Working Paper

Evaluation of the College Bound Program: Early Findings

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Preface

College Bound (CB) is a college readiness program designed to increase the college graduation rates of low-income students, most of whom are first-generation college students. The CB program was started in 2006 and operates in and around St. Louis, Missouri. Starting at the 10th grade, it provides comprehensive support services to its participants who have been chosen through an admissions process. These services include academic enrichment, life-skill instruction, familiarization with college, financial literacy instruction, mentoring, and engagement with the family from 10th grade through college completion.

With funding provided by TG, a non-profit organization that promotes educational access and success, the CB program asked the RAND Corporation to conduct an evaluation of the program. The study has two goals: (1) to examine the relationship between students' participation in the program and their achievement and behavioral outcomes; and (2) to provide feedback on ways to improve the program as it develops. Using standardized test scores, course grades, and disciplinary, attendance, and demographic data provided by three school districts around St. Louis, this report presents outcomes for seven cohorts of CB participants.

The findings should be of interest to educators and policymakers who aim to improve the college participation and graduation rates of urban youths. This study was conducted by RAND Education, a unit of the RAND Corporation.

Abstract

There has been growing interest in out-of-school time programs as a means of increasing traditionally underrepresented youths' awareness of, access to, and graduation from college. This study examines the impact of one such intervention, the College Bound (CB) program, on students' behavioral, achievement, and postsecondary outcomes that should be of interest to practitioners, researchers and funders hoping to increase the rate at which low income students prepare, enroll and persist in postsecondary education. Using advanced statistical methods, we analyzed seven cohorts of CB participants. CB students were more likely to reach proficiency on the End of Course exams in English and biology, to obtain at least a B grade in a number of foundational college courses (e.g., biology, chemistry, geometry, and algebra 2), to take more AP or honors courses, to demonstrate fewer disciplinary problems, to attend school more frequently, and to score higher on the PLAN, a college readiness measure, than would have been the case had they not participated in the program. In addition, the percentage of CB participants enrolling in a college and attending a four-year postsecondary institution was significantly higher than the percentage estimated in the absence of program participation. We also examined full-time college enrollment and college persistence, which was defined as re-enrollment into a college for at least one additional term after their initial matriculation. While high rates were observed for CB students with respect to enrollment and persistence (i.e., 61 percent for full-time college enrollment and 93 percent for college persistence), these figures were not different from what might have been expected if the students had not participated in the CB program

The CB program was also found to implement many of the recommended practices within the literature including have a clear mission, providing a supportive emotional climate, assisting students with the college application process, and providing financial aid counseling. The program also retained well-credential coaches, all of whom hold at least a bachelor's degree, had a college-level grade-point average above 3.0, and demonstrated leadership in a service position.

There were three areas where the program could improve. First, the program may want to take steps to increase the interactions between CB participants and more permanent CB staff. Second, the CB program should examine students' performance on standardized state and district tests to assess their college readiness. Finally, the program should offer incentives to encourage students to participate in the voluntary program components, which may lead to even stronger benefits.

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Summary

Despite public investments aimed at improving educational opportunities for low-income students, not all income groups complete the same amount of schooling. Low-income students are less likely than more affluent students to pursue college degrees (Harvey & Anderson, 2005; Perna & Titus, 2005; Summers & Hrabowski III, 2006). Currently, 52 percent of students from low-income families enroll in a postsecondary institution in the fall immediately after high school graduation compared to 82 percent of students from high-income families (NCES, 2012). There are numerous benefits of a college education compared to a high school diploma, including higher earnings (Carnevale et al., 2011), greater civic engagement (U.S. Census Bureau, 2006), better health (MacInnis, 2006), and more satisfaction with life (Fischer & Hout, 2006).

College Bound Program Helps Students Go To College

Recognizing that a college education confers many advantages, the College Bound (CB) program provides a variety of free services to low-income, Hispanic, and African American students with the goal of increasing their interest in and readiness for college. The program began in 2006 and serves approximately 1,100 students and their parents in four partner high schools in and around St. Louis, Missouri. St. Louis was chosen, in part, because schools in this area serve a high proportion of low-income students who traditionally do not go on to college. The program starts with "Get Your Prep On" for students in the ninth grade. At the end of the year, they can apply to receive more intensive services in their sophomore year and through their college years. Those services are organized around three program components:

- **Making the Grade** is a comprehensive academic enrichment program that provides weekly tutoring sessions and summer workshops to mitigate summer learning loss.
- **Culture, Character, and Capacity** offers activities that are intended to promote character building, leadership, and citizenship.
- **Admission Accomplished** focuses on helping students with the college application process.

The program also includes:

- **Complete U**, which enrolls students in the second semester of their senior year in high school and helps them transition to and complete college.
- **Families as Partners**, which helps to build the capacity of families to support CB participants as they plan, prepare, pay for, and persist in college.

Is the Program Working? How Can It Be Improved?

At the request of the CB program, RAND conducted an evaluation of the program to determine if it is meeting its goals and to discover ways that it can be improved. Specifically, we addressed the following research questions:

1. Does the program have an effect on participating students' academic achievement, school attendance, behavior, and college enrollment and persistence?
2. Does the CB program operate and provide services that are consistent with best practices that have been identified in other successful programs? In what ways can the CB program be improved?

Our study used both quantitative and qualitative methods. We focused on the CB students who were selected to receive intensive services from their sophomore year in high school and beyond. We then obtained data from three school districts to find a group of comparison students who were similar in test performance and demographics to the CB students, but who did not participate in the program. Applying propensity weighting and generalized weighted regression methods to the data from this comparison group, we predicted the CB students' counterfactual outcomes, or the likely outcomes for the CB students if they had not enrolled in the program. While this analytic approach allows us to estimate program impact, it cannot account for unobserved student characteristics, such as differences relating to motivation, that could conceivably influence enrollment into a program. Additional studies, such as through the use of a randomized design, are needed in order to draw causal inferences.

We examined a number of outcomes, including scores on the states' End of Course exams in English and biology, scores on standardized college readiness measures (i.e., the ACT and PLAN tests), course grades in core subjects, number of Advanced Placement (AP) or honors courses taken, disciplinary problems, school attendance, enrollment in college, attendance at two-year versus four-year colleges, rates of full-time versus part-time enrollment in college, and college persistence, which was defined as re-enrollment into a college for at least one additional term after first starting.

We also conducted focus groups with 26 CB high school and college students and interviewed 29 CB staff to hear first-hand their ideas for improving the program and to gauge the program's alignment with recommended best practices. To identify best practices, we relied on two sources: (1) an Institute of Education Science's practice guide that recommends strategies that high schools can engage in to help increase students' access to higher education (Tierney, Bailey, Constantine, Finkelstein, & Hurd, 2009); and (2) Bodilly's and Beckett's (2005) review of the factors in out-of-school-time programs that help to deliver services to students effectively.

CB Students Improved Their Grades and Test Scores

CB program participants showed improvements in several areas over what would have been expected if they had not participated in the program. They were more likely to meet proficiency

targets on the End of Course exams in English and biology (see Figure A), to obtain at least a B grade in a number of high school courses considered foundational for college (see Figure B), to take more AP or honors courses, to demonstrate fewer disciplinary problems, to attend school more frequently, and to score higher on the PLAN. The course grade results based on the CB and non-CB participants should be interpreted cautiously because we could not standardize the grades to account for variation in stringency of teachers' grading practices.

Figure A

Percentages of CB Participants who Obtained Proficiency on the End of Course Tests in Comparison to their Estimated Counterfactual (CF) Percentages

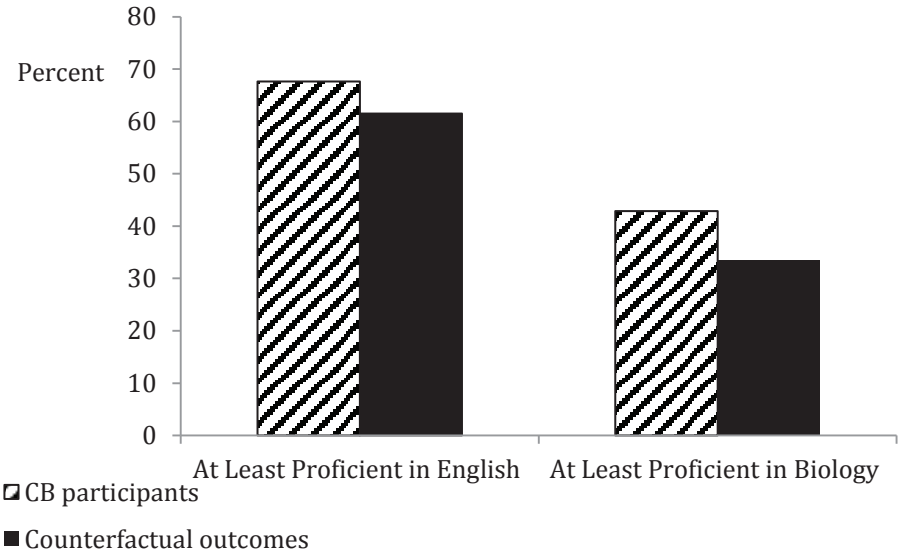
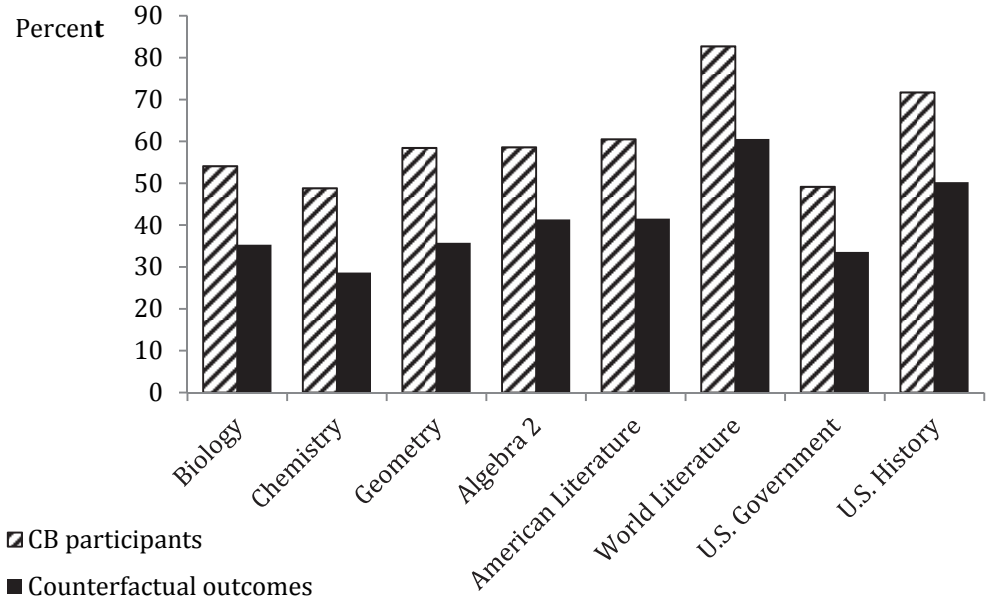


