Prepared by
Abt Associates
for Success Boston

Success Boston Coaching

College Persistence and Completion Report

Corporation for NATIONAL & COMMUNITY SERVICE

Success Boston
COLLEGE COMPLETION INITIATIVE

About Success Boston

Success Boston is Boston's citywide college completion initiative. Together, the Boston Foundation, the Boston Public Schools (BPS), the City of Boston, the Boston Private Industry Council (PIC), 37 area institutions of higher education, led by UMass Boston and Bunker Hill Community College, and local nonprofit partners are working to double the college completion rate for students from the BPS. Success Boston was launched in 2008 in response to a longitudinal study by Northeastern University and the PIC, which showed that only 35% of those BPS graduates who had enrolled in college ever completed a postsecondary certificate, Associate's or Bachelor's degree within seven years of graduation from high school. Success Boston's theory of change is that cross-sector partnerships, guided by data and mutual accountability, will significantly change the post-secondary trajectory for BPS graduates. Its strategic framework focuses on helping Boston's high school students "Get Ready, Get In and Get Through" college, then "Get Connected" to jobs. A core intervention of Success Boston's is a transition coaching model; other key activities within this framework include improving academic preparation and offering as-needed supports through higher education institutions until students successfully attain a degree prepared to enter the workforce. In 2014, the Boston Foundation received a grant from the Corporation for National and Community Service to expand this effort. This $6 million Social Innovation Fund award gave the Foundation the resources necessary to expand Success Boston's transition coaching model from serving 300 to 1,000 students from each of the Boston Public Schools classes of 2015, 2016, 2017 and 2018.

About Abt Associates

Founded in Cambridge, Massachusetts in 1965, Abt provides applied research and consulting services to government agencies, philanthropic, nonprofit, and commercial organizations around the world. Abt's mission is to improve the quality of life and economic well-being of people worldwide. It applies its exceptional subject matter expertise, outstanding technical capabilities in applied research, and strategic planning to help local, national and international clients make better decisions and deliver better services.

About the Social Innovation Fund

This report is based upon work supported in part by the Social Innovation Fund (SIF) which unites public and private resources to evaluate and grow innovative community-based solutions with evidence of results. The Social Innovation Fund was a program of the Corporation for National and Community Service that received funding from 2010 to 2016. Using public and private resources to find and grow community-based nonprofits with evidence of results, SIF intermediaries received funding to award subgrants that focus on overcoming challenges in economic opportunity, healthy futures, and youth development.

Success Boston Coaching (SBC)

College Persistence and Completion Report

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Executive Summary

Access to middle class jobs increasingly requires a college degree or other postsecondary credential. Compared to those without a college degree, college graduates earn more, are less likely to suffer job losses in a recession, and are projected to have superior long-term labor market prospects (U.S. Census Bureau 2019; McFarland et al. 2019). But in Boston, more than half of the city's 2012 public high school graduates had graduated from college by 2018 (The Boston Opportunity Agenda 2021).[1] This rate improves upon the 39 percent seven-year graduation rate for 2000 graduates (Sum et al. 2013). Yet it likely is not sufficient to meet the predicted demand for a college-educated workforce.[2]

Boston's public school graduates are disproportionately from groups traditionally underrepresented in postsecondary education. Almost one-half (43 percent) of Boston Public Schools graduates are Hispanic and about one-third (33 percent) are Black non-Hispanic; nearly three-quarters (72 percent) are economically disadvantaged (BPS 2019). First-generation-college students and students from low-income backgrounds and racial/ethnic minority groups, like BPS graduates, can face social, academic, logistical, and financial barriers to succeeding in college; can lack the supports needed to overcome barriers; and can struggle with managing key deadlines, such as financial aid and course registration (Arnold et al. 2009; Avery, Howell, and Page 2014; Bozick and DeLuca 2011; Castleman, Arnold, and Wartman 2012; Castleman, Page, and Schooley 2014; Engle and Tinto 2008; Roderick et al. 2008).

One-on-one coaching from experienced counselors when students are completing their senior year in high school and beginning college can help them succeed (Castleman, Arnold, and Wartman 2012; Bettinger and Baker 2014; Castleman, Page, and Schooley 2014; Avery, Howell, and Page 2014).

Selected Study Findings

- SBC does not have a significant effect on degree and certificate completion.

- SBC students are 5-13% more likely than non-coached peers to persist in college in their first two years; however, SBC's effects on persistence decrease in later years after coaching ends.

- SBC students accumulate 7-10% more credits toward their degrees than do non-coached students during their first four years of college.

Success Boston, a city-wide initiative to boost college persistence and ultimately improve college completion rates for Boston's high school graduates, has one-on-one transition coaching as a core strategy. Transition coaching offers students sustained, proactive, and responsive support in their first two years of college. Specifically, coaches help students navigate the academic, financial, career, and personal aspects of college through one-on-one meetings, phone calls, emails, and text messages. In addition, coaches refer students to resources and services on their campuses. By providing these supports, Success Boston coaches aim to help students succeed in college and ultimately complete their degrees and certificates.

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1 The college graduation rate includes completion of certificates, associate's degrees, and bachelor's degrees.

2 For example, Massachusetts is faced with an aging workforce, where nearly half of its workforce is age 45 or older (Massachusetts Executive Office of Labor and Workforce Development 2017).

