependent variable "Took ACT", translating that coefficient into estimated change in probability for an applicant with all explanatory variables at their sample mean values. The standard errors associated with each coefficient are reported in parentheses.

The coefficients in Table 5 suggest that the program had little to no observable effect on ACT outcomes. Students in Treatment Group 1 are assessed to have mildly positive results by comparisons to students in the Control Group, but none of these results are statistically significant. Students in Treatment Group 2, however, performed about 1 point worse than students in the Control Group in ACT composite score, but given the small number of students in Treatment Group 2, none of these coefficients is significant at the 5% level.

Table 6 reports detailed results of two-stage least squares instrumental variables analysis of the effect of participating in the program on ACT outcomes, using separate dummy variables for "Treatment Group 1" and "Treatment Group 2" to predict program

participation. The variable "Program Participant" is a binary variable identifying students who participated in at least one program session.

Table 6: Instrumental Variables Analysis Analysis for the Effect of Program Participation on ACT Results

	Took ACT	ACT Comp	ACT E	ACT M	ACT R	ACT S
Program Participant	0.004 (0.064)	0.154 (0.561)	0.640 (0.731)	0.532 (0.548)	-0.072 (0.705)	-0.264 (0.591)
GPA Grade 9/10	0.115** (0.052)	3.000** (0.477)	3.618** (0.622)	3.162** (0.466)	2.528** (0.600)	2.385** (0.503)
Hmong	0.006 (0.069)	-2.878** (0.646)	-4.273** (0.843)	-2.375** (0.632)	-2.627** (0.813)	-2.385** (0.681)
Male	0.053 (0.059)	0.265 (0.529)	-0.697 (0.690)	1.474** (0.517)	-0.996 (0.665)	1.051* (0.558)
Rank 1	0.055 (0.075)	0.457 (0.687)	0.208 (0.896)	0.839 (0.672)	0.690 (0.864)	0.024 (0.724)
Income (in $1000s)	0.001 (0.002)	0.041** (0.114)	0.050** (0.019)	0.041** (0.014)	0.034* (0.018)	0.045** (0.015)
Constant	0.481** (0.189)	10.212 ** (1.639)	7.091 ** (2.137)	8.332** (1.603)	12.405** (2.061)	13.100** (1.727)
Observations	238	171	171	171	171	171

* = significant at the 10% level; ** = significant at the 5% level.
Second stage regression coefficients are reported for each independent variable and specification with standard errors listed in parentheses. A linear probability model was used for each specification. All specifications include dummy variables for each participating high school.

The first column of Table 6 reports the second-stage regression coefficients for each variable on the probability of taking the ACT. The remaining columns report the second stage coefficients for each variable on scores on different components of the ACT test. The number of observations in these columns declines from 238 to 171 because the ACT database only included (matched) scores for 171 of the 238 students in the study.

Several independent variables are predicted to have significant effects on ACT performance. Ninth and tenth grade GPA and family income are both positive predictors of ACT score, while self-identification as a Hmong student is a negative predictor of ACT score. Male students score significantly better than female students (after controlling for other variables) on the Math and Science sections of the test, but the coefficient on "Male" is close to zero in predicting the composite ACT score.

By contrast, the coefficient on the fitted "Program Participant" variable is relatively small in all cases. This coefficient takes a maximum value just more than one-half point for the Math and English sections of the test, but neither of these coefficients is significant at even the 10% level. "Program Participation" is also predicted to have a small positive effect of 0.15 points on the ACT composite score, but this is a very small magnitude by comparison to the standard error of nearly 0.6 points for this coefficient