Figure B

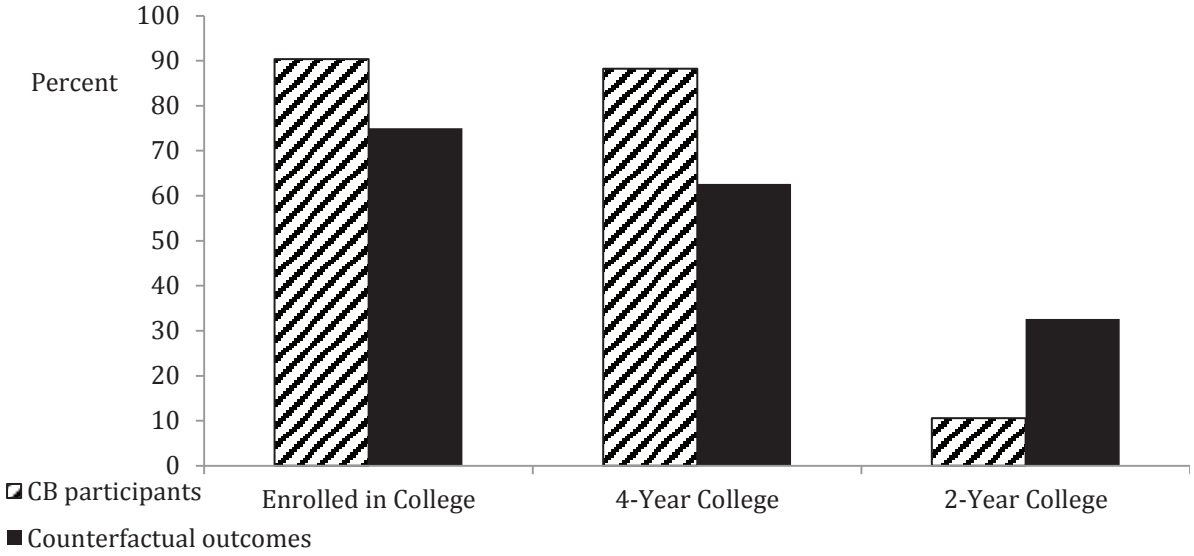
Percentages of CB Participants who Obtained at Least a B Grade or Better in Comparison to their Estimated Counterfactual (CF) Percentages



In addition, CB students were more likely to attend college than would have been predicted had they not participated in the program. Furthermore, when CB students attended college, they were more likely to attend a four-year college than a two-year college (see Figure C). Also, 61 percent of CB students enrolled in college full time rather than part time, and 93 percent of students re-enrolled after their first term. The full time and persistence percentages are high, but at the time the study ended, there were no observable differences between CB participants and what might have been expected if the students had not participated in the CB program. The lack of statistical significance may have stemmed from the smaller sample sizes for these two outcomes, which may not have afforded sufficient statistical power to detect differences.

Figure C

Percentages of CB Participants within Each Postsecondary Category in Comparison to their Estimated Counterfactual (CF) Percentages



Note. The enrollment rates for 4-year and 2-year colleges are among college attendees.

The results also point to the importance of program exposure or dosage. When we limited the analysis to higher-participating CB students, the results were similar to those reported above, such that the significant relationships observed in the CB population were replicated for the sample of higher-participating students. In addition, we observed two additional significant relationships that were not previously observed for the overall CB population. Namely, with respect to ACT scores and timely completion of the required college-preparatory courses in social studies, program effects were stronger for students who participated in CB more often. This is consistent with previous research that found the extent to which participation influences students' outcomes depends upon the depth and breadth of participation in the program (Vandell, Reisner, & Pierce, 2007; Zief, Lauver, & Maynard, 2006).

The CB Program Compares Favorably with Recommended Best Practices

In many ways, the CB program implements many practices that are believed to lead to successful student outcomes. It has a clear mission and supportive emotional climate. It ensures that students know what courses they need to take for college admission, provides students with peer and adult mentors to support their college aspirations, assists them with their college applications, and counsels them about obtaining financial aid. It also retains well-credential coaches, all of whom hold at least a bachelor's degree, have a college-level grade-point average above 3.0, and have demonstrated leadership in a service position.

Looking Ahead

RAND's evaluation identified three opportunities for the CB program to improve. In addition to fostering relationships between CB students and the coaches, who have a one-to-three year tenure with the program, the CB program may want to take steps to increase the interactions between CB participants and more permanent CB staff. This will help to ease transitions when coaches end their tenure with the program. Furthermore, the CB program should examine not only students' course grades, but also their scores on standardized state and district tests to assess their college readiness. Finally, the program should offer incentives to encourage students to participate in the voluntary program components, which may lead to even stronger benefits.

Although the study results indicate that the CB program is on-track to meet its ultimate goal of improving the college graduation rates of participants, we did not have the requisite data to examine whether the program is actually improving the college performance of CB students. Future studies that examine important college-level outcomes such as selectivity of the college entered, number of remedial courses taken at college, college major, college GPA, and college graduation rates would provide further information about the CB program's impact on its participants.

It is also important to recognize that because the program did not employ a randomized design to select participants, it remains possible that the results are partially attributable to the pre-existing differences that we observed between the CB participants and the comparison group, and which we could not fully disentangle from program effects. Although we used advanced statistical techniques to adjust for these pre-existing differences, such methods cannot fully account for other unobserved differences. In the future, as the CB program continues to attract attention and receive more applications from qualified applicants than it can feasibly support, it may be possible to select students from a random lottery system. This will help facilitate an experimental design that allows for better estimates of program effectiveness.

Acknowledgements

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Abbreviations

AP	Advanced Placement
CB	College Bound
EOC	End of Course
IES	Institute of Education Sciences
GPA	Grade point average
MRH	Maplewood Richmond Heights, Missouri Public School District
NSC	National Student Clearinghouse
STL	St. Louis, Missouri Public School District
UCITY	University City, Missouri Public School District

1. The College Bound Program

Despite public investments aimed at improving educational opportunities for at-risk students, inequality in educational attainment by income continues to persist (Harvey & Anderson, 2005; Perna & Titus, 2005; Summers & Hrabowski III, 2006). High-income high school graduates enroll in college at a rate that is 25 percentage points higher than those from low-income backgrounds (Pathways to College Network, 2004). According to recent reports (Bowen, Chingos, & McPherson, 2009; Ryu, 2010), the low-income postsecondary attainment gap has not gotten smaller over time. Although there has been a 20 percent increase in the number of students who immediately enroll in college between 1972 and 2007, the gaps between lower-income and higher-income students have remained the same over this time period (National Center for Education Statistics (NCES), 2009). Currently, 52 percent of students from low-income families enroll in a postsecondary institution in the fall immediately after high school graduation compared to 82 percent of students from high-income families (NCES, 2012).

Because of lower postsecondary participation, low-income groups remain underrepresented across many professions, particularly those requiring postsecondary degrees for job placement and security (Grumbach & Mendoza, 2008). Unemployment rates are significantly higher among high school graduates (9.4 percent) compared to those who have at least a bachelor's degree (6.3 percent) (Carnevale, Jayasundera, & Chea, 2011). Furthermore, studies have consistently found that college graduates earn significantly more over their lifetime than high school graduates (Day & Newburger, 2002; Kane & Rouse, 1995; Miller, Mulvey, & Martin, 1995). Carnevale, Rose, & Cheah (2011) found that on average, college graduates with a bachelors degree earn $2.3 million over their lifetime compared to $1.3 million for those with a high school degree. In a summary of the literature on the relationship between postsecondary education and earnings, Card (1999) found that typical estimates of a single additional year of education on hourly earnings can range from 5 to 11 percent.

Holding a college degree has also been associated with a host of social benefits as well. College graduates are more likely to engage in more hobbies and leisure activities (Institute of Higher Education Policy, 1998), are more likely to vote (U.S. Census Bureau, 2006b), and are more likely to have better health, including lower rates of mortality and obesity than high school graduates with no college degree (Cohn & Geske, 1992; MacInnis, 2006). College graduates also report higher levels of satisfaction and happiness with their lives than do non-college graduates (Baum et al. 2010; Fischer & Hout, 2006; Kingston et al., 2003). It is important to recognize that that while a college degree has found to be associated with a number of social benefits, a college degree is not necessarily the causal factor for these observed advantages.

There are a number of barriers to college participation, especially for low-income or first-generation college students. These factors include an inadequate high-school course-taking

program that does not prepare students academically for college (Adelman, 1999; 2006), a lack of monetary resources and of knowledge about financial aid (Choy, 2001; Heyman, 2003), and lower aspirations to go to college, relative to their higher-income peers (Higher Education Research Institute, 2007). To remove the barriers to college participation and set students on college-bound trajectories, there has been a proliferation of college readiness programs across the nation (Gullat & Jan, 2003; Perna & Swail, 2001). One promising intervention is College Bound (CB), which aims to increase traditionally-underrepresented students' interest in and preparation for college through provisions of a variety of services. Started in 2006, the CB program serves students around the St. Louis, MO area. This city was chosen, in part, because schools in this area serve a high proportion of low-income students who traditionally do not go on to college.

Operating on an annual budget of approximately $1.1 million, the program implements several components designed to provide students with the academic enrichment, social supports, and life skills needed to succeed in college and careers.[1] Starting at ninth grade, the CB program implements "Get Your Prep On," which provides college awareness counseling to approximately 1,100 students and their parents in four partner high schools. Get Your Prep On provides information about how to plan, prepare for, and pursue a college education. During the spring of their freshman year, students can apply to receive more intensive services, where CB continues to provide support for up to nine years, from their induction in the summer before tenth grade through completion of their college degree. These services are cost-free to the students. Accepted students take part in three concurrent programs during their high school years: "Making the Grade," "Culture, Character, and Capacity," and "Admission Accomplished." Making the Grade is a comprehensive academic enrichment program that provides weekly tutoring sessions, summer workshops to mitigate summer learning loss, and counseling on course selection to promote participation in a college preparatory curriculum. Culture, Character, and Capacity is intended to promote character building, leadership, and citizenship through activities such as community service, workshops with community partners, and cultural events. Admission Accomplished focuses on helping students with the college application process, and includes activities such as ACT preparation, college visits, workshops on financial aid, personalized college guidance, and on-going mentorship. In the second semester of their senior year and beyond, students are enrolled in "Complete U," which aims to help students transition to and complete college. Complete U includes provisions for individualized financial aid advising, weekly interactions with a coach, and assistance with college course selection and utilization of on-campus services. Throughout high school and college, families of CB students are also served through the Families as Partners component,

[1] The program's annual operating budget has grown steadily from approximately $350,000 in 2007 to $1.5 million in 2010. To calculate the annual operating budget, we averaged the program's expenses, including those related to employee salaries and benefits, from 2007 through 2010.

which helps to build the capacity of families to support their student's planning and preparation for higher education and persistence after matriculation. The program provides whole group workshops, individualized meetings, mailings, phone calls and home visits to meet the needs of the participants' families.

Students who can demonstrate financial need in their freshman year of high school are eligible to apply to receive continuing support at the end of their freshman year and beyond. The admission process requires an application, recent transcript, several essays, and an interview. Priority in admission is given to first-generation college students, students whose parents went to college later in life, and students who have special life circumstances. Although there are no formal grade point average (GPA) requirements to be accepted in the program, accepted students typically have a GPA of at least 2.0. Attrition from the program is low, with approximately 13 percent of students not returning during the high school years. The majority of departures are due to relocation away from the St. Louis, MO area as opposed to students dropping out of the program.

Early analysis of the CB program suggested positive impacts on participants, but an external evaluator had yet to conduct a quantitative evaluation of the program. The purpose of this report is to provide an evaluation of the CB program and help it improve its functioning by addressing the following research questions:

1. What are the relationships between program participation and students' academic achievement, school attendance, disciplinary behavior, and college enrollment and persistence?
2. In what ways does the CB program operate and provide services that are consistent with best practices within the literature? In what ways can the CB program be improved?

This remainder of this report is organized as follows. The next section focuses on the results of the quantitative analysis, and examines the effects of the program on participants' outcomes. The third section describes the qualitative analysis, focusing on the extent that the CB program follows best practices for increasing access to higher education. The final section recaps the results of our qualitative and quantitative analysis, and provides recommendations on how to improve the program.

2. Relationships between CB Program Participation and Participants' Outcomes

In this section, we provide a description of the methodology used to examine the relationships between program participation and student outcomes. We begin with a description of the selected cohorts that are the focus of our analysis. We then describe the data received from each district. This is followed by a description of the analytic approach, particularly the methods used to identify the comparison peers and to address missing data. We then present the results of our analysis, and conclude this section with policy implications derived from the findings.