The Boston Foundation is the convening backbone organization of the Success Boston initiative. The Boston Public Schools (BPS) and local institutions of higher education, including the University of Massachusetts Boston and Bunker Hill Community College, work together with the Boston Foundation, the City of Boston, and nonprofit organizations to reduce barriers students' face in transitions to and success in college.

Beginning with the Class of 2009, Success Boston provided transition coaching to about 300 Boston high school graduates each year, most of whom are from groups traditionally underrepresented in college. In 2015 the number of students served increased more than threefold to about 1,000 students per cohort, a scale-up effort supported in part by a Social Innovation Fund grant from the Corporation for National and Community Service.

About the Evaluation

Prior studies of SBC provide evidence that it can be effective at increasing student persistence in college (Linkow et al. 2017a; Linkow et al. 2019), suggesting SBC may boost college graduation rates for BPS high school graduates. This is the third impact report to be released over the course of the multi-year SBC evaluation.[3]

This report examines the impacts of SBC on college completion, college persistence, and academic achievement for four cohorts of students: the Boston high school graduates from the Classes of 2013 and 2014 (cohorts before the scale-up) and 2015 and 2016 (cohorts after the scale-up). Using a quasi-experimental design, the evaluation compares persistence and completion rates for the students who participated in SBC ("treatment" group) versus those of a group of similar students ("comparison" group) who did not participate in SBC. As such, the report provides evidence that observed differences in outcomes between the two groups are due to SBC.

About the Findings

Findings suggest that SBC may improve students' college outcomes in their early college years, especially while students are receiving coaching, but the positive effects of coaching wane after coaching ends. Compared with carefully matched peers who do not receive coaching, SBC students (depending on the cohort) are

- more likely to persist into their *second* year of college (83 percent for SBC students in the treatment group versus 75-78 percent for the non-coached students in the comparison group) and into their *third* year of college (71-75 percent for SBC students versus 63-70 percent for comparison students); and
- accumulating more college credits during their first four years of college, of the credits necessary to graduate at their college (SBC students completed 58 percent versus 53-54 percent for comparison students).

However, the impacts of SBC begin to decrease in students' later years of college.

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[3] Findings about the effects of SBC on students' success in the first two years of college can be found in two prior reports: *The Power of Coaching: Interim Report on the Impact of Success Boston's Transition Coaching on College Success* (Linkow et al. 2017a) and *The Story of Scaling Up: Interim Report on the Impact of Success Boston's Coaching for Completion* (Linkow et al. 2019).

- Relative to the earlier persistence impacts, SBC has smaller positive effects on students' persistence into the fourth through seventh years of college, and these effects are not always statistically significant across all cohorts of students.
- SBC does not appear to have a statistically significant effect on students' completion of degrees or certificates after five years. Completion rates increase over time for all students, both those receiving coaching and peers who do not, with a particularly large increase occurring between students' fourth and fifth years of college.

Overall, SBC appears most helpful to students during and right after coaching but thereafter, the program's impacts begin to weaken.

The lack of a statistically detectable effect on completion differs from the results of some other studies, which have found higher graduation rates associated with other coaching programs (see Gupta [2017] and Rodger and Elliot [2020], for example). However, the studies showing positive impacts on college completion typically examine programs that, unlike Success Boston, combine transition coaching or advising with financial assistance and sometimes impose participation requirements (such as full-time enrollment while receiving coaching). Extending Success Boston Coaching for students beyond the first two years, and potentially adding some form of financial assistance, might be needed to help coached students cross the college finish line.

1. Introduction

Today, earning a college degree or other credential is seen as crucial for future well-being. College graduates earn more, are less likely to suffer job losses in a recession, and are projected to have superior long-term labor market prospects (U.S. Census Bureau 2019; McFarland et al. 2019). Nationally, approximately three of 10 jobs already require postsecondary education (Torpey 2020), and more than six of 10 current jobs are filled by candidates with postsecondary education (Carnevale, Smith, and Strohl 2013). These figures reflect the competitive advantage of postsecondary education: even when a job does not explicitly require a degree, a candidate with a degree will tend to be hired over an equally qualified candidate without one.

Over the next decade, the number of jobs requiring postsecondary credentials is expected to grow at a faster pace than the number of jobs that do not require such a credential (Bureau of Labor Statistics 2019; Scott and Nightingale 2018). At the same time, Massachusetts is faced with an aging workforce, where nearly half of the state's workforce as of 2017 was age 45 or older (Massachusetts Executive Office of Labor and Workforce Development 2017). In Boston, 54 percent of the city's 2012 public high school graduates—most of whom are Black or Hispanic and come from low-income households—who entered college in the first year after their high school graduation had graduated from college six years later (The Boston Opportunity Agenda 2021). This rate improves upon the 39 percent seven-year rate for 2000 graduates, yet likely is not sufficient to meet the predicted demand for a college-educated workforce.[4]

The Success Boston initiative focuses on helping low-income, first-generation-college students of color *get ready* for college, *get into* college, *get through* college, and *get connected* to a career upon college graduation. The initiative is a city-wide collaborative of the Boston Foundation (TBF), City of Boston, Boston Public Schools (BPS), University of Massachusetts Boston, Bunker Hill Community College, other regional colleges and universities, uAspire, Boston Private Industry Council, and other local nonprofit organizations. Since 2009, Success Boston has provided one-on-one transition coaching to BPS high school graduates, with the vast majority of students served by the program receiving coaching starting in their first fall semester of college.[5] Through coaching, along with other efforts led by the BPS and the higher education partners, Success Boston has endeavored to boost college persistence and improve college completion rates for Boston's public school graduates.