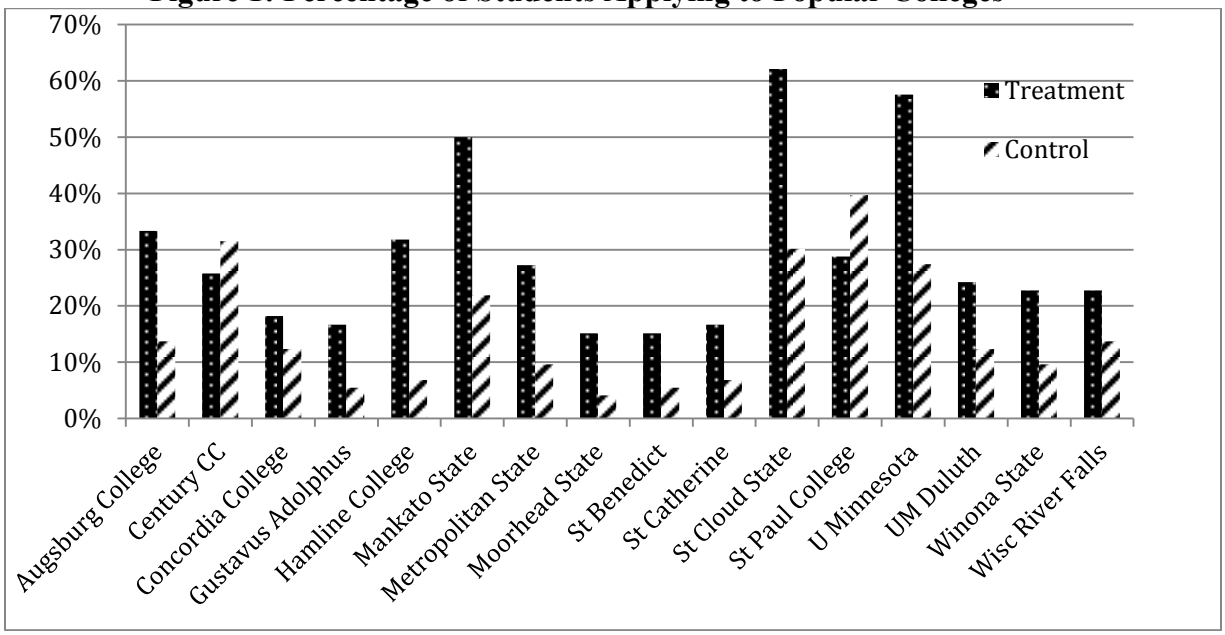
B. College Applications

This randomized controlled trial encompasses students from eight high schools affiliated with College Possible. Four of these high schools are from the partner district that has formal records of college applications; these schools compiled and provided a full list of college applications for their students. We do not have a systematic record of college applications for Control Group students in the other four schools in the study, thus we limit our analysis of college applications to students in these four schools. Among the 238 students in the study, 139 attended these four high schools, including 66 Treatment Group Students (56 in Treatment Group 1 and 10 in Treatment Group 2) and 73 Control Group students. Since this application data was compiled by an external source, it should be similarly complete for both Treatment and Control Group students, and thus an unbiased source of evaluation data.[6]

Figure 1 compares the percentage of students in Treatment Group and Control Group (from the partner district with records of college applications) who applied to each of a number of popular colleges. For the three most popular four-year colleges: Mankato State, St. Cloud State, and the University of Minnesota, Treatment Group students were more than twice as likely to apply as Control Group students. Yet, at the same time, Treatment Group students were less likely to apply to popular two-year colleges such as Century Community College and St. Paul College than Control Group students.

[6] We reran the regressions reported in Tables 7 and 8 for the effect of the program on students in these four schools alone and found a smaller effect than for students in all schools. This suggests that restricting the analysis of applications to students in these four high schools yields an underestimate of the effect of the program on application behavior overall.

Figure 1: Percentage of Students Applying to Popular Colleges



For further analysis, we classify colleges according to the Barrons rankings. The Barrons ranking is based on a combination of statistics, emphasizing admission rates and the interquartile range of standardized test scores for each college. There are six separate categories for four-year colleges: "Most Competitive", "Highly Competitive", "Very Competitive", "Competitive", "Less Competitive" and "Non Competitive" (which is essentially open access). Relatively few of the students in the study had sufficient academic qualifications for admission to "Most Competitive" colleges, so we emphasize the other ranking categories in the analysis below.

Table 7 reports results of regression analysis to assess the effect of the program on college applications after controlling for demographic variables and academic achievement variables for students prior to the start of the program. Column 1 reports the results for regressions with a single dummy variable to identify the 134 students who were ever randomly selected for admission to the program. Columns 2 and 3 report the coefficients for a different set of regressions with two dummy variables, where Treatment

Group 1 refers to the 101 students admitted in the initial randomization and Treatment Group 2 refers to the 33 students admitted from the wait list the following fall.
The OLS regression results reported in Table 7 indicate strong positive effects of admission to the program on the number of applications submitted. In particular, students in each treatment group submitted significantly more applications to colleges at almost every level of Barrons ranking. The magnitudes of these coefficients are so large that they are even significant in most cases for Treatment Group 2 students despite the very small number of those students in Treatment Group 2 for the partner district that provided records of college applications.