Sample

Although CB provides school-wide support to ninth-grade students, we focused on the subset of students who received intensive and sustained CB support after their freshman year. Some of these students were recruited from community-based programs, but the majority was recruited from three public school districts around the St. Louis, MO area: Maplewood Richmond Heights (MRH), University City (UCITY), and St. Louis (STL). MRH serves a diverse student population, in which 50 percent of the student population are black and 43 percent of the students are eligible for free- or reduced-price lunches. In UCITY and STL, most of their student population are black (89 and 80 percent, respectively), and the majority are eligible for free- or reduced-price lunches (53 and 77 percent, respectively). Both UCITY and STL are considered under-performing districts according to their No Child Left Behind Annual Yearly Progress classifications, and STL is no longer an accredited district.

Our sample included all participating CB students since the inception of the program. This resulted in analysis of seven CB cohorts, representing graduates from the high school class from 2007-08 through future graduates from the high school class of 2013-14. Excluding students from community-based programs for whom we could not obtain data, our analytic sample consisted of 384 CB participants, which constituted 94 percent of the total CB population. Approximately 65 percent of the CB sample were female, 90 percent were black, 7 percent were white, and 3 percent were another race. In addition, 69 percent were eligible for free- or reduced-price lunches, 2 percent were limited English proficient, and 3 percent were identified with a learning disability. STL students comprised 51 percent of the CB sample, UCITY comprised 37 percent, and MRH comprised the remaining 12 percent.

Data Collection

District Data

For the academic years from 2007-08 through 2010-11, the districts provided extensive student-level information, including demographic data (i.e., race, gender/ethnicity, disability status, limited English proficiency status, and eligibility for free- or reduced-price lunch), course grades in core subject areas, attendance data, and disciplinary data. In UCITY, we did not obtain disciplinary data at the eighth grade, and disciplinary data at the ninth grade was available only after the 2009-10 graduating cohort.

Districts also provided scores on the Missouri Assessment Program (MAP) test, a standards-based assessment that measures specific skills defined for each grade by the state of Missouri. To obtain a baseline measure of students' academic performance prior to their entry to the CB program, we obtained MAP scores when students were in the eighth grade. For communication arts and mathematics, we obtained MAP test scores for all cohorts. For science, we obtained MAP test scores for cohorts who graduated in the 2011-12 academic year and later. Prior to this cohort, the MAP science test was not administered at the eighth grade. Students' performance on the MAP exams was reported both as scale scores and as proficiency categories.

In addition to the MAP assessments, Missouri requires that students take several End-of-Course (EOC) exams in core subjects. We focused on the subjects of Algebra, Biology, and English II because these EOC exams were administered in every cohort. Although the grade at which students take the exams varies by students' own personal course-taking schedules, most students take the Algebra exam in ninth grade, and the English II and Biology exams in tenth grade. Like the MAP tests, EOC exams are reported in terms of both scale scores and achievement levels, corresponding to Below Basic, Basic, Proficient, or Advanced.

At tenth grade, each district also administered the PLAN test, which is designed to provide information about students' readiness for college. The PLAN test is a series of tests in English, reading, mathematics, and science, and serves as a predictor to the ACT college entrance test. We also obtained students' scores on the ACT, which assess the same subjects as the PLAN, and are used by many colleges to inform their college admissions decision. We obtained total composite scores for PLAN and ACT.

National Student Clearinghouse Data

Districts also provided postsecondary enrollment data from the National Student Clearinghouse (NSC). More than 3,300 postsecondary institutions provide data to the NSC, resulting in coverage of 93 percent of student enrollments (NSC, 2011). In all three districts, we obtained information about whether students were enrolled in college within six months of their graduation date, and if so, whether the college was a 2- or 4-year institution. For the MRH and STL districts, we also received data on whether students were enrolled in college on a full- or

part-time basis, and whether students re-enrolled in college for at least one additional term after their initial postsecondary matriculation. This definition of persistence allowed us to capture students who transferred between colleges, as well as students who returned to college after taking time off.

CB Program Attendance Data

Although the CB program requires mandatory participation in weekly classes in college knowledge and service learning, job shadowing, summer institutes and ACT preparation, other events are voluntary. The voluntary events provide students with an opportunity to engage in community service, college visits, tutoring, math and reading clubs, cultural activities, and career exploration. These opportunities are recommended and strongly encouraged but students are not removed from the program if they do not participate. Starting with the graduating cohort of 2009-10, the CB program collected data about the total number of events attended within each category since the student's induction into the program. We used this attendance data as a measure of program exposure or dosage.

Analytic Approach

Outcomes Examined

We examined a number of outcomes at the secondary level, including scores on the schools' End of Course exams in English and biology,[2] scores on standardized college readiness measures (i.e., the ACT and PLAN tests), course grades in core subjects, number of Advanced Placement (AP) or honors courses taken, disciplinary problems, and school attendance. We examined five postsecondary outcomes: the percent of students enrolled in any type of college, in a 2-year college, in a 4-year college, the percent enrolled in college full-time, and the percent who re-enrolled in college for at least one additional term after their initial matriculation into a postsecondary institution (i.e., college persistence).

For the EOC exams, we examined the scale scores and the percent of students who met the standard of proficient or higher. We adopted a similar approach for PLAN and ACT, where we examined the composite scores and the percent of students who scored at least at the national average, which was 17.5 for PLAN and 21 for ACT (ACT, 2012; West Virginia Department of Education, 2006). For the course grades, we examined the proportion of students who received a B grade or higher in core subject areas. We chose this standard because it is consistent with the GPA requirements of many selective college scholarship programs. For example, the New Haven Promise, which provides significant financial assistance for New Haven, CT students to

[2] We did not examine EOC scores in Algebra because the majority of students took this test at the 9th grade. Thus, it is not considered an outcome measure, but is instead a baseline measure, taken prior to students entering the CB program.

attend an in-state college, requires a minimum GPA of 3.0 to be eligible to apply for the program. Likewise, Georgia's HOPE Scholarship, which provides money to assist students with their educational costs of attending a HOPE-eligible college in Georgia, also has a 3.0 GPA eligibility requirement. The 3.0 GPA requirement has also been adopted by Tennessee's HOPE Scholarship, West Virginia's Promise Scholarship, Idaho's Promise Scholarship, as well as numerous other local and state scholarship programs.[3] In our analysis, we could not standardize the course grades to account for variation in stringency of teachers' grading practices, so the results of our course grade analysis should be interpreted carefully.

In addition to examining the proportion of students who received at least a B grade in core courses, we examined whether students were on-track for engaging in a college preparatory curriculum. A college preparatory curriculum consists of four courses in English, and three courses each in mathematics, science, and social studies upon high school graduation (American Diploma Project, 2004). We considered students to be on-track if their course-taking pattern would allow them to finish the recommended coursework by their senior year. For example, students who had taken three English courses and two courses each in mathematics, science, and social studies by their junior year were considered on track. Likewise, students who had taken two courses in English and one course each in mathematics, science, and social studies by their sophomore year were considered on track. Because some policymakers contend that course type is more important for college readiness than course quantity (Allensworth, Nomi, Montgomery, & Lee, 2009; Lee, 2002), we also examined the number of Advanced Placement (AP) and honors courses.

Estimating the Counterfactual

We adopted the approach of estimating counterfactual outcomes to estimate program impact. The counterfactual outcome answers the question of "What would have happened to the CB participants had they not enrolled in the program." The difference in the CB participants' true outcomes and their counterfactual outcomes is the causal effect of the program. Because counterfactual outcomes cannot be directly observed, they must be estimated. In observational studies such as this one, the best basis for estimating the counterfactual is a group of comparison

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[3] New Haven Promise: http://schoolpromise.webship.com/new-haven-promise/scholarship/guidelines-and-details/
Georgia Hope Scholarship: https://secure.gacollege411.org/financial_aid_planning/hope_program/georgia_s_hope_scholarship_program_overview.aspx
Tennessee Hope Scholarship: http://www.tn.gov/collegepays/mon_college/hope_scholar.htm
West Virginia Promise Scholarship: http://secure.cfwv.com/Financial_Aid_Planning/Scholarships/Promise/Eligibility_Requirements.aspx
Idaho Promise Scholarship: http://www.isu.edu/scholar/idaprom.shtml

students who were not exposed to the program, but were plausibly similar to the CB participants in terms of demographics and achievement prior to program admission. Because the manner in which students were admitted to the CB program did not allow us to assume that the comparison group was similar to the CB participants in all aspects except for program participation, we could not directly compare the outcomes of the two groups. Therefore, we used the comparison groups' baseline and outcome data to estimate the counterfactual outcomes. Comparison students were included in the analysis if they were present in the district at the eighth or ninth grade and had observable achievement or disciplinary outcomes at tenth grade and beyond. This approach of estimating the counterfactual outcomes is similar to that used in Brand, Pfeffer, & Goldrick-Rab's (2012) study, who examined the effects of two-year community college enrollment on students' attainment of a bachelor's degree.

We used a three-step process to estimate counterfactual outcomes. In the first step, we built a generalized boosted regression model (GBM) to estimate the propensity of each student to be a CB participant (McCaffrey, Ridgeway, & Morral, 2004; Harder, Stuart, and Anthony, 2010; Lee, Lessler, and Stuart, 2010). The GBM model is then used to weight the comparison students to resemble the CB participants. Each comparison student is assigned a weight equal to the log odds of their propensity score such that

$$w_i = Log\,[P(T_i = 1|\boldsymbol{X_i}) / (1 - P(T_i = 1|\boldsymbol{X_i}))] \quad (1)$$

where w_i represents the propensity weight, $T_i = 1$ indicates that student i is a CB participant, and $\boldsymbol{X_i}$ represents the vector of available covariates including student demographics and student outcomes measured at baseline prior to program entry (i.e., EOC Algebra proficiency level at ninth grade, MAP scores at eighth grade, attendance and disciplinary outcomes at both the eighth and ninth grades, and high school graduating class). CB participants retained a weight of $w_i = 1$.

Weighting the treatment and control groups in this way establishes a control group for evaluating the treatment effect on the treated students (McCaffrey, Ridgeway, & Morral, 2004). Non-participants with higher propensity scores received higher weights, so that the features of the weighted control group were balanced with the CB participants on each of the covariates to the extent possible. To examine the balance of the covariates between CB participants and non-participants, we conducted several statistical tests. For covariates measured in a categorical manner, we examined weighted chi-squared tests of independence between the covariate and CB participation status. For covariates measured on a continuous metric, we examined weighted two-sample t-tests of the difference between the CB covariate mean and the weighted mean of non-participants, and computed Kolmogorov-Smirnov (K-S) statistics. The K-S statistic is a non-parametric statistical measure of the extent to which the two distributions of the CB participants and non-participants overlap. The larger the K-S statistic, the less the distributions overlap.

In the second and third steps, we used the weights w_i in a weighted generalized linear regression model to predict the outcomes of CB participants had they not been participants, thus producing the counterfactual outcome estimates. Because of variations in the grade level at

which an outcome could be observed (e.g., EOC Biology could be taken at any grade in high school), our model restricted the analysis to students whose outcomes were observed after their freshman year, and controlled for the grade level at which the outcome was observed. The form of the regression model depended on the nature of the outcome variable. When the outcome variable was measured on a continuous metric, we used a regression model of the form:

$$Y_i = \mu + \alpha T_i + \beta X_i + \varepsilon_i \quad with \quad \varepsilon_i \sim N(0, \sigma^2) \tag{2}$$

where the observations are weighted as described above. When the outcome was measured on a dichotomous metric, we fit the analogous weighted logistic regression model of the form:

$$\text{Logit}(\ P(Y_i = 1 | T_i, X_i)\ ) = \mu + \alpha T_i + \beta X_i + \varepsilon_i \tag{3}$$

For a continuous outcome, the coefficient of the participation indicator, α, is an estimate of the impact of the program on that outcome (i.e., $Y_i - \alpha$ is an estimate of the counterfactual outcome of each participant). In the case of the logistic regression, there is no direct link from the model coefficients to a CB participant's estimated counterfactual outcome and estimated program impact. Instead, we set the participation indicator variable of all the CB participants to $T_i = 0$ and then predicted their counterfactual outcomes from the model (i.e., we pretended that the CB participants were actually non-participants and predicted their individual outcomes from the model, $P(Y_i = 1 | T_i = 0, X_i)$, with their covariate values unchanged). We then averaged these predictions to obtain an estimate of the mean counterfactual outcome among those treated. Subtracting this estimated mean counterfactual from the mean of the observed outcomes of the participants yields an estimate of the impact of the program on that outcome.