In the sections that follow, we provide a brief overview of the Success Boston Coaching (SBC) initiative, the research questions answered in this report, and an overview of how this report is organized.

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4 A 2008 report, *Getting to the Finish Line: College Enrollment and Graduation, a Seven-Year Postsecondary Longitudinal Study of the Boston Public Schools Class of 2000 Graduates* (Sum et al. 2008), found that 64 percent of nearly 3,000 Boston Public Schools Class of 2000 graduates enrolled in a postsecondary institution within seven years of high school graduation, yet only 35.5 percent of the college enrollees had earned a certificate, a two-year degree, or a four-year degree. That figure was later revised to 39 percent (Sum et al. 2013).

5 A small proportion of students (3 percent based on the most recent implementation report; see Linkow et al. 2017b) receive coaching before they enter college, either in the summer before they start college or in their senior year of high school.

1.1 About Success Boston Coaching

Beginning with the high school Class of 2009, Success Boston had provided transition coaching to about 300 BPS high school graduates each year, many of whom are from groups traditionally underrepresented in college. In 2015 the reach of SBC expanded from serving several hundred Boston young adults per cohort to about 1,000 students per cohort, a scale-up effort supported in part by a Social Innovation Fund grant from the Corporation for National and Community Service. The coaching model is grounded in one-on-one coaching focused on non-academic issues affecting college persistence and completion (such as financial need, personal and emotional support, career and life planning, and better utilization of existing academic supports). To maintain continuity with prior evaluation reports and transparency with students, colleges, nonprofit organizations, and the community, this report refers to the transition coaching program across all time periods as Success Boston Coaching (SBC).

SBC depends on a network of partner organizations, colleges, and coaches to provide transition coaching to students, as illustrated in Exhibit 1-1. As the convening backbone organization of the Success Boston initiative, the Boston Foundation facilitates communication across the network of partners. The goal of this collaborative network is to improve college completion rates by reducing barriers to college success, particularly for students from groups traditionally underrepresented in college.

Exhibit 1-1: Success Boston Coaching model

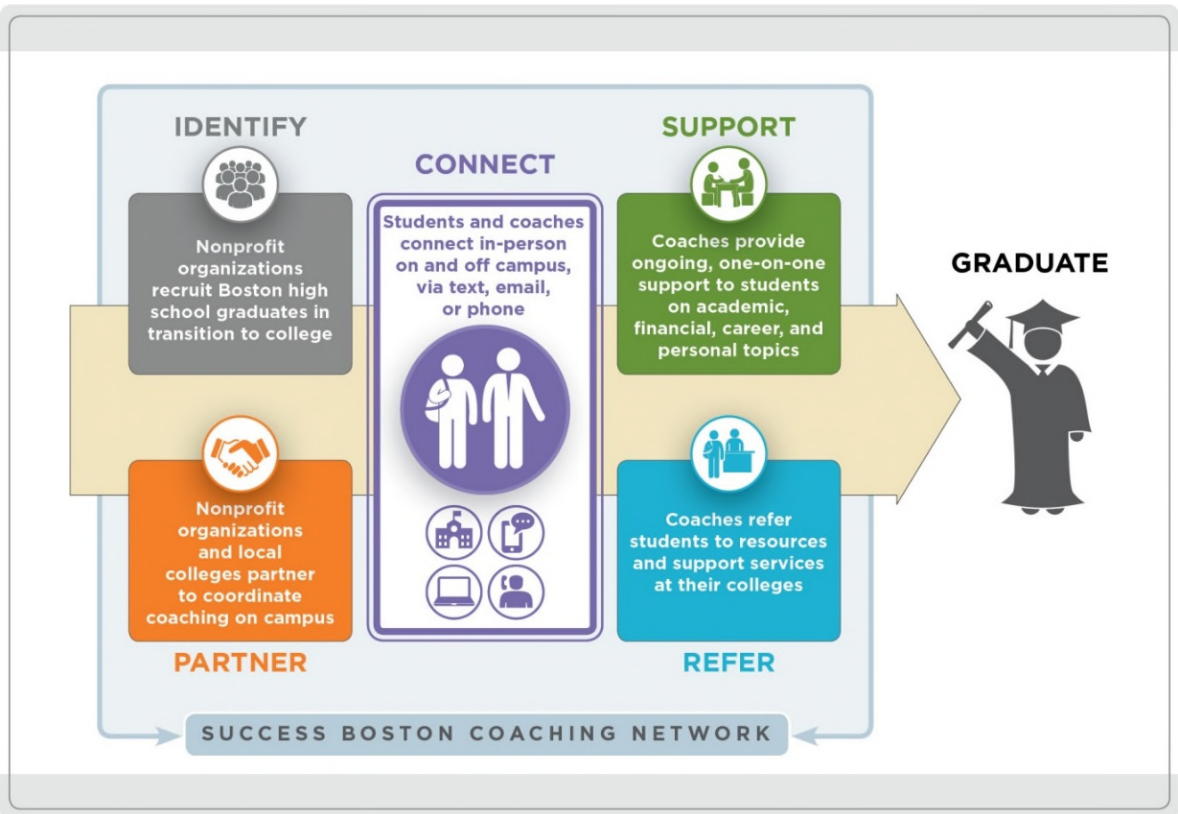

Exhibit 1-1 outlines the steps that comprise Success Boston Coaching: each nonprofit organization first ***identifies*** and recruits BPS high school graduates to participate in the SBC transition coaching program, in which coaching is provided by coaches employed by the nonprofit organization. SBC is designed to support recent BPS high school graduates entering college who are most likely to leave before

completion. Therefore, as part of the identification and recruitment process, Success Boston prioritizes low-income, first-generation-college students of color. Importantly, SBC serves students who enroll in two-year and four-year colleges.