Table 7: "Intent to Treat" Regression Coefficients for College Applications

Dependent Variable	Any Treatment		Treatment Group 1	Treatment Group 2
Applied to Four-Year College	0.304** (0.066)		0.276** (0.069)	0.450** (0.132)
Total Applications	4.754** (0.687)		4.441** (0.721)	6.392** (1.373)
Applications to Highly Comp.	1.075** (0.209)		1.107** (0.221)	0.905** (0.421)
Applications to Very Competitive	1.380** (.229)		1.313** (0.242)	1.731** (0.461)
Applications to Competitive	0.442** (.114)		0.457** (0.121)	0.364 (0.230)
Applications to Less Competitive	1.834** (0.301)		1.622** (0.313)	2.943** (0.596)
Applications to Two Year Colleges	-0.276** (0.192)		-0.404** (0.200)	0.398 (0.381)

* = significant at the 10% level; ** = significant at the 5% level.
Each entry represents the coefficient on the "Admitted to Program" dummy variable in a regression analysis with additional control variables for race, gender, prior GPA, family income, College Possible application ranking, as well as dummy variables for each participating high school. We use an OLS specification for all dependent variables except "Applied to Four-Year College". We use a Probit specification to predict the dependent variable "Applied to Four-Year College", translating that coefficient into estimated change in probability for an applicant with all explanatory variables at their sample mean values. The standard errors associated with each coefficient are reported in parentheses.

Table 8 reports detailed results of two-stage least squares instrumental variables analysis of the effect of participating in the program on college applications, using separate dummy variables for "Treatment Group 1" and "Treatment Group 2" to predict program

participation. Once again, "Program Participant" is a binary variable identifying students who participated in at least one program session.

As shown in Table 8, participation in the College Possible program is estimated to increase the probability of applying to a four-year college by 31.7 percentage points Similarly, participation in the program is also estimated to significantly increase the number of applications to each selectivity ranking from "Highly Competitive" to "Less Competitive" in the Barrons rankings.

Table 8: Instrumental Variables Analysis for the Effect of Program Participation on College Applications

	Applied 4-Year	Apps	HC Apps	VC Apps	C Apps	LC Apps
Program Participant	0.317** (0.067)	4.972** (0.675)	1.131** (0.209)	1.445** (0.231)	0.466** (0.114)	1.912** (0.300)
GPA Grade 9-10	0.064 (0.053)	1.561** (0.546)	0.916** (0.167)	0.616** (0.184)	-0.243** (0.091)	-0.647** (0.239)
Hmong	0.074 (0.067)	-0.983 (0.689)	-0.542** (0.210)	-0.329 (0.233)	0.202 (0.115)	0.174 (0.301)
Male	-0.023 (0.064)	-0.386 (0.654)	-0.103 (0.200)	-0.281 (0.221)	-0.082 (0.109)	-0.438 (0.286)
Rank 1	0.012 (.072)	0.381 (0.741)	0.012 (0.226)	0.064 (0.250)	0.078 (0.124)	-0.138 (0.324)
Income (in $1000s)	0.001 (0.002)	0.020 (0.018)	0.009 (0.006)	0.006 (0.006)	0.003 (0.003)	0.015* (0.008)
Constant	0.482** (0.189)	-2.432 (1.939)	-2.525** (0.591)	-1.732** (0.654)	0.803** (0.324)	2.206** (0.847)
Observations	139	139	139	139	139	139

* = significant at the 10% level; ** = significant at the 5% level.
Second stage regression coefficients are reported for each independent variable and specification with standard errors listed in parentheses. A linear probability model was used for each specification. All specifications include dummy variables for each participating high school.

C. College Enrollment

At the time of this report, students in the study were one year out of high school; we plan to continue following them over time to assess the effect of the program on long-run educational attainment. In this section of the report, we analyze enrollment for the fall and spring semesters of the first year beyond high school separately.