It is important to note that our approach of including the baseline covariates in both the propensity weighting models and the weighted generalized regression models is known as conducting doubly robust models (Bang & Robbins, 2005). Doubly robust models produce a consistent estimate of the treatment effect if either the propensity or regression model is properly specified, thus minimizing the potential for mis-specification. While this analytic approach allows us to estimate program impact, it cannot account for unobserved student characteristics, such as differences relating to motivation, that could conceivably influence enrollment into a program. Additional studies, such as through the use of a randomized design, are needed in order to draw causal inferences.

Addressing Missing Data on the Baseline Covariates

A potential challenge in our analysis was dealing with missing data on the baseline covariates. (The percent of missing observations on each covariate is provided in Appendix A). We addressed missing in two ways. For the MAP scores and attendance data, we implemented a multiple imputation technique in which each missing value was replaced with a random sample of plausible values. We used a multivariate normal model as a basis to impute 10 sets of plausible values, with the stipulation that the distributions of the imputed variables remain similar to the observed data (Schafer, 1997). We then included indicator variables in our model

denoting whether the observations were imputed. Outcome model results were aggregated across these multiply imputed datasets using standard procedures (Schafer & Graham, 2002).

For the EOC Algebra and disciplinary variables, we used a nominal variable approach where we treated missing as another category. In the case of EOC Algebra, approximately one-quarter of the observations were observed after the baseline year. To capture important information about the timing of when EOC Algebra was taken, our model included variables denoting whether students were missing an EOC Algebra score, the grade level at which they took the exam (if not missing), whether the EOC Algebra exam was taken after ninth grade, the observed proficiency level, and whether the proficiency level was missing.

For the disciplinary variables, to account for structural missing within the UCITY district, we examined the distribution, then divided the disciplinary variables into four categories. For the number of disciplinary indices, we created categories denoting missing, zero incidences, one incidence, and two or more incidences. For the number of days suspended, we created categories denoting missing, zero days suspended, one to three days suspended, and four or more days suspended.

Operationalizing Exposure to CB Services

Conceivably, students who engage in more CB-sponsored events have more opportunities to learn and grow from the program. To account for the fact that older cohorts can be expected to participate in more CB-sponsored events than younger cohorts, we standardized the CB attendance variable by computing the median number of events attended by each graduating cohort, and identified students within each cohort who were above average with respect to attendance for their cohort. We then conducted additional sensitivity analysis to determine whether stronger program effects could be observed with these higher-participating students.

Accounting for Multiple Statistical Tests

Statistical significance was assessed by adjusting our statistical tests using a false discovery rate procedure (Benjamini & Hochberg, 1995). A false discovery rate (FDR) is the expected proportion of rejected null hypothesis tests that are truly null (i.e., the expected proportion of statistical tests that report significant relationships when no relationships actually exist). Adopting an FDR of 5% led to rejecting the null hypothesis of zero effects when p-values were less than 0.030. In other words, 0.030 was the smallest p-value that was not rejected under a FDR of 5%. This standard was applied to all of the regression results presented in the next section.

Results

Comparability between the CB Students and the Comparison Group

It is important to examine the covariate balance in our study because the extent to which the covariates are well balanced improves our prediction of estimated counterfactual outcomes. By "well balanced" we mean that the full distribution of each covariate coincides as closely as possible between CB participants and comparison students. Well-balanced covariates were those with small K-S statistics and no mean differences between the weighted comparison students and the CB participants. Although our propensity weighting approach resulted in vastly improved balance on the available baseline covariates, there remained statistically significant differences between CB participants and the comparison students on some of the achievement and disciplinary variables at baseline (see Appendix B for details). For example, although the MAP science scores were well-balanced between CB participants and comparison students, we could not achieve optimal balance on the MAP scores in communications arts and mathematics. However, it is important to note that this residual post-weighting imbalance is mitigated by the inclusion of these baseline covariates in our weighted generalized regression modeling (i.e., we conducted doubly robust models).

Standardized Achievement Measures

Tables 3.1 and 3.2 present the results of the analysis for the EOC exams and college readiness measures. There was a positive association between CB program participation and performance on the EOC English and Biology exams, where CB participants not only had higher scale scores, but also reached the proficient categories at significantly higher percentages than those estimated for their counterfactual outcomes. There were no differences with respect to ACT performance, but CB participants demonstrated higher PLAN composite scores than those predicted absent their program participation. However, the percent of CB participants who exceeded the national average on the PLAN was comparable to the estimated percentages for their counterfactual outcomes.

Table 3.1

Mean Scale or Composite Scores of CB Participants (CB) in Comparison to their Estimated Counterfactual (CF) on the EOC Exams and College Readiness Measures

Outcome	CB N	CB Mean	Weighted CF N	Weighted CF Mean	Std. Error Difference
EOC English	247	207.17 **	1194.3	204.99 **	0.83
EOC Biology	196	197.21 **	1656.7	192.95 **	1.05
ACT	255	19.11	839.89	18.70	0.21
PLAN	275	15.78 *	1168.74	15.51 *	0.12

Notes.

N refers to the observed sample size for CB students and the effective sample size for CF outcomes.

Std. Error refers to the standard error of the difference between the mean CB participant outcome and the estimated mean counterfactual outcome.

* indicates significant at the .03 level.

** indicates significant at the .01 level.

Table 3.2

Percentages of CB Participants within Each Proficiency Category in Comparison to their Estimated Counterfactual (CF) Percentages

Outcome	CB N	CB (%)	Weighted CF N	Weighted CF (%)	Std. Error Difference
At least proficient on EOC English	247	67.61 **	1343.46	61.53 **	2.28
At least proficient on EOC Biology	196	42.86 **	1684.65	33.47 **	3.60
At least national average on ACT	255	31.76	788.87	26.86	3.01
At least national average on PLAN	275	16.73	1255.20	14.42	2.23

Notes.

N refers to the observed sample size for CB students and the effective sample size for CF outcomes.

Std. Error refers to the standard error of the difference between the observed proportion of CB participant outcomes and the estimated proportion of counterfactual outcomes falling in the stated outcome category.

* indicates significant at the .03 level.

** indicates significant at the .01 level.

Course Grades

Table 3.3 provides the results of the course grade analysis. To ensure a sufficient sample size, we limited the results to courses where there were at least 50 CB participants enrolled. There were strong relationships between program participation and course grades, such that participation in the CB program was associated with statistically significant advantages of

approximately 19 to 22 percentage points in English, 17 to 23 percentage points in mathematics, 19 to 20 percentage points in science, and 16 to 21 percentage points in social studies. We observed significant relationships in general requirement courses, such as U.S. history and American literature, as well as in more advanced courses, such as algebra 2 and chemistry.

Table 3.3

Percentages of CB Participants Attaining at Least a B Grade or Better in Core Courses in Comparison to their Estimated Counterfactual (CF) Percentages

Outcome	CB N	CB (%)	Weighted CF N	Weighted CF (%)	Std. Error Difference
English					
AP Language and Composition	61	55.74	90.73	47.47	8.54
AP Literature and Composition	58	44.83	61.39	54.05	11.49
American Literature and Composition	119	60.50 **	499.39	41.55 **	5.64
World Literature	110	82.73 **	716.88	60.58 **	4.31
Mathematics					
Algebra 2	157	58.60 **	508.49	41.37 **	4.65
Algebra 2/Trigonometry	80	42.50	106.95	29.53	6.45
Geometry	166	58.43 **	1068.29	35.78 **	3.83
Science					
Anatomy	78	64.10 **	164.41	44.27 **	8.29
Biology	183	54.10 **	1764.86	35.31 **	3.87
Chemistry	170	48.82 **	799.63	28.67 **	3.93
Physics	119	48.74	120.12	41.76	7.77
Social Studies					
U.S. Government	116	49.14 **	495.21	33.60 **	4.77
U.S. History	106	71.70 **	650.53	50.25 **	5.13

Notes.
N refers to the observed sample size for CB students and the effective sample size for CF outcomes.
Std. Error refers to the standard error of the difference between the observed proportion of CB participant outcomes and the estimated proportion of counterfactual outcomes falling in the stated outcome category.
* indicates significant at the .03 level.
** indicates significant at the .01 level.

Fewer statistically significant results were observed when considering the percentage of students who were on-track for a college preparatory curriculum (see Table 3.4). Across all subjects, upwards of 90 percent of CB participants were on-track for taking a college preparatory curriculum, with the only significant relationship to CB participation occurring in English. The

proportion of CB students who were on-track for English was 11 percentage points higher than expected in the absence of program participation.

With respect to the number of AP or honors courses taken, we also observed a difference in favor of CB participation. CB students took an average of 3.28 AP or honors courses compared to an estimated average of 2.78 courses had they not participated in the CB ($p < 0.01$). Due to small sample sizes, we could not examine the performances of CB students in many AP or honors courses, although the two AP courses that we did examine (i.e., AP language and composition and AP literature and composition) suggested no differences in the performance of the CB participants relative to their predicted counterfactual outcomes (see Table 3.3).

Table 3.4

Percentages of CB Participants Who Were On-Track for a College Preparatory Curriculum in Comparison to their Estimated Counterfactual (CF) Percentages

Outcome	CB N	CB (%)	Weighted CF N	Weighted CF (%)	Std. Error Difference
English	95	90.53 *	265.49	79.36 *	4.47
Mathematics	123	92.68	399.20	89.18	2.47
Science	123	93.50	391.84	93.49	2.45
Social Studies	123	92.68	377.06	92.09	2.17

Notes.
N refers to the observed sample size for CB students and the effective sample size for CF outcomes.
Std. Error refers to the standard error of the difference between the observed proportion of CB participant outcomes and the estimated proportion of counterfactual outcomes falling in the stated outcome category.
* indicates significant at the .03 level.
** indicates significant at the .01 level.

Postsecondary Outcomes

As shown in Table 3.5, among postsecondary students, the percentage of CB participants who enrolled in a college (90 percent) was significantly higher than estimated absent CB participation (75 percent). Furthermore, unlike that predicted for their counterfactual outcomes, when CB participants enrolled in college, they were significantly more likely to enroll in a 4-year college than in a 2-year college. We also examined full-time college enrollment and college persistence. While high rates were observed for CB students with respect to enrollment and persistence (i.e., 61 percent for full-time college enrollment and 93 percent for college persistence), there were no differences in these outcomes relative to their estimated counterfactual percentages at the time the study ended.

Table 3.5

Percentages of CB Participants within Each Postsecondary Category in Comparison to their Estimated Counterfactual (CF) Percentages

Outcome	CB N	CB (%)	Weighted CF N	Weighted CF (%)	Std. Error Difference
Enrolled in any college	198	90.40 **	402.70	75.00 **	3.02
Enrolled in a 2-year college	179	10.61 **	295.01	32.59 **	4.60
Enrolled in a 4-year college	179	88.27 **	245.46	62.67 **	5.28
Enrolled in college full time	113	61.06	136.92	49.87	8.59
Persisted in college	113	92.92	132.90	86.82	4.87

Notes.
N refers to the observed sample size for CB students and the effective sample size for CF outcomes.
Std. Error refers to the standard error of the difference between the observed proportion of CB participant outcomes and the estimated proportion of counterfactual outcomes falling in the stated outcome category.
* indicates significant at the .03 level.
** indicates significant at the .01 level.

Attendance and Disciplinary Outcomes

The attendance rates for the CB participants and their estimated attendance rates absent CB participation were very high from grades 10 through 12, with average observed rates of at least 91 percent (see Table 3.6). Across the three grade levels, CB participation is associated with nearly a two percentage point increase in average attendance.