To recruit students into SBC, the nonprofit coaching organizations use multiple strategies, including referrals from high school guidance counselors and other community organizations; nonprofit organizations' middle school and high school programming pipelines; word of mouth; and outreach on college campuses. Students reported in a 2015 survey that they learned about SBC through presentations from the nonprofit organizations at their respective high school as well as from conversations with individuals ranging from a nonprofit coach, an afterschool or summer program staff member, a high school or college staff person, to a friend or neighborhood acquaintance (Linkow et al. 2017b). The local area colleges and universities also referred students to the nonprofit partner organizations. Once students are recruited, the coaching activities typically start during the first fall semester of college.[6]

SBC calls for local colleges to ***partner*** with the nonprofits and coaches to coordinate coaching activities on their campuses. Each year between seven and nine local nonprofit coaching organizations provided SBC coaching.

Once students are confirmed as coaching participants, coaches ***connect*** with them through multiple modes—in person or via text, email, or phone—to help students navigate the college-going process. Through this program, students can access one-on-one coaching during their first two years of college, with most students receiving coaching starting in their first fall semester. Through one-on-one meetings, coaches provide ongoing ***support*** to students across a range of topics and ***refer*** students to supports on their campuses. Specifically, SBC coaches work with students to prepare them to become independent college students able to navigate their way to college graduation. SBC coaches provided support on life skills, study skills, help-seeking skills, and academic skills. They also helped students develop meaningful relationships with their campus community (peers, faculty, and staff), clarify goals, access networks and resources, understand college culture, and make college life feasible. SBC coaches also provided job and career mentoring.[7]

In addition to these coaching supports, SBC students also received direct support in filling out financial aid forms. This support was provided by uAspire, a national nonprofit organization focused on increasing knowledge and resources to make college affordable. In addition to direct support, uAspire administered a text message program for SBC students to send financial aid–related information and reminders. Students received automated text messages throughout their first year of college, with the option to reply back to receive help from a uAspire staff member. uAspire also provided periodic professional development to SBC coaches on financial aid–related topics and processes. Together, the components of the SBC model

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6 Typically, students' first interactions with their coaches occur at the start of their first fall semester. Seventy-one (71) percent of students who started college in fall 2014, and 87 percent of students in who started college in 2015, first interacted with their coaches during the first fall semester of college (Linkow et al. 2015; Linkow et al. 2017b).

7 For more about student recruitment and coaching interactions with students, the specific nonprofit organizations providing coaching each year, and how SBC was implemented, see the prior reports *Degrees of Coaching: Success Boston's Transition Coaching Model* (Linkow et al. 2015) and the *Success Boston Coaching for Completion 2015-16 Implementation Report* (Linkow et al. 2017b).

are focused on supporting students in their first two years of college and preparing them to succeed through to completion and into their careers.

1.2 About This Report

Given earlier evidence and TBF's continued investment in BPS students' postsecondary success, TBF contracted with Abt Associates to conduct a comprehensive evaluation of the transition coaching program. The evaluation is designed to answer questions about the implementation and impacts of SBC transition coaching.

Earlier reports focused on implementation of SBC (Linkow et al. 2015; Linkow et al. 2017b) and on impacts of SBC on students' successes in the first two years of college (Linkow et al. 2017a; Linkow et al. 2019). This report explores the effectiveness of SBC on longer-term college outcomes, including students' credit accumulation after four years of college, persistence into their third through seventh years of college, and completion of degrees and certificates after four, five, and six years of college.

Specifically, the research questions addressed in this report are:

1. *What are the effects of SBC on students' academic achievement, college persistence, and completion rates?*
2. *How, if at all, do these impacts vary by student characteristics?*

Before we turn to study specifics, we summarize relevant literature about what we might expect to learn about the impact of transition coaching (Chapter 2). Next we review the study's design, analysis approach, data sources, and measures (Chapter 3). Chapter 4 summarizes the findings of impact analyses separately for each student outcome, including postsecondary completion, persistence, and credit accumulation; it also examines how these impacts vary by student characteristics. The report concludes with a discussion and recommendations (Chapter 5).

2. Efforts to Improve College Enrollment and Completion

This chapter begins by describing the barriers to college enrollment and completion for students from low-income backgrounds and racial/ethnic minority groups. Then the chapter describes recent research on the impact of coaching interventions in varied contexts. It concludes by reviewing current research on the SBC program.

2.1 Barriers to College Enrollment and Completion

A college degree represents an opportunity for socioeconomic mobility; when children born into the lowest 20 percent of the income distribution receive a four-year college degree, their chances of escaping that bottom tier increase by more than 50 percent (Isaacs, Sawhill, and Haskins 2008), reflecting the well-documented significant and positive economic returns to a bachelor's degree (Aud et al. 2012; Carnevale, Rose, and Cheah 2011). A college degree is also related to improved social and health outcomes (Baum, Ma, and Payea 2013; Hout 2012; Meara, Richards, and Cutler 2008).