Fall Semester Enrollment

Table 9 reports enrollment choices according to the Barrons Rankings for four-year colleges. We group the three highest selectivity categories ("Most Competitive", "Highly Competitive", "Very Competitive") together, since relatively few of the students in the study had sufficient ACT Scores to be admitted at colleges of that level of selectivity. There is little difference in overall enrollment figures for Treatment and Control Group students – a bit less than 2/3 of the students in each group enrolled in college this fall.

One conspicuous difference between the groups is that Treatment Group students were much more oriented to four-year colleges. While students in the Control Group were only slightly more likely to enroll in a four-year college than a two-year college (34.4% enrolled in a four-year college while 29.5% enrolled in a two-year college, students in the Treatment Group were more than twice as likely to enroll in a four-year college (45.2% enrolled in four-year colleges and 18.8% enrolled in two-year colleges).

Table 9: Fall College Enrollment for Treatment and Control Group Students

	Control Group	Treatment Group		Treatment Group 1	Treatment Group 2
Most, Highly, or Very Competitive	10.6%	18.1%		18.8%	15.2%
Competitive	17.1%	21.1%		23.7%	15.2%
Other 4-Year	6.7%	6.0%		6.9%	3.0%
2-Year College	29.5%	18.8%		19.8%	18.2%
Not Enrolled	36.2%	36.1%		30.7%	48.5%
Students	104	134		101	33

Table 10 lists the ten most popular colleges chosen by students in Treatment and Control Groups. On the whole, these lists overlap nearly completely: eight colleges appear on both lists. The most popular college for students in the Treatment Group, chosen by 7.8% of the students selected for the College Possible Program – was Augsburg College, yet not even one student from the Control Group enrolled there.

The popularity of Augsburg College among Treatment Group students suggests that we should expect to see differences in enrollment at the "Competitive" rank, where Augsburg falls. In fact, as shown in Table 9 above, the program seems to have achieved the largest gains in enrollment at selective colleges: students in the Treatment Group were 7.5 percentage points more likely than Control Group students to enroll in a college ranked at least "Very Competitive" (and 11.5 percentage points more likely to enroll in a college ranked at least "Competitive").

Table 10: Most Popular Colleges by Enrollment

Treatment Group	Control Group
Augsburg College 10	St. Paul College 9
St Cloud State 10	Century Community College 8
Century Community College 8	St. Cloud State 6
University of Minnesota 7	Minnesota Community & Tech 6
Northern Hennepin CC 5	University of Minnesota 5
St. Paul College 5	U Minnesota, Duluth 5
Minnesota Community & Tech 4	Northern Hennepin CC 3
College of St. Benedict 4	U Wisconsin, River Falls 3
Minnesota State U, Mankato 4	College of St. Benedict 2
University of Wisconsin, Eau Claire 3	Minnesota State U., Mankato 2*

* Three other colleges (Concordia, Metropolitan State, and Normandale CC) also enrolled at least two students from the Control Group.

Table 11 provides separate estimates of the effect of the program on students in the two separate Treatment Groups. As shown in the first column of Table 11, admission to the program is estimated to have little effect on enrollment overall. However, as shown in the subsequent rows of the table, we find a strong and significant effect of admission to the program on enrollment in four-year colleges, and also to colleges with Barrons ranking of "Competitive" or higher. In particular, the program is estimated to increase

the probability of enrollment at a four-year college (and similarly at colleges ranked "Competitive" or higher) by approximately 15 percentage points.

Table 11: "Intent to Treat" Regression Coefficients for Fall Enrollment

	Any Treatment		Treatment Group 1	Treatment Group 2
Enrolled at Any College	.017 (.068)		.059 (.071)	-.125 (.110)
Enrolled at Four Year College	.151** (.069)		.178** (.074)	.062 (.115)
Enrolled at MC, HC or VC Ranked College	.071 (.042)		.069 (.049)	.146** (0.116)
Enrolled at MC, HC, VC, or C Ranked College	.153** (.065)		.168** (0.072)	0.118 (0.117)

* = significant at the 10% level; ** = significant at the 5% level.
Each entry reports the estimated effect of the "Admitted to Program" dummy variable in a Probit specification with a dependent variable for each row in the table. Each specification includes additional control variables for race, gender, prior GPA, family income, College Possible application ranking, as well as dummy variables for each participating high school. In each case, we translate that Probit coefficient into an estimated change in probability for an applicant with all explanatory variables at their sample mean values. The standard errors associated with each coefficient are reported in parentheses.