Table 3.6

Mean Attendance Rates of CB Participants (CB) in Comparison to the Estimated Attendance Rates for their Counterfactual (CF)

Outcome	CB N	CB Mean	Weighted CF N	Weighted CF Mean	Std. Error Difference
Grade 10 attendance	283	93.92 **	1648.91	92.03 **	0.36
Grade 11 attendance	223	94.40 **	716.32	92.48 **	0.70
Grade 12 attendance	196	93.13 **	351.12	91.32 **	0.62

Notes.
N refers to the observed sample size for CB students and the effective sample size for CF outcomes.
Std. Error refers to the standard error of the difference between the mean CB participant outcome and the estimated mean counterfactual outcome.
* indicates significant at the .03 level.
** indicates significant at the .01 level.

With respect to disciplinary outcomes, we examined whether students had any disciplinary incidents, and the number of times in which students had been suspended for more than three days. At grades 11 and 12, the percentages of CB participants who had any disciplinary incidents were significantly lower than estimated had they not participated. Furthermore, at grade 11, CB participation was associated with a lower percentage of suspensions lasting more than three days.

Table 3.7

Percentages of CB Participants within Each Disciplinary Category in Comparison to their Estimated Counterfactual (CF) Percentages

Outcome	CB N	CB Mean	Weighted CF N	Weighted CF Mean	Std. Error Difference
Grade 10 any disciplinary incidents	321	16.82	1780.04	19.14	2.02
Grade 10 suspended for more than 3 days	321	4.98	2014.80	7.45	1.29
Grade 11 any disciplinary incidents	296	9.80 **	1595.47	22.24 **	2.77
Grade 11 suspended for more than 3 days	296	4.39 *	1642.77	8.56 *	1.82
Grade 12 any disciplinary incidents	282	8.51 **	1526.23	17.79 **	2.55
Grade 12 suspended for more than 3 days	282	3.90	1302.33	6.47	1.74

Notes.
N refers to the observed sample size for CB students and the effective sample size for CF outcomes.
Std. Error refers to the standard error of the difference between the observed proportion of CB participant outcomes and the estimated proportion of counterfactual outcomes falling in the stated outcome category.
* indicates significant at the .03 level.
** indicates significant at the .01 level.

Sensitivity Analysis: Examining the Role of Exposure to CB Services

Our next analysis examined whether stronger program effects could be observed among CB students with greater exposure to CB services. Across cohorts with participation data, between 73 and 98 percent of participants engaged in at least one optional CB-sponsored event during their tenure with the program, with community service and cultural activities the most frequently-attended events. Higher-participating students engaged in an average of ten optional events compared to an average of three optional events by lower-participating students.

We re-ran the analysis above, limiting the CB students in the sample to those identified as higher participating. The results were similar to those reported above, such that the significant relationships observed in the overall CB population were replicated for the sample of higher-participating students. In addition, we observed two additional significant relationships that were not previously observed for the overall CB population. First, higher-participating CB students demonstrated better ACT performance than was predicted in the absence of participation. Higher-participating CB students had an average ACT score of 19.82 compared to their average predicted counterfactual ACT score of 18.78 ($p < 0.01$). Additionally, approximately 41 percent of higher-participating CB students surpassed the ACT national average compared to the estimated 25 percent had they not participated ($p < 0.01$).

Second, the percentage of higher-participating CB students who were on-track to complete a college-ready curriculum in social studies was significantly higher than the percentage estimated absent participation. Approximately 98 percent of higher-participating CB students were on-track to complete a college-preparatory social studies curriculum compared to the predicted 94 percent had they not been in the program ($p < 0.03$).

To understand which particular program component was most highly associated with participant outcomes, we conducted additional sensitivity analysis in which CB students' achievement and behavioral outcomes served as the dependent variables, and students' attendance at each of the five separate program components served as the independent variables. However, none of the individual program components was significantly related to outcomes, suggesting that no single component was definitively contributing to better outcomes, but instead a combination of components taken together appeared to be underlying the positive results.

Summary of Empirical Findings

Overall, the results suggest mostly positive relationships between CB participation and students' outcomes. Relative to their expected outcomes without the program, CB program participants were more likely to reach proficiency on the End of Course exams in English and biology, to obtain at least a B grade in a number of foundational college courses, to take more AP or honors courses, to demonstrate fewer disciplinary problems, to attend school more frequently, and to score higher on the PLAN, a measure of college readiness. In addition, the percent of CB participants enrolling in college and the percent of CB students attending a 4-year postsecondary institution was significantly higher than would be expected absent the program.

Our analyses did not reveal a relationship between CB participation and either full-time college enrollment or college persistence, although the observed rates for full-time college enrollment and college persistence were high for CB students at 61 and 93 percent, respectively. The lack of significant results for these two outcomes may have stemmed from the fact that we were not able to obtain full-time enrollment and persistence data from one of our districts. As a result, the smaller sample sizes available for this particular set of analyses may not

have afforded sufficient statistical power to detect differences. Additionally, for higher-level courses, such as AP courses, physics, and algebra 2/trigonometry, the percentages of CB participants who attained at least a B grade were comparable to the estimated percentages absent participation.

The results also point to the importance of program exposure or dosage. Previous research has shown that the extent to which participation influences students' outcomes depends upon the depth and breadth of participation in the program (Vandell, Reisner, & Pierce, 2007; Zief, Lauver, & Maynard, 2006). We found similar results in our study. For the higher-participating CB students, results were similar to those reported for the overall CB population. In addition, we observed two additional significant effects, such that greater participation was related to higher ACT scores and with timely completion of the required college-preparatory courses in social studies. Although we could not identify which specific program component was most highly associated with students' outcomes, the findings suggest that program incentives that encourage greater program participation may lead to even stronger benefits for students.

Taken together, the results indicate that the CB program shows promise as a college readiness intervention that helps students prepare for college. However, despite positive relationships observed between program participation and a number of achievement, behavioral, and postsecondary outcomes, the results also suggest CB participants may still be at-risk for performing poorly at college. For example, nearly 60 percent of CB students did not score at the proficient level on the EOC biology test and 45 percent attained lower than a B grade in their biology course. Similarly, about half of CB participants attained lower than a B grade in advanced mathematics and science courses such as algebra 2/trigonometry, chemistry, and physics. Thus, although the results suggest that CB students are performing academically better than would have been the case had they not been enrolled in the program, the findings also suggest that they may not be adequately prepared to take college-level courses. This result is not surprising, given that two of the districts that CB students attend (UCITY and SLPS) have been designated as academically under-performing. However, it is also important to note that the observed college persistence rate for CB students was very high at 93 percent, so the fact that many students were not performing at a B level in their high school courses does not appear to be a deterrent to their staying in college.

Future Directions for Research

There are some limitations that circumscribe the inferences drawn from the study. First, we could not standardize the course grades to account for variation in stringency of teachers' grading practices, so it is possible that our results are biased, although the direction of bias is unknown. However, it is important to examine course grades because they are an important measure of college readiness. Studies have shown that students' high-school course taking and performance is a strong predictor of first-year college performance (Geiser & Studley, 2003),

cumulative college grade point average (ACT, 2008), and college graduation (Geiser & Santelices, 2007). Furthermore, course grades provide an indication of different types of college readiness skills that may not be as readily captured by standardized achievement measures, such as skills relating to work habits, organization, persistence, and effort (Nagaoka, Roderick, & Coca, 2009). Nonetheless, because course grades are often perceived as unreliable criterion measures for college admissions due to their potential for inflation and their variability in grading standards across teachers and across high schools (Woodruff & Ziomek, 2004), the course grade analysis should be viewed as exploratory.

Second, although our propensity weighting approach resulted in vastly improved balance on the available baseline covariates, there remained statistically significant differences between CB participants and the comparison students on the achievement and disciplinary variables at baseline. However, it is important to note that this imbalance is mitigated by the inclusion of these baseline covariates in our weighted generalized regression modeling, which produced the counterfactual outcome estimates.

Third, although the study results provide some indication as to the extent that the program is on-track to meet its ultimate goal of improving the college graduation rates of participants, we did not examine whether the program is actually improving the college graduation rates of CB students. Using students' current enrollment status and their cumulative credits earned, the CB program has projected that approximately 69 percent of its first cohort will graduate from college within six years. This figure is considerably higher than the approximately 25 percent observed for low-income or first-generation college students (Pell Institute, 2011). However, we did not have comparable data to determine the projected college graduation rates for comparison students, so we could not examine the extent to which the program may be impacting college graduation. Similarly, data limitations and the relatively short-term duration of the project meant that we could only examine whether students re-enrolled in college for at least one additional term after their initial postsecondary matriculation, and we did not examine at what stage, if any, students ceased to enroll in college. Additionally, although the CB program keeps track of many college-level indicators for program improvement purposes, this information was lacking for the comparison students. Thus, we could not examine important college-level outcomes such as selectivity of the college entered, number of remedial courses taken, college major, and college GPA. These types of outcomes would provide further information about the CB program's impact on its participants at the college level.

Finally, because the program did not employ a randomized design to select participants, it remains possible that the results are partially attributable to pre-existing differences between the CB participants and the comparison group that we could not fully disentangle from program effects. While we used a wealth of data to estimate the counterfactual outcomes, we cannot be assured that the mechanism inducing a student to participate in the program is fully captured by the variables used to establish group equivalence. For example, we were unable to control for motivational differences that could conceivably have influenced whether or not students joined

the program. Thus, we cannot definitively conclude that the program was the sole factor underlying the relationships between program participation and relevant outcomes. In the future, as the CB program continues to attract attention and receive more applications from qualified applicants than it can feasibly support, it may be possible to select students from a random lottery system, which will facilitate an experimental design that allows for better estimates of program effectiveness.

3. Insights from CB Participants, Coaches, and Staff

This section describes the current operations and program features of the CB program, focusing on alignment with best practices identified in the literature. We first provide details about the methodology relating to the interviews and focus groups of staff and CB participants. We then describe the framework used to analyze the different stakeholders' perspectives. We conclude this section with a discussion of potential problematic areas for the program.

Interviews and Focus Group Samples

We conducted focus groups with 9 coaches and interviews with 20 other staff representing program managers, directors, and developers. For the coaches, we conducted three 1-hour sessions, with three coaches in each session. For the remaining staff, most were one-on-one half-hour interviews. In addition, we conducted four 45-minute focus groups with 26 CB participants. The focus groups with CB participants were conducted separately by grade, with high-school sophomores, juniors, seniors, and students at all levels of college represented in our study. In addition, focus group participants were recruited from all three districts and four community-based organizations. Given the limited number of CB participants included in the focus groups, it is important to recognize that the perceptions of the focus group participants may not be generalizable to the larger population of CB students.

The interviews and focus groups with staff and coaches were intended to provide complementary information about the program from different stakeholders' perspectives. The interview protocol for staff and coaches focused on program operations and services, and included items about the context in which the program operates, the program's goals and priorities, services provided in support of those goals, and coordination efforts with parents and schools. We also probed about services provided at the high school and college levels.

CB participants were asked about the program components they thought worked well and the components that they believed needed improving. Focus group participants were also asked to note the impact that their participation in the program may have had on themselves, other family members, peers, or friends.

There were two researchers for each interview or focus group. The interviews and focus groups were carried out under conditions of confidentiality. Each researcher took detailed notes and recorded the sessions to supplement their note-taking. In addition, we collected information about coaches' credentials and prior work experience.

Frameworks for Assessing Program Alignment with Best Practices

To analyze our notes taken during the interviews and focus groups, we organized the notes according to themes, and were able to extract common themes across both CB participants' and staffs' responses. We then compared the themes to two frameworks to determine the extent that the CB program provided services that are consistent with best practices within the literature. Although the use of the frameworks to analyze the notes was conducted on a post-hoc basis, the themes that we identified coincided with the practices included within the two frameworks.