Despite an overall increase both nationally and locally in college-going rates in recent decades, students from low-income backgrounds and racial/ethnic minority groups are less likely to attend, persist, and complete college than their peers (e.g., U.S. Department of Education 2019; Haskins 2008; Bailey and Dynarski 2011). Across the income distribution, only 46 percent of those from the lowest income quartile attended a postsecondary institution, compared with 78 percent of those from the top income quartile. College completion rates among low-income students paint an even bleaker picture: only 16 percent of youth from the lowest income quartile attain a bachelor's degree, compared with 62 percent of those from the top income quartile (Cahalan et al. 2020).

BPS graduates are disproportionately from groups traditionally underrepresented in postsecondary education. Almost one-half (43 percent) of BPS graduates are Hispanic and about one-third (33 percent) are Black non-Hispanic; nearly three-quarters (72 percent) are economically disadvantaged (BPS 2019). Success Boston's recent *Staying the Course* report highlights racial/ethnic and gender disparities in the college successes of BPS graduates. White and Asian students were more likely than their Black and Hispanic peers to enroll in college and to earn a college credential, and female students across all racial groups were more likely to graduate from college than male students (McLaughlin and Van Eaton 2018).

In today's knowledge-based economy, disparities in college enrollment and completion rates for male students, students of color, and low-income students place them at a distinct disadvantage in the workforce because college education can be a gateway to the middle class (e.g., Ayala and Striplen 2002; Haskins 2008; Pfeffer and Hertel 2015). In Boston, the education gap has consequential effects on median annual earnings: adults age 25 and older with a bachelor's degree earn, on average, $66,212—nearly twice what high school graduates earn (U.S. Census Bureau 2019). Adults with Associate's degrees also earn higher wages on average, and are less likely to be unemployed than those with only a high school diploma (U.S. Census Bureau 2019; Vuolo, Mortimer, and Staff 2016). In fact, adults with an Associate's degree earn more than $259,000 over the course of their respective careers than do high school graduates (Klor de Alva and Schneider 2013). Associate's degree holders who focused on occupational and technical skills (e.g., healthcare, high-end manufacturing), in particular, have even greater earnings potential than do other associate's degree and some bachelor's degree recipients (Klor de Alva and Schneider 2013).

Low rates of college attendance and completion among students from low-income backgrounds and racial/ethnic minority groups are attributed in part to informational and support gaps for these students

both before and once they enroll in college (Arnold et al. 2009; Avery and Kane 2004; Avery, Howell, and Page 2014; Bozick and DeLuca 2011; Roderick et al. 2008). In a phenomenon called "summer melt," low-income college-intending high school graduates fail to matriculate to the college of their choice in the fall following their senior year of high school (Arnold et al. 2009; Castleman, Arnold, and Wartman 2012; Castleman, Page, and Schooley 2014). Summer melt has been attributed to gaps in support available to students during the summer, particularly as they encounter difficulties navigating financial aid options and completing numerous time-sensitive administrative tasks, such as completion of the Free Application for Federal Student Aid (FAFSA) and course registration (Arnold et al. 2009; Castleman, Arnold, and Wartman, 2012; Castleman and Page 2015; Castleman, Page, and Schooley 2014).

Even once enrolled, students from groups traditionally underrepresented in college, in particular, may lack access to professional guidance to help them navigate the financial aid process (Arnold et al. 2009; Bettinger et al. 2012; Roderick et al. 2008) or to prompt them to meet unfamiliar deadlines (Hoxby and Turner 2013; Ross et al. 2013). Students from low-income backgrounds and racial/ethnic minority groups are more likely to be first-generation-college students (U.S. Department of Education, 2016) whose parents and peers are unfamiliar with the challenges students can face when entering college (Castleman and Page 2013; Stephens et al. 2015).

Students who are new to college can also experience a range of academic challenges, including unanticipated course difficulty, uncertainty about how to select the appropriate courses to meet degree completion requirements, and time allocation management across classes. Further, too many first-generation-college students enter higher education underprepared for college-level academic demands, which can affect their capacity to persist and complete college degrees (Greene and Winters 2005; Engle and Tinto 2008).

Moreover, academic advisors might have limited time to provide the level of support students need, particularly students attending public institutions. A survey of college academic advisors found that the median caseload of a full-time academic advisor is 441 advisees at public community colleges and 260 advisees at public four-year colleges (Carlstrom and Miller 2013). A separate study, based on a national survey of college counseling center directors, found that the counselor-to-advisees ratio is 1 to 1,500 for 55 percent of community colleges (Gallagher 2010).

Coaching is a promising intervention to help students manage the financial, administrative, and academic obstacles they can face in college (Avery and Kane 2004; Bettinger, Boatman, and Long 2013; Deming and Dynarski 2009; Roderick et al. 2008). SBC designates coaches employed by nonprofit organization partners to work with high school graduates as they enter and adjust to college. As such, SBC aims to bridge the gap for students who might not have sufficient resources and supports during the transition from high school to college.

2.2 Research on Impact of Transition Coaching

Over the past decade, several studies, including studies that use a lottery-like process called random assignment to determine which students receive coaching, find that coaching interventions significantly increase students' college matriculation and persistence. Exhibit 2-1 summarizes the characteristics of several college success programs with coaching or advising as a core component that have been rigorously evaluated. The programs each differ somewhat in their eligibility requirements; or the participant characteristics; or the content of advising they provide; or how they provide financial assistance, if at all; or in the duration and intensity of the support. Yet the similarities between the

programs' activities provide meaningful insights on the potential effects of coaching or advising for students during their transition to college.