Comparing the coefficients in Table 11 for "Treatment Group 1" and "Treatment Group 2", we estimate more positive effects of the program on college enrollment for students in the first treatment group (admitted Spring 2010) than in the second treatment group (admitted Fall 2010). But none of the estimated differences for the two treatment groups is statistically significant.

Table 12 reports detailed results of two-stage least squares instrumental variables analysis of the effect of participating in the program on college applications, using separate dummy variables for "Treatment Group 1" and "Treatment Group 2" to predict program participation. Once again, "Program Participant" is a binary variable identifying students who participated in at least one program session. Columns 1 through 3 of the table report the results of specifications that do not include fixed effects / high school dummy variables. Columns 4 through 6 repeat the analysis from each of Columns 1 through 3 with the addition of these high school dummy variables.

Table 12: Instrumental Variables Analysis for the Effect of Program Participation on Fall Semester Enrollment

	Enrolled	Four-Year College	Barrons Ranking MC to C	Enrolled	Enrolled Four-Year	Barrons Ranking MC to C
Program Participation	.072 (.068)	.168** (.067)	.165** (.064)	.061 (0.069)	.160** (.068)	.152** (.064)
GPA Grade 9-10	.122** (.055)	.271** (.054)	.260 (.051)	.113** (.057)	.266** (.055)	.243** (.053)
Hmong	-.022 (.068)	-.045 (.066)	-.013 (.063)	-.061 (.075)	-.047 (.073)	.002 (.069)
Male	-.031 (.063)	-.003 (.061)	.003 (.058)	-.042 (.064)	-.009 (.062)	-.009 (.059)
Rank 1	.060 (.067)	-.026 (.065)	-.001 (.062)	.038 (.082)	-.008 (.079)	.035 (.076)
Income	.003** (.002)	.003* (.002)	.004** (.002)	.003* (.002)	.003* (.002)	.003* (.002)
Constant	.137 (168)	-.530** (.163)	-.607 (.155)	.140 (.205)	-.516** (.200)	-.462** (.190)
High School Fixed Effects	NO	NO	NO	YES	YES	YES
Observations	238	238	238	238	238	238

* = significant at the 10% level; ** = significant at the 5% level.
Second stage regression coefficients are reported for each independent variable and specification with standard errors listed in parentheses. A linear probability model was used for each specification. All specifications include dummy variables for each participating high school.

As shown in Table 12, “Program Participation" is estimated to increase enrollment overall and enrollment at four-year colleges. The estimated effect of the program is a 15 to 17 percentage point increase in enrollment at four-year colleges and at four-year colleges with ranking of “Competitive” or higher; each of these coefficients is significant at the 5% level whether high school fixed effects are included or not. The estimated effect of the program on enrollment at any college is smaller and not significant with or without high school fixed effects.

Spring Semester Enrollment

Table 13 reports spring semester enrollment choices according to the Barrons Rankings for four-year colleges. Most students who enrolled in both semesters chose the same

college for the spring as for the fall. However, 26 students enrolled in only the first semester. (Relatively few students – just 10 - enrolled in the spring but not in the fall.)

Table 13: Spring College Enrollment for Treatment and Control Group Students

	Control Group	Treatment Group		Treatment Group 1	Treatment Group 2
Most, Highly or Very Competitive	10.6%	15.7%		16.8%	12.1%
Competitive	13.4%	19.4%		21.8%	12.1%
Other 4-Year	5.8%	3.0%		3.0%	3.0%
2-Year College	30.8%	16.5%		17.8%	12.1%
Not Enrolled	39.4%	45.5%		40.6%	60.6%
Students	104	134		101	33

Some differences are apparent between fall semester enrollment (Table 9) and spring semester enrollment (Table 13). While enrollment fell off to some degree among all groups from fall to spring semester, it declined to a greater degree for Treatment Group students, especially for Treatment Group 2 students. Overall, enrollment at four-year colleges was still greater in the spring semester for Treatment Group students (38.1%) by comparison to Control Group students (29.8%), but Control Group students were more likely to be enrolled overall (60.6%) than were Treatment Group students (54.5%).