We chose two frameworks for our analysis. The first framework was drawn from an Institute of Education Science's (IES) practice guide that recommends strategies that high schools can engage in to help increase access to higher education (Tierney, Bailey, Constantine, Finkelstein, & Hurd, 2009). We chose this framework because of its focus on increasing the number of students who go to college, which is consistent with the goals of the CB program. The second framework was drawn from Bodilly's and Beckett's (2005) comprehensive review of out-of-school-time programs. Bodilly and Beckett examined studies of quality indicators in out-of-school time, school-age-care, youth development, effective-school, and teacher-training effects in order to identify the program features that may be promising at promoting youth development. While there have been other reviews of out-of-school-time programs (e.g., Durlak, Weissberg, & Pachan, 2010), these meta-analyses have focused on quantifying the effects of out-of-school-time programs on students' outcomes. In contrast, the Bodilly and Beckett study focused on identifying the program characteristics that may explain why some programs are more effective than others.

It is important to recognize that the IES framework was geared towards high schools, which differ from the CB program with respect to funding, hours of service, purpose, and nature of student participation. In this regards, the Bodilly and Beckett framework may be more relevant, because it focuses on programs that have the same operational features as the CB program. However, the Bodilly and Beckett framework did not focus on improving college-level participation. Thus, by using both the IES and Bodilly and Beckett frameworks, we are able to examine the extent to which the CB program's operational features align with the best practices recommended for out-of-school-time programs, while also examining whether the CB services are consistent with the practices recommended for improving college enrollment.

The IES practice guide recommended five practices:

1. Offer courses and curricula that prepare students for college-level work, and ensure that students understand what constitutes a college-ready curriculum by 9th grade
2. Utilize assessment measures throughout high school so that students are aware of how prepared they are for college, and assist them in overcoming deficiencies as they are identified
3. Surround students with adults and peers who build and support their college-going aspirations

4. Engage and assist students in completing critical steps for college entry
5. Increase families' financial awareness and help students apply for financial aid

Source. Tierney, Bailey, Constantine, Finkelstein, & Hurd, 2009, p.6

The Bodilly and Beckett framework identified the following factors as facilitating youth development.[4]

1. A clear mission
2. A supportive emotional climate
3. Stable, trained personnel

In the sections below, we evaluate the CB program against these recommended practices and factors. However, it is important to note that while these practices have been identified as potentially promising strategies, the empirical evidence attesting to their effectiveness is generally weak or nonexistent, partly because of the lack of studies that have used a randomized design (Bodilly & Beckett, 2005; Tierney et al., 2009). Nonetheless, correlational studies have led to emerging consensus that these strategies and characteristics have the potential to improve students' outcomes (Tierney et al., 2009), and can provide guidance for program improvement efforts.

Program Alignment to the IES Framework

Ensure that Students Understand What Constitutes a College-Ready Curriculum

The CB program offers students individualized counseling with respect to course selection in order to ensure that students know what constitutes a college preparatory curriculum. As part of this process, the program requires that prospective candidates submit transcripts with their application. Coaches examine the course-taking patterns and advise of any gaps within the core subject areas. Coaches also coordinate with the partner schools to ensure that CB participants are taking college preparatory classes. A CB program director explained a system of checks and balances as follows:

> CB was finding out too late that kids are only getting so many math, English, etc. so now there are meetings between coaches and students, where we bring triplicate forms and plan the four core [subject]. Then a copy goes with the kid to the school counselor so the counselor knows the kid has already thought about it and discussed it. CB takes the first sheet and gives it straight to the school counselor – a way of ensuring students are getting into the right classes because schools are shuffling classes. Finally, before kids leave for summer break, [we] make sure they're still

[4] Although Bodilly and Beckett (2005) identified several other factors, we do not discuss these factors either because we lacked sufficient information to evaluate the program against those factors (e.g., safe and healthy environment) or because they were redundant with the IES recommended practices (e.g., frequent assessment).

> enrolled in the same classes. So there are several checkpoints along the way –it's a three-prong checks and balance: with students, with counselors, before summer.

Across the four core subjects, more than 90 percent of CB participants were on-track to take a college-ready curriculum. Furthermore, CB participants were not only taking the required number of core courses, they were also taking courses that are considered foundational college-preparatory courses. For example, more than two-thirds of CB participants had taken Algebra 2 and chemistry by their junior year, and more than 50 percent had taken physics by their senior year.

Use Assessments so that Students are Aware of How Prepared They are for College

Although the CB program offers academic enrichment and tutoring, its academic offerings are not intended to take the place of the curriculum taught by teachers in the schools or classrooms. As one CB director indicated, "We don't benchmark using test scores like the PLAN because we're not providing that type of academic services. We're not trying to be a school." Thus, the CB program does not administer many assessment measures, except within the context of their summer institute, spring break mathematics intensive, and ACT preparation. For the summer institute and spring break mathematics intensive, students are administered instructor-created pre- and post-tests, and with ACT preparation, students take released forms of prior ACT tests.

The CB program monitors students' academic performance principally through progress reports and transcripts of its participants. Students whose progress report indicate academic difficulties are given an intervention, where they meet with coaches and are put on an academic recovery plan. As part of the academic recovery plan, students are required to attend the academic tutoring sessions. Coaches continue to work intensively with students until their course grades improve.

Build and Support Students' College-Going Aspirations

Through a variety of support systems, the CB program reinforces participants' college-going aspirations. Focus group participants were unanimous in their perceptions that the CB program was supportive of their college expectations and was preparing them for college. Many students noted that the CB program "pushes you to do better," and "encourages you to go to a four year college so you're challenged by peers around you." As one CB participant indicated:

> I went into high school not knowing how I'll get into college and I kept worrying about how I would go to college because my dad told he didn't have the money to send me. Getting involved with College Bound, I have that hope that I will get into college. They build up my confidence and make me want to do more.

A college-level CB participant agreed:

> It really helped me prepare for college. College life, not just academics. Like what you would do in a dorm, the lingo that goes with it. They teach you beyond just getting you in, but to support you throughout.

In addition to support from CB staff, students also receive support from their peers. For example, the program has mentoring programs that match seniors with collegians. In addition, the CB program has implemented an on-campus peer mentoring program, where college-level juniors and seniors mentor the incoming freshman and sophomores

Engage and Assist Students in Completing Critical Steps for College Entry

The CB program helps students with all critical aspects of the college entry process, including preparing students for the college entrance exams, assisting them in their college search, and helping students complete their college applications. When asked about how the CB program prepared them for college, CB participants answered:

> There were seminars that were mandatory: FAFSA, ACT prep, tests that we had to come every Saturday for four weeks (the longest day ever!). They bring in professional tutors, and gave me strategies to take the [ACT] test. They raised my ACT score by 4 points.

In addition to ACT preparation, the CB program holds a three-day college application workshop that focuses on creating high-quality college applications, including assistance with activity profiles, personal statements, and short answers. The CB program also counsels students on their college search by advising to students to consider such factors as graduation rates, federal loan default rates, costs of admission, average financial aid package, average ACT scores, and percent of students who are eligible for PELL grants in the college decision. CB students are encouraged to choose colleges that have high graduation rates, low federal loan default rates, and are the most selective colleges that students are qualified to attend.

Increase Families' Financial Awareness and Help Students Apply for Financial Aid

The CB program provides individualized counseling to students regarding financial aid. As described by one CB director:

> In an enrollment meeting, coaches sit down with students, and parents if they care to join. Students bring their financial aid award letter and coaches help to break it down: how much students' personal expenses will be, how much books will be, how much aid they got, scholarships, grants, etc. A lot of the meeting is finances, then students get a folder with a lot of the materials they might need in college, like worksheets on buying books cheaply.

CB participants indicated this was one of the areas where the CB program was most helpful:

> I didn't know any of this before. They tell you about different types of money you can get like loans, scholarships, grants, work study, and to stay away from [private] loans.

Another CB participant indicated that knowledge about financial aid gave her confidence that she could attend college:

> My mom didn't go to college so I didn't know how to fill out applications or to get money to pay for college. But now I don't worry about owing a lot of money because College Bound helps you to find money for school.

Summary of Findings Regarding CB's Program Services

Overall, the CB program provides services that are consistent with the IES practice guide for increasing access to higher education. In the case of financial aid, mentorship, and the college application process, the CB program appears to be successfully implementing the practices that are believed to increase access to higher education. To monitor participants' academic progress, the program reviews progress reports and transcripts of its participants, and works with students who show deficiencies in performance to improve their grades. Additional monitoring of students' academic readiness through such means as state tests and other standardized achievement measures could provide another indication of students' readiness for college, beyond course grades. We will return to the implication of this finding at the end of this section.

Program Alignment to the Bodilly and Beckett Framework

A Clear Mission

There was consensus among the CB directors and staff that the main priority of the program is to ensure that students enroll and graduate from college by providing them with the necessary academic and social supports. A director noted that "we went through an extensive goal-setting process last summer, and the emphasis in the high school program is now on academic achievement." Consistent with this goal, the program has services that include academic tutoring, ACT preparation, mathematics-intensive workshops, and summer programming to prevent summer learning loss. In addition, the program examines the college transcripts of its college-level participants to determine ways in which to improve its high-school programming. For example, after learning that many of its college-level participants were struggling with mathematics, the program attempted to increase the mathematics preparation of its high-school level participants by refining the content of the mathematics-intensive workshops and counseling all high-school level participants to take algebra 2. The CB program also provides test results from the summer institutes to the teachers in their schools. This allows teachers to use the data to support students, and use the summer performance results to judge whether students are receiving high-quality instruction in their classroom or whether they are, perhaps, receiving inflated grades.

In addition to these academic supports, the program also aims to provide students with a caring adult in the times of emotional and financial stress. For example, in addition to CB staff referring participants to various social service agencies, as needed, the CB program has a full-

time social worker who provides "wellness sessions" for the students and individualized therapy sessions. The program has also provided monetary coverage to help students cope with various emergencies (e.g., death in the family, lack of funds for tuition or books). Furthermore, students have access to their coaches during and after school as well as on weekends, and students can call a CB-staffed hotline that is available at all times.

The program also tailors different types of social supports for the high school and college levels. At the high school level, CB offers life skills training in the form of their Teen Outreach Program, which helps students deal with issues such as peer pressure, drug abuse, and teenage sex. At the college level, coaches contact participants weekly, help connect students to on-campus mentors, and provide care packages during the finals.

A Supportive Emotional Climate

All the CB focus group participants described the CB coaches and staff as nurturing and encouraging. One CB participant noted "I stay here because the staff here is like a family. They're always there for you if you need anything." Another participant indicated that "I can go to [a coach] and talk about things I don't talk to my best friend about, about problems in my life." Students also say that CB staff are "very good supporters," and "are always sending me notes about how good of a job I'm doing." Another student agrees:

> They're always calling, they're somebody who actually cares. I had ACT tutoring and I missed a couple and one of the coaches got on my head about it and gave me a wake up call. Even when it irks me sometimes, I appreciate it a lot, that they actually care about me.

Overall, providing a supportive emotional climate appears to be one of the strengths of the program.

A Stable, Trained Personnel

All the coaches included in our interviews had at least a bachelor's degree, a college-level GPA above 3.0, and demonstrated leadership in a service position. Coaches indicated they received two weeks of training at the start of their tenure with CB, where they read books about teaching, conducted mock lessons, gave and received feedback on their teaching, and shadowed other teachers. They also received training on facilitation and classroom management skills and about CB's ways of operations. Although coaches believed that this training prepared them for their job duties, they also indicated they were overwhelmed at the pace of the training. As one coach described his experience with the training:

> There's enough to hit the ground running but you need to look more at what is being done training-wise in those first couple months of hands-on experience. There needs to be "just coaches" training up front instead of trying to squeeze in training about institutional knowledge. We need to have strong support for the

> first few months of the school year and then taper off. You can't fit everything into the first two weeks of training.

By design, the program lacks consistency with respect to coaching. The program relies on AmeriCorps members to serve as coaches, and the tenure of AmeriCorps members is typically one to three years. Although the percent of coaches who choose to return the following year is fairly high at 40 percent, it also means that every year the program has many new coaches. CB uses AmeriCorps because it allows the program to provide a high level of service on a smaller budget. Additionally, because all AmeriCorps members have graduated from college, they support and reflect the college-going culture. However, relying on coaches who may change each year has adverse effects on the program. First, it leads to inefficiencies, as training benefits and acquired knowledge about CB program's operations are lost annually. As one coach described the situation:

> There's no overlap between old and new AmeriCorps, and any transmission has to happen through full-time staff or returning AmeriCorps. It's a question of efficiency because you can move more quickly if you've known this stuff for years.