Ongoing, regular support once students are enrolled in college can help keep them on track. Coaching can help students struggling to stay on task in their courses by identifying additional supports that can promote persistence and graduation (Avery et al. 2020; Bettinger and Baker 2014; Bettinger, Boatman, and Long 2013; Castleman and Page 2015; Karp 2011; Johnson and Rochkind 2009; Oreopoulos and Petronijevic 2016; Swecker, Fifolt, and Searby 2013). For example:

- A study that examined college academic advising found positive effects on college persistence. The advising focused on connecting students to academic resources on campus. The odds of a first-generation-college student remaining enrolled at a given college increased 13 percent for every meeting with an advisor (Swecker, Fifolt, and Searby 2013).
- A random assignment study that examined the effect of the Inside Track program found positive impacts on college persistence. The program provides virtual one-on-one coaching to help and support students as they start their college careers and throughout their first year of college. First-year students attending eight different postsecondary institutions, including two- and four-year schools, who received targeted coaching were 15 percent more likely to have persisted in college 18 to 24 months later than those who did not receive the coaching (Bettinger and Baker 2014).
- An evaluation of the Bottom Line college advising program showed positive effects on four-year college enrollment and persistence. Students offered counseling during high school were 7 percentage points more likely to enroll in college in the fall after high school graduation and 10 percentage points more likely to enroll in a four-year college. Students who received counseling once enrolled in college were 7 percentage points more likely to persist into the second year of college than students in the control group in the same schools (Barr and Castleman 2018).
- A study of the Opening Doors program in Ohio randomly assigned students in community colleges either to a regular college counselor or to a program counselor. It found positive impacts on students' academic achievement. Program students were expected to meet with their Opening Doors counselors at least twice each semester during the students' first year of college to check in about their academic progress. Although the program improved academic outcomes during students' second semester in the study, it did not significantly increase the average number of credits that students earned after the program ended or over the study's three-year follow-up period, nor did the program have any impact on degree or certificate completion at three years (Scrivener and Weiss 2009).
- A random assignment study of a peer coaching program at the University of Toronto found positive impacts on first-year students' academic achievement. The peer coaches met regularly with students to provide one-on-one support (either in person or via Skype) on a variety of college-related topics. Students who received coaching had significantly higher average grades and overall GPAs: approximately a 5 percentage point increase in average course grades and a 0.35 standard deviation increase in GPA versus students who did not receive coaching (Oreopoulos and Petronijevic 2016).

Programs that combine coaching with financial assistance can result in gains in student persistence and completion (Clotfelter, Hemelt, and Ladd 2017; Gupta 2017; Miller et al. 2020; Page et al. 2019;

Ratledge et al. 2019; Rolston, Copson, and Gardiner 2017; Scrivener et al. 2015). Professional coaches often support students in these programs through tutoring, financial aid counseling, and career advising.

- A random assignment study of the Accelerated Study in Associate Programs (ASAP), operated by the City University of New York (CUNY), showed that participation resulted in large gains in community college persistence and completion. Students participating in ASAP received intensive advising from an ASAP-dedicated advisor with a small caseload, career information from career and employment services staff, and dedicated tutoring services. ASAP also required students to attend full-time, and it included free tuition, textbooks, and transportation. Participation in ASAP increased students' likelihood of receiving a degree by 18 percentage points and transferring to a four-year institution by nearly 8 percentage points during the study's three-year follow-up period (Scrivener et al. 2015). Even six years after the start of the program, ASAP continued to increase graduation rates; 51 percent of program group students versus 41 percent of control group students had earned degrees (Gupta 2017). Further, an evaluation of the ASAP Ohio Demonstration, a replication of CUNY's ASAP, found that the program doubled graduation rates (Miller et al. 2020).
- A random assignment study of Project QUEST, which aims to help low-income adults pursuing healthcare careers earn postsecondary education credentials, found positive impacts of the program on enrollment and educational attainment. In addition to counseling on personal and academic issues, Project QUEST provides students with a variety of other supports, including tutoring; remedial instruction in preparation for college placement exams; job placement assistance; weekly meetings on study skills and life skills (e.g., time management); referrals to external agencies for assistance with food, utilities, childcare, and other needs; and financial assistance to cover tuition and fees as well as transportation and other expenses. The Project QUEST participants in this study were ages 25-64, had high school diplomas, and had children under age 18; on average, they received support for almost two years (22.6 months) after random assignment. Relative to non-participants, Project QUEST participants were 21, 11, and 12 percentage points more likely to be enrolled in college in the first, second, and third years after random assignment, respectively, though there were no significant effects on enrollment in the fourth through ninth years. Project QUEST participants were also 16 percentage points more likely to earn a postsecondary education credential (certificate or diploma, associate's degree, or bachelor's degree), relative to the comparison group, in the nine years after random assignment (Roder and Elliot 2020).
- A random assignment study of the Detroit Promise Path found positive impacts on community college enrollment and persistence. Detroit Promise scholarship recipients either received the scholarship only or received the scholarship plus additional coaching and a $50 monthly incentive beginning the summer after high school. Students offered the Detroit Promise Path program were more likely than students not offered the program to enroll in college. Specifically, the offer resulted in a 5 percentage point increase in college enrollment in the first semester after random assignment, and an 8 percentage point increase in enrollment in the second semester after random assignment. Promise Path students earned 25 percent more credits in their first year of college than the control group. Impacts for the second year are more modest (Ratledge et al. 2019).
- A study of the Dell Scholars program used two quasi-experimental strategies to evaluate the effectiveness of the program on four-year college success. The program provides motivated, low-income students with a $20,000 scholarship and personal assistance to help students with

challenges they can face in completing college, including dealing with stress, managing childcare, and other life circumstances. Compared to their non-Scholar counterparts, Dell Scholars were 8 to 12 percentage points more likely to persist into their third year of college, 6 to 10 percentage points more likely to earn a bachelor's degree within four years, and 9 to 13 percentage points more likely to earn a bachelor's degree within six years (Page et al. 2019).