Table 14: "Intent to Treat" Regression Coefficients for Spring Enrollment

	Any Treatment		Treatment Group 1	Treatment Group 2
Enrolled at Any College	-.083 (.072)		-.042 (.077)	-.239** (.111)
Enrolled at Four Year College	.097 (.067)		.117 (.073)	.026 (.112)
MC, HC or VC Ranked College	.049 (.049)		.048 (.046)	.087 (.100)
MC, HC, VC, or C Ranked College	.123* (.063)		.145** (.069)	.045 (.111)

* = significant at the 10% level; ** = significant at the 5% level.

Each entry reports the estimated effect of the "Admitted to Program" dummy variable in a Probit specification with a dependent variable for each row in the table. Each specification includes additional control variables for race, gender, prior GPA, family income, College Possible application ranking, as well as dummy variables for each participating high school. In each case, we translate that Probit coefficient into an estimated change in probability for an applicant with all explanatory variables at their sample mean values. The standard errors associated with each coefficient are reported in parentheses.

As shown in Table 14, admission to the program is still estimated to have a positive effect on spring semester enrollment at four-year and selective colleges, though the magnitudes of these coefficients are somewhat diminished from those for the fall semester. Further, admission to the program is now estimated to have negative effect on spring semester enrollment overall. The only significant positive effects in these specifications are that admission to the program increased enrollment at colleges ranked "Competitive" or better by 12.3 percentage points overall and by 14.5 percentage points for students admitted to the program in the first round of randomization. The only significant negative effect in these specifications is that admission to the program reduced enrollment overall for students admitted to the program in the second round of randomization. But given the small percentage of students in the second round of randomization who ever participated in the program, this finding is likely spurious.

Table 15: Instrumental Variables Analysis for the Effect of Program Participation on Spring Semester Enrollment

	Enrolled	Four-Year College	Barrons Ranking MC to C	Enrolled	Enrolled Four-Year	Barrons Ranking MC to C
Program Participation	-.010 (.069)	.125** (.006)	.154** (.062)	-.029 (.068)	.102 (.064)	.131** (.062)
GPA Grade 9-10	.187** (.055)	.294** (.051)	.254** (.050)	.156** (.056)	.278** (.053)	.233** (.051)
Hmong	-.008 (.686)	-.006 (.006)	-.019 (.062)	.002 (.074)	.006 (.070)	-.013 (.068)
Male	-.160** (.063)	-.090 (.058)	-.071 (.057)	-.168** (.063)	-.098* (.059)	-.077 (.058)
Rank 1	-.015 (.067)	-.040 (.062)	-.005 (.061)	-.061 (.080)	-.044 (.076)	.012 (.073)
Income	.004** (.002)	.003* (.002)	.003** (.001)	.003* (.002)	.002 (.002)	.002 (.002)
Constant	-.005 (.168)	-.604 (.156)	-.572 (.151)	.271 (.202)	-.505** (.190)	-.414** (.185)
High School Fixed Effects	NO	NO	NO	YES	YES	YES
Observations	238	238	238	238	238	238

* = significant at the 10% level; ** = significant at the 5% level.

Second stage regression coefficients are reported for each independent variable and specification with standard errors listed in parentheses. A linear probability model was used for each specification. All specifications include dummy variables for each participating high school.

Table 15 reports detailed results of two-stage least squares instrumental variables analysis of the effect of participating in the program on college applications, using separate dummy variables for "Treatment Group 1" and "Treatment Group 2" to predict program participation. Columns 1 through 3 of the table report the results of specifications that do not include fixed effects / high school dummy variables. Columns 4 through 6 repeat the analysis from each of Columns 1 through 3 with the addition of these high school dummy variables.

The results in Table 15 indicate that program participation had a significant positive effect on spring semester enrollment at selective colleges, but little to no effect on spring semester enrollment overall. Comparing the results of Tables 12 and 15, we estimate that participation in the program increased in enrollment in four-year and selective colleges by 15 to 17 percentage points in the fall semester, as opposed to 10 to 15 percentage points in the spring semester. Further, the statistical significance of the spring semester results is much more delicate than that of the fall semester results. The significance of the predicted effect of program participation on enrollment at four-year colleges for the spring semester turns on the inclusion of high school fixed effects. Though these coefficients in columns 2 and 5 of Table 15 are similar (12.5% vs. 10.2%), the result in column 2 without high school fixed effects is significant at the 5% level whereas the result in column 5 with high school fixed effects is not even significant at the 10% level.