This sentiment is echoed by a CB director:

> College Bound is so nuanced, it entails a very long and steep learning curve. Training new members is difficult as they have no institutional knowledge and you have to repeat this process each year.

Another director agreed that the program's reliance on AmeriCorps in terms of continuity, had challenges.

> A lot of knowledge just falls on the returners to be available for the people who ask questions. It makes the professional development piece even more crucial, [and] trying to be on the same page is a challenge, especially in terms of values. Every time there is a new group, you have to re-evaluate where everyone is.

Another challenge of having members that do not return often is that the "relationship capital with students is lost" once those coaches leave. CB staff and participants indicated that one of the main drawbacks of the annual changes in staff was the lack of personal knowledge about the students. As one CB persistence coach noted "It's hard to establish a relationship with someone you've never met, not only for me as a coach but also for the student." This sentiment was shared by other CB participants. One in particular noted:

> I had two coaches last year, one stayed and one didn't. Having the coach two years in a row is easier since you don't have to try to get know someone new and repeat your same story. You can just jump right in.

Another CB participant felt the lack of coach continuity undermined her willingness to form relationships with her coaches: "The biggest thing is the attachment. If you know they're going to be leaving, you don't get so personal or so attached." It is clear that proximity and stability,

which is integral to forming and maintaining relationships (Greenberg, Siegel, & Leitch, 1983), is an important consideration to many CB participants when interacting with their coaches, although in many instances, CB participants also continue to keep in touch with their coaches, even after the coaches' departure.

Summary of Findings Regarding CB's Operational Features

Overall, the CB program's operational features are consistent with most of the recommended characteristics associated with effective delivery of services. The program has a clear mission of helping students graduate from college, and its services are geared towards preparing participants both academically and emotionally for college. All coaches were well credentialed, holding at least a bachelors degree coupled with having relevant work experience. In addition, CB focus group participants were unanimous in their perceptions that CB staff created a supportive climate. Below are areas recommended for improvement.

Opportunities for Improvement

Most of the CB program's features and components appear to follow "best practices" within the literature. However, there are potential opportunities for improvement that the program should consider as it moves forward. These include:

Address the Systemic Transitions Among Coaches

The program has begun to address the effects of the systematic changes in coaches in several ways. First, to manage participants' expectations about coaches, the program informs students about the AmeriCorps model, and explains that coaches have a limited tenure with the program. Students are also told that AmeriCorps members who depart may also choose to stay in touch with their students, and students are invited to maintain relationships. Second, the program has changed the timing of when coaches train with the program, thereby allowing the persistence coaches to personally meet with college-level participants before the college-level participants leave for college. Third, coaches record notes about the participants to whom they are assigned within communication logs located on CB's proprietary database, so that when the coaching transitions occur, new coaches can read through case histories for each student they will support. Finally, CB participants are encouraged to build relationships with the entire CB staff, as opposed to the coaches alone. To facilitate these relationships with the entire CB staff, the program has instituted a pinning ceremony where CB staff are present during CB participants' induction into the program. The program has also implemented an Advancement Ceremony for high school juniors attended by staff, families and students to celebrate students' continuation in the program. In addition, the CB program expanded services and increased the number of programs held at the CB office, thereby affording students with weekly opportunities to interact

with a wide range of CB staff beyond their coaching team. Finally, the program offers multiple optional enrichment activities to increase interactions between the CB participants and staff.

It is not yet known to what extent that these strategies will mitigate the effects of changes among coaches on participants' relationships with coaches. This is an area for further investigation after the noted changes can be measured over time. It is important to note that participants do not appear to be dropping out of the program because of their dis-satisfaction with the coaching changes, although the majority of the focus group participants also indicated a desire for continuity in coaching. The program may consider administering a survey to understand whether changes in coaches materially affect participants' perceptions of the support they receive from the program. In addition, the program may want to take steps to increase the interactions between CB participants and more permanent staff. For example, in addition to designating a coach to each student, the program can formally assign a CB staff to each student, with an explanation that the CB staff are intended to be a secondary source of support. Thus, when coaches transition to new roles outside of the program, students would continue to have continuity of relationships within the CB program.

To the extent that there is available funding, the program may consider other ways to build and maintain relationships with exiting AmeriCorps members and provide more robust training both initially and ongoing in order to build institutional knowledge and facilitate long-term relationships with coaches. This may help inform program services and functioning in the future.

Use Standardized Assessment Data to Monitor Academic Progress

The CB program relies primarily on students' progress reports and transcripts to gauge students' academic progress. Although course grades are an important indicator of college readiness, the CB program may also want to monitor students' performance on the standardized assessments. As one coach indicates,

> Working with under-resourced schools, the curriculum is very watered down. There are such gaps in knowledge. Students with really low skills have inflated GPAs. We have students who have A's in math but can't do basic math tasks.

Indeed, analysis suggests that the course grades are not always an accurate predictor of students' performance on the standardized tests. For example, nearly 60 percent of CB students failed to reach proficiency on the EOC biology exam, yet half of these students had received at least a B grade in their biology class. Similarly, one quarter of the students who had failed to reach proficiency on their EOC English exam had received an A grade in their AP English course.

These findings suggest that course grades may not be giving a complete indication of students' readiness for college. If capacity and funding allowed, the CB program could benefit from obtaining standardized assessment results (e.g., PLAN, EOC, and MAP scores) from their partner schools to better diagnose strengths and weaknesses within students' college readiness

preparation. If, for example, the MAP tests show that students are not proficient in mathematics but the course grades indicate otherwise, the CB program may try to understand the source of discrepancy (e.g., poor test-taking skills) and address those potential deficiencies. Again, this would require additional resources but the program could then be more effective in helping its students prepare for the rigors of postsecondary work.

4. Conclusion

In spite of the significant educational investments that have been made to try to improve the postsecondary opportunities for low-income students, there continues to be a persistent gap in the educational attainment of high-poverty youth groups (Harvey & Anderson, 2005; Perna & Titus, 2005; Summers & Hrabowski III, 2006). A lack of a college education, in turn, is related to poorer earnings over a lifetime (Carnevale et al., 2011; Kane & Rouse, 1995; Miller, Mulvey, & Martin, 1995). The CB program has responded to the educational attainment gap by providing low-income participants with academic coaching and tutoring, college planning and counseling, an aspirational college-going community based on high expectations and high supports, life coaching and mentoring, and postsecondary financial counseling. CB support continues for up to nine years, from their induction in the summer before their sophomore year in high school through completion of their college degree.

The results indicate that program participation was positively related to students' performance on the EOC exams and PLAN test, higher grades in foundational college courses, higher attendance rates, fewer disciplinary incidences, higher rates of college enrollment, and higher rates of enrollment at 4-year postsecondary institutions among college attendees. We also observed high rates of full-time college enrollment and college persistence (at 61 and 93 percent, respectively), although neither of these outcomes were statistically different from those estimated for their counterfactual percentages at the time the study ended. It should be noted that these empirical findings should be interpreted carefully because we did not achieve optimal covariate balance between CB participants and the comparison group. The study also could not account for unobserved student characteristics, such as differences relating to motivation, that could conceivably influence students' participation in a program.

There are several possible explanations underlying the observed statistically significant relationships. The positive relationships between program participation and achievement outcomes may be traced to program components such as the summer learning institute, mathematics-intensive workshops, and tutoring sessions, which are designed to strengthen students' academic skills. Furthermore, in light of feedback that the college-level CB students were struggling with mathematics, the program has specifically emphasized improving high-school participants' mathematics skills. This may explain why there were positive relationships between program participation and performance in foundational mathematics courses such as geometry and algebra 2.

That CB participation is associated with fewer disciplinary problems and higher attendance rates may also be attributable to several components of the CB program. For example, as part of the Teen Outreach Program component, participants discuss ways in which to resist peer pressure and refrain from taking drugs. Exposure to this type of life-skills training, coupled with

the mentorship of their coaches, may have provided CB students with the needed social support to reduce their engagement in problem behaviors (e.g., absenteeism or behaviors that result in disciplinary actions).

Relative to their predicted counterfactual outcomes, we also observed that CB students were significantly more likely to enroll in college. This result may have stemmed from several aspects of the CB program, such as the college-going environment created by the CB staff and coaches. In addition, the program provides course counseling to ensure that students are on-track to graduate from high school with a college-preparatory curriculum. Furthermore, the CB program provides high-quality individualized counseling about the college application and college selection process to ensure that students enroll in the most selective college to which they are qualified. This may explain why CB students enrolled in a 4-year college at significantly higher rates than would have been expected had they not participated in the program.

Overall, the CB program appears to be implementing many of the practices that have been identified in the literature as reflecting best practices. It has a clear mission and a supportive environment. It provides counseling relating to the college application process, financial aid, and college selection. An outcome of this evaluation is the opportunity for College Bound to investigate several recommendations for program improvement. For example, in addition to fostering relationships between CB students and the coaches, who have a limited tenure with the program, the CB program may want to take steps to increase the interactions between CB participants and more permanent CB staff. This will help to ease transitions when coaches end their tenure with the program.

In addition, the CB program should examine not only students' course grades, but also their scores on standardized state and district tests to assess students' college readiness. A number of coaches indicated that the curriculum in the schools was "watered down," and the results suggest that students may not be academically prepared for college, even when they receive high grades in courses considered foundational for college. Our analysis suggests that that less than half of the students were proficient on the EOC biology exam, yet many of these same students obtained grades of A or B in their biology course. The CB program has recognized this potential for grade inflation, and shares the results of CB participants' performance during the summer workshops with their school principals in an effort to gauge whether students are receiving inflated grades. Resources permitting, the CB program should also leverage students' performance on standardized state and district tests as another means of assessing students' college readiness, which may not be accurately reflected in their course grades.

Finally, the program should offer incentives to encourage students to participate in the voluntary program components. Our analysis suggested that CB students who participated more frequently in the optional components showed even stronger benefits. When we limited the analysis to higher-participating students, results were similar to those reported above, along with two additional significant effects not previously observed with the overall CB population. Namely, with respect to ACT scores and timely completion of the required college-preparatory

courses in social studies, program effects were stronger for students who participated in CB more. Although we could not identify which specific program component was underlying the positive results, the findings suggest that program incentives that encourage greater program participation may lead to even stronger benefits for students.

As the program attracts more attention, there may be more qualified applicants than can be supported by the program. Under these circumstances, if the program selects students using a random lottery system, an experimental design can be implemented. Namely, in addition to tracking the outcomes of the accepted CB participants, the study would also track the outcomes of prospective candidates who were qualified to enroll in the CB program, but who were not admitted to the program due to space limitations. This wait-listed set of students represents the ideal comparison group, as they are likely to be similar to the admitted CB participants with respect to motivation, achievement, and other characteristics, but were not exposed to the program's services. This study design will allow us to attribute any differences between the CB participants and the comparison group to the program, and provide the strongest evidence of program effectiveness.

Appendix A: Description of Missing Data

The extent of missing data depends on the covariate in question. There were no missing data on any of the demographic variables. Table A.1 provides the percent of missing observations for the remainder of the covariates included in our analysis. The figures represent the percent of missing observations across the different cohorts and sites. The relatively high rates of missing observed for the MAP Science stemmed from the fact that prior to the cohort who graduated in the 2011-12 academic year, the test was not required by the state, although some individual schools may have chosen to administer the test. The MAP Science score notwithstanding, we observe low to moderate levels of missing data.