- A study of the Carolina Covenant used two quasi-experimental strategies to evaluate four-year college success for two cohorts of students eligible for the Covenant: the first received scholarship funds and the second received the scholarship and nonfinancial supports including, but not limited to, peer mentoring, learning disability services, and cultural experiences. There was no statistically significant impact of the Covenant on four-year college graduation rates for students in either cohort. However, students who received the scholarship plus nonfinancial supports were more likely to accumulate credits on time and had a higher GPA on average than similar non-Covenant peers (Clotfelter, Hemelt, and Ladd 2017).

Though impacts on student outcomes for these studies are generally positive, the magnitude of the impacts and the outcomes on which impacts are detected varies. Castleman, Page, and Schooley (2014) attribute differences in impact to several factors related to the intervention itself, including differences in the rates of student communication with advisors; amount of attention each student received from their counselor; and prior experience coaches had with supporting students' college enrollment tasks. Also differences in student access to other supports, particularly financial support, can play a role in program effectiveness.

Exhibit 2-1: Characteristics of college coaching programs

Program Name	Professional Coach or Peer Coach	Timing, Frequency, Duration of Coaching (typical/ average)	Students Served	Program/College Type	Amount of Financial Support Provided	Transportation, Other Financial or In-Kind Supports	Participation Requirements	Positive Impact
Success Boston Coaching	Professional	First 2 years of college; 8x a year; 30 minutes per session	Must be a graduate from a Boston high schools or Boston resident and age 17-22 Typically from low-income households, Black, and Hispanic	2-year, 4-year	None	Transportation subsidy	None	See this study
ASAP (Scrivener et al. 2015; Gupta 2017; Miller et al. 2020)	Professional	Up to 3 years; 8x+ in 1st and 2nd semesters, 6x+ in 3rd, 4th, 5th semesters; 16-30 minutes per session	CUNY ASAP: Must be from low-income household, NYC resident, in ASAP eligible major, < 12 credits earned, >2.0 GPA, need 1 or 2 development courses ASAP OHIO: Must be from low-income household, degree program could be completed in 3 years, < 24 credits earned	2-year	Tuition waiver	Transportation subsidy, free use of textbooks, access to individual career and employment services, tutoring	Full-time enrollment, must attend tutoring if GPA falls below 2.0 (CUNY ASAP only)	• Enrollment and full-time enrollment (CUNY and Ohio) • Persistence (CUNY and Ohio) • Credits earned (CUNY and Ohio) • Associate's degree completion (CUNY and Ohio)
Bottom Line (Barr and Castleman 2018)	Professional	Access: 1 hour every 3 to 4 weeks throughout high school Success: 3-4x semester first year of college and 2x semester thereafter	Must have high school GPA > 2.5 Typically from low-income households	2-year, 4-year	None	None	No information provided	• Enrollment (2-year and 4-year colleges) • Persistence (2-year and 4-year colleges)
Carolina Covenant (Clotfelter, Hemelt, and Ladd 2017)	Peer	No information provided (funding is provided for up to 8 semesters)	Must be from low-income household, admitted to UNC-Chapel Hill and first-time, full-time undergraduate student	4-year	Tuition and fees after financial aid (unmet need)	Targeted summer support	Full-time enrollment, make good academic progress toward a degree	• Credits earned • GPA
Dell Scholars (Page et al. 2019)	Professional	Up to 4 years	Must be from low-income household, participate in college-readiness program, and have high school GPA > 2.4	4-year	Up to $20,000	Laptop, textbooks	No information provided	• Persistence • Bachelor's degree completion

Program Name	Professional Coach or Peer Coach	Timing, Frequency, Duration of Coaching (typical/ average)	Students Served	Program/College Type	Amount of Financial Support Provided	Transportation, Other Financial or In-Kind Supports	Participation Requirements	Positive Impact
Detroit Promise Path (Ratledge et al. 2019)	Professional	First 2 years and potentially beyond; 2x per month	Students from Detroit Typically Black and from low-income households	2-year	Tuition and fees after financial aid (unmet need)	$50 gift card for transportation, books, other expenses	Full-time enrollment encouraged	• Enrollment and full-time enrollment • Persistence • Credits earned
Inside Track (Bettinger and Baker 2014)	Professional	2 semesters (first year of college); 5x+ in total	No specific groups	2-year, 4-year	None	None	None	• Persistence
Opening Doors Program (Scrivener and Weiss 2009)	Professional	2 semesters; about 8x in total	Must be from low-income household, age 18-34, have high school diploma or GED, < 13 credits earned, experienced academic difficulties; must not have an AA degree	2-year	$150 for two semesters, $300 total	None	None	• Credits earned (while participating in the program)
Project Quest (Roder and Elliot 2020)	Professional	Up to 2 years of college through job placement	Must be adults from low-income households, pursuing health-care jobs Typically female and Latino students	Certificate and 2-year	Tuition and fees	Transportation subsidy, financial assistance for books, uniforms, licensing exams, tutoring.	Full-time enrollment (after remedial courses and prerequisites)	• Enrollment and full-time enrollment • Persistence • Credential completion
Unnamed program (Swecker, Fifolt, and Searby 2013)	Professional	1 year; 3x+ in total	First-generation college students	4-year	None	None	Full-time enrollment	• Persistence
University of Toronto Peer Coaching Program (Oreopoulos and Petronijevic 2016)	Peer	First year of college	First-year students in introductory economics course	4-year	None	None	No information provided	• GPA • Credits earned