VI. Conclusion

The results of this randomized trial provide strong but not unqualified support for the efficacy of the College Possible program. We find significant evidence that the program promoted both applications and enrollment at both four-year colleges and selective four-year colleges, but little to no evidence of any effect of the program on ACT performance or enrollment overall.

The randomized trial results are reasonably close to the results of the regression discontinuity analysis of (non-experimental) historical data for initial enrollment in four-year colleges. Our analysis of the historical data, presented in Table 1, suggested that the program increased enrollment in four-year colleges by approximately 20 percentage points, whereas our analysis of experimental data, presented in Tables 11 and 12, suggests that the program increased enrollment in four-year colleges by approximately 15 percentage points. But, even taking as given the (non-significant) point estimate in Table 12 that program participation increased fall semester enrollment in any college by 7.2 percentage points, the effect of the program on college enrollment (at any college) is at most one-third the size of the magnitude of the point estimate from historical data. In general, however, the results of the trial do seem to suggest that the sample size was sufficient to detect the effects of the program on desired outcomes.

One surprising result in the trial is that the Treatment Group students achieved the ACT scores that College Possible expected, but even though these scores represent improvement from pretest results compiled by College Possible, they essentially match the ACT scores for students in the Control Group. This finding suggests that some Control Group students may have solicited and received help from other sources after learning that they were not admitted to the College Possible program. (It is also possible that another year of coursework in school contributed to increased ACT scores for students in both Treatment and Control Groups.) Thus, the randomized trial should probably be viewed as assessing the effectiveness of the College Possible program relative to the effectiveness of alternative programs that would be chosen by (some) students. This interpretation suggests a much higher threshold for the program to

produce statistically significant results than we might have anticipated in advance of the randomized trial.

Looking beyond the immediate results presented in this paper, the typical goal of college access programs like College Possible is to help students complete a BA degree and to do so as a steppingstone towards career success. In this context, initial college enrollment is simply an intermediate outcome, but also one that can dramatically alter the long-term path of individual students.

Previous descriptive studies by Bowen et al. (2009) and by Roderick et al. (2006, 2008, 2009) strongly suggest that a student's chances of college graduation substantially increase if that student enrolls at a selective four-year college instead of a less selective college or at any four-year college instead of a two-year college, but these studies do not attempt to demonstrate a causal link between college choice and college graduation. Two recent studies using regression discontinuity methods provide evidence of a positive link between college selectivity and future outcomes. Cohodes and Goodman (2013) find that students induced by a Massachusetts scholarship to attend an in-state four-year college are less likely to complete a BA degree than are students with similar but slightly lesser qualifications who did not qualify for the scholarship (and thus were more likely to attend a typically more selective out-of-state private college). On a similar note, Hoekstra (2009) finds that students who barely met the test score cutoff for admission to the flagship public university in one state had significantly higher long-run earnings than students who barely missed that cutoff for admission.

The results of the trial primarily indicate that the program induced Treatment Group students to shift enrollment from two-year colleges to four-year colleges and from both two-year colleges and non-selective four-year colleges to selective four-year colleges. Based on the findings of Cohodes and Goodman (2013) and Hoekstra (2009), we hypothesize that these differences in enrollment patterns will translate into long-run differences in educational attainment and in earnings between Treatment and Control Group students. Yet, since not all students who enroll at a four-year college go on to

graduate, we also should expect to see smaller differences in BA completion rates than in initial enrollment rates between Treatment and Control Groups. For example, Hurwitz et al. (2013) conclude that the choice by the state of Maine to make taking the SAT exam mandatory for all public high school students resulted in a significant increase in four-year college enrollment, but that this policy change had a smaller, not statistically significant effect on BA completion.

There is already some suggestion that the effects of the College Possible program are diminishing over time. The estimated effects of the program are smaller for the spring semester than for the fall semester of the first year after high school graduation; the effect of the program on second semester enrollment in four-year colleges is only on the borderline of statistical significance. We plan to continue tracking outcomes for the students in the treatment and control group for at least the next several years. It will be interesting to see if the outcomes for Treatment and Control Group students converge or continue to diverge in the future.

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