Table A.1

Summary of Percent of Missing Observations for Each Covariate

Covariate	Percent Missing
Grade 8 attendance	35.94
Grade 8 disciplinary days	30.24
Grade 8 number of incidences	30.24
Grade 9 attendance	12.72
Grade 9 disciplinary days	9.40
Grade 9 number of incidences	9.40
MAP Communication arts	36.59
MAP Mathematics	36.11
MAP Science	54.81
EOC Algebra	33.74

Appendix B: Summary of the Covariate Balance

Tables A.2 and A.3 provide a summary of the covariate balance between CB participants and the comparison students for the continuous and categorical variables, respectively. For both tables, the first column provides the covariate, and the next three columns provide the mean or percent for the comparison group prior to weighting, the mean or percent for the comparison group after weighting, and the mean or percent for the CB participants, respectively. For continuous variables, the table also provides the median K-S statistic, with lower values indicating greater concurrence of the CB and weighted comparison distributions, and the proportion of times that the chi-square test associated with the K-S statistic was rejected, as well as the median p-value for the test that the CB and weighted comparison means are the same and the proportion of times that test was rejected. For categorical variables, the table indicates the median difference between the proportion of CB and weighted comparison observations found in each category, along with the median p-value for a weighted chi-square test of independence between the baseline covariate and CB participation and the proportion of times this test was rejected.[5]

It is important to recognize that for each outcome there are multiple values associated with the displayed balance measure stemming from the imputation process, where we created 10 sets of plausible values. For each of these 10 separate imputations, there were 10 separate balance tables for each outcome. To synthesize the information across these covariate balance tables within an outcome, we found the median for the K-S statistics, differences in proportions, and p-values across these 10 imputations. To synthesize the covariate balance information across the multiple outcomes for display in the tables below, we then found the median of these values across all the outcome measures. Due to the multiple imputation process, it is possible that a covariate was balanced in one set of imputation, but not another set of imputation. Similarly, a covariate could be balanced for one outcome but not another outcome. To take into account the variability in covariate balance, we computed the proportion of times the p-value was rejected across imputations and across outcomes. If the covariates were balanced across all outcomes and all sets of imputations, the proportion of times the p-value was rejected would be zero.

As shown in Tables A.1 and A.2, our covariate balance was mixed, with some variables being very well balanced (e.g., eligibility for free- or reduced-price lunch), whereas others were less so (e.g., disability status). However, it is important to recognize that our propensity weighting approach vastly improved the covariate balance, even if it could not entirely eliminate

[5] The median p-values and proportion of rejections for individual categories within a baseline covariate may not exactly coincide. For each outcome, only the observations for which the outcome is observed are retained. Thus, some individual baseline variable categories may not be observed for all outcomes, allowing for differing values across categories within a covariate in the summary table displayed.

differences between the CB participants and the comparison group. An example is provided in Figure A.1 for the first set of imputations for the ACT scale score outcome. Figure A.1 presents the distribution of MAP mathematics scores for CB participants (black line, labeled as treatment), for comparison students prior to weighting (red line, labeled as control-unweighted), and for comparison students after weighting (blue line, labeled control-weighted). Prior to weighting, the mean difference between the CB participants and the comparison group was approximately 26 points. After weighting, the mean difference was 6 points. While this difference remained statistically significant, and the K-S statistic suggested that there will still differences in the distributions between the CB participants and the comparison group, it is also apparent that the distributions overlapped much more than they had previously. Thus, the use of propensity weighting greatly improved our ability to estimate program effects, even in the cases where balance was not fully achieved.

Table A.2

Summary of Covariate Balance Between CB Participants and Comparison Students for the Continuous Baseline Variables

	Unweighted Comparison	Weighted Comparison	CB	Median K-S statistic	Proportion of times K-S test was rejected	Median t-test p-value	Proportion of times t-test was rejected
Attendance							
Grade 8 attendance	91.371	93.335	93.295	0.054	0.006	0.632	0
Grade 9 attendance	87.837	92.258	91.836	0.059	0.084	0.263	0.138
MAP							
Communication arts	672.097	692.335	697.927	0.104	0.466	0.001	0.636
Mathematics	677.977	698.425	706.306	0.11	0.52	0	0.678
Science	671.127	681.037	682.365	0.052	0.016	0.121	0.042

Table A.3

Summary of Covariate Balance Between CB Participants and Comparison Students for the Categorical Baseline Variables

	Unweighted Comparison	Weighted Comparison	CB	Median difference in proportions	Median chi-square test p-value	Proportion of times p-value was rejected
Student characteristics						
Disability	0.081	0.052	0.017	0.033	0.000	0.871
Eligible for free- or reduced-price lunch	0.788	0.694	0.701	0.029	0.479	0.000
Female	0.514	0.578	0.659	0.077	0.051	0.408
Limited English proficient	0.082	0.046	0.028	0.018	0.161	0.292
Race/ethnicity: black	0.806	0.865	0.902	0.042	0.279	0.280
Race/ethnicity: other race	0.052	0.042	0.037	-0.005	0.279	0.280
Race/ethnicity: white	0.137	0.096	0.064	-0.036	0.274	0.286
Site						
MRH	0.023	0.100	0.098	0.002	0.593	0.050
SLPS	0.851	0.591	0.598	0.010	0.571	0.057
UCITY	0.122	0.323	0.311	-0.008	0.572	0.058
Attendance						
Grade 8: missing	0.354	0.178	0.114	0.066	0.012	0.624
Grade 9: missing	0.093	0.200	0.364	0.151	0.000	0.816
Disciplinary						
Grade 8 disciplinary days: 0	0.624	0.540	0.652	0.104	0.029	0.500
Grade 8 disciplinary days: 1 to 3	0.061	0.042	0.018	-0.021	0.015	0.540
Grade 8 disciplinary days: 4 or more	0.062	0.039	0.022	-0.017	0.009	0.541
Grade 8 disciplinary days: missing	0.271	0.385	0.316	-0.055	0.029	0.500

Grade 8 number of incidences: 0	0.614	0.522	0.635	0.109	0.054	0.476
Grade 8 number of incidences: 1	0.057	0.052	0.025	-0.021	0.044	0.490
Grade 8 number of incidences: 2 or more	0.061	0.037	0.029	-0.010	0.035	0.505
Grade 8 number of incidences: missing	0.271	0.385	0.316	-0.055	0.054	0.476
Grade 9 disciplinary days: 0	0.624	0.668	0.770	0.097	0.062	0.440
Grade 9 disciplinary days: 1 to 3	0.133	0.076	0.041	-0.030	0.038	0.469
Grade 9 disciplinary days: 4 or more	0.201	0.083	0.057	-0.016	0.062	0.440
Grade 9 disciplinary days: missing	0.081	0.192	0.144	-0.037	0.035	0.484
Grade 9 number of incidences: 0	0.574	0.641	0.753	0.113	0.028	0.504
Grade 9 number of incidences: 1	0.137	0.08	0.060	-0.016	0.027	0.506
Grade 9 number of incidences: 2 or more	0.228	0.103	0.054	-0.036	0.028	0.504
Grade 9 number of incidences: missing	0.081	0.192	0.144	-0.037	0.019	0.555
EOC Algebra						
EOC proficiency: advanced	0.022	0.048	0.045	0.005	0.279	0.234
EOC proficiency: basic	0.233	0.239	0.218	-0.021	0.253	0.265
EOC proficiency: below basic	0.255	0.181	0.145	-0.036	0.211	0.273
EOC proficiency: proficient	0.099	0.131	0.113	-0.010	0.232	0.268
EOC proficiency: missing/not taken	0.288	0.329	0.419	0.079	0.232	0.268
EOC proficiency: taken late	0.097	0.058	0.046	-0.007	0.232	0.271
EOC grade level taken: 12	0.020	0.013	0.018	0.005	0.123	0.340
EOC grade level taken: 11	0.021	0.013	0.014	0.002	0.114	0.388
EOC grade level taken: 10	0.055	0.032	0.016	-0.016	0.123	0.344
EOC grade level taken: 9	0.598	0.586	0.496	-0.064	0.123	0.324
EOC grade level taken: 8	0.016	0.029	0.037	-0.003	0.155	0.309
EOC grade level taken: 7	0.000	0.000	0.003	0.003	0.116	0.355
EOC grade level taken: not taken	0.288	0.329	0.419	0.079	0.123	0.324
MAP						
Communication arts: missing	0.360	0.179	0.114	0.069	0.000	0.652
Math: missing	0.356	0.178	0.114	0.066	0.000	0.632
Science: missing	0.589	0.614	0.723	0.086	0.000	0.760
Graduating cohort						

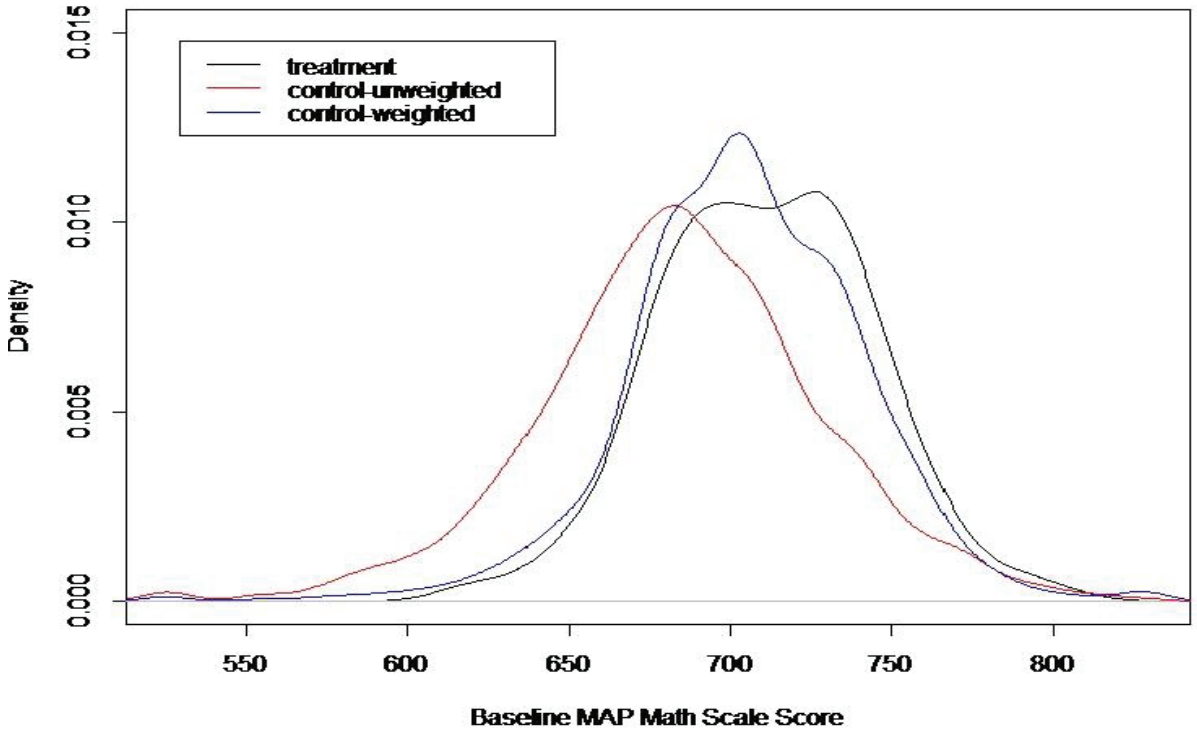
2007-08	0.027	0.032	0.071	0.039	0.001	0.745
2008-09	0.067	0.118	0.159	0.041	0.002	0.715
2009-10	0.124	0.146	0.195	0.055	0.002	0.715
2010-11	0.304	0.282	0.230	-0.053	0.002	0.658
2011-12	0.235	0.250	0.186	-0.048	0.003	0.645
2012-13	0.173	0.154	0.124	-0.025	0.002	0.703
2013-14	0.162	0.105	0.117	-0.006	0.001	0.848

Notes.
Median difference in proportions is the median value of the difference between the CB and weighted control groups on the indicated baseline variable category over all balance tables for all outcomes. Since each outcome model is restricted to students with the observed outcome, some baseline variable categories do not appear in all models.

Figure A.1.

CB Participants and the Comparison Group's MAP Mathematics Distributions

Unweighted Comparison Mean	Weighted Comparison Mean	CB Mean	p-value of mean differences
684.56	704.64	710.941	0.00



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