2.3 Research on Success Boston Coaching

Prior research focused specifically on SBC provides promising evidence of the benefits to coaching. In 2014, the Center for Labor Market Studies at Northeastern University used a matched comparison group design to compare outcomes for BPS 2009 graduates who did and did not participate in SBC (Sum, Khatiwada, and Palma 2014). The study found preliminary evidence of a positive and statistically significant effect on college persistence. SBC students were more likely than their non-coached peers to persist in each of the first four years of college, with estimated effects of 17, 18, 15, and 12 percentage points in the first, second, third, and fourth years, respectively. Although SBC students outperformed each of their comparison group counterparts, persistence rate impacts varied slightly by gender and ethnicity, and impacts were generally greater for Black students. Specifically, SBC impacts on persistence were larger for Black students than for their Hispanic peers (25 percent versus 13 percent).

Sum, Khatiwada, and Palma (2014) also conducted analyses that controlled for student demographics, students' 10th-grade Massachusetts Comprehensive Assessment System (MCAS) English/language arts scores, and the type of colleges students initially attended. They found positive and statistically significant effects on college outcomes for BPS 2009 graduates as of 2013.

Success Boston's *Reaching for the Cap and Gown* report (McLaughlin et al. 2016) provides a descriptive examination of college enrollment and completion for participants in SBC for the BPS Class of 2009, comparing them with non-participating students. The report found that the coached and non-coached students who enrolled in four-year colleges immediately following high school generally completed college at similar rates of about 60 percent, quite similar to the national six-year completion rate of 62 percent for students entering four-year colleges in the fall of 2009 (Shapiro et al. 2019). SBC students had an edge when attending two-year colleges, however: among students who originally enrolled at two-year colleges, 35 percent of SBC students versus 24 percent of non-participating students completed a degree or other credential within six years.

The *Reaching for the Cap and Gown* report also examined outcomes at the seven top-enrolling colleges and universities (as had Sum and colleagues in their 2013 and 2014 reports), and it found that nearly half (49 percent) of SBC students at these colleges completed a degree, compared with 38 percent of non-coached students. Further, the overall completion rates for Black SBC students—who represented more than one third (36 percent) of SBC students—were higher than the completion rates of Black students who did not participate in coaching through Success Boston: 53 percent versus 41 percent.

Recently, the SBC interim impact report (Linkow et al. 2017a) examined impacts for two earlier cohorts of students: those who graduated from BPS in 2013 and 2014 and entered college in the fall of 2013 and 2014, respectively. Using a rigorous quasi-experimental design, the report compared outcomes for the group of students who participated in SBC versus those of a group of similar students who did not participate. As such, the report provides evidence that observed differences in outcomes between the two groups are due to participation in Success Boston coaching.

Those analyses estimated that SBC students (the "treatment group" in the evaluation) had better early college outcomes than did their carefully matched peers not participating in SBC ("comparison group"). Specifically, SBC students were more likely to persist into their *second* year of college (83 percent for the treatment group versus 75 percent for the comparison group), more likely to persist into their *third* year of college (75 percent versus 62 percent), and more likely to complete renewals of the FAFSA for their second year of college (85 percent versus 78 percent) (Linkow et al. 2017a).

A second impact report found that SBC continued to have significant positive effects on early college outcomes after it was expanded to serve more students across a greater number of colleges. Using a similar design to the 2017 report, this follow-up study followed students who graduated high school in 2015 and 2016 through their first two years of college. The study found that among these later cohorts of students, SBC students were more likely than comparison students to persist into their second year of college (82.6 percent for the treatment group versus 78.3 percent for the comparison group), more likely to be enrolled full-time (67.3 percent vs. 63.6 percent), accumulated more credits toward their degree or certificate (45.5 percent of the credits required to graduate versus 42.5 percent), and submitted their FAFSAs at higher rates (83.9 percent versus 77.7 percent) (Linkow et al. 2019).

The current study builds on the 2014 Center for Labor Market Studies study described above (Sum, Khatiwada, and Palma 2014). It uses a more rigorous design that matches students more systematically, uses more extensive baseline characteristics in the matching process, and includes not just one but several cohorts of students. The current study also examines additional student outcomes, including academic achievement and college graduation rates. And it investigates how differences in key programmatic features affect student outcomes. Chapter 3 describes the current study design in greater detail.

3. Evaluation Design

In this chapter, we begin with an overview and then describe the evaluation design in more detail. The chapter outlines the quasi-experimental approach we used to estimate program impacts. Then it describes the study sample—both the program students and the non-coached matched students who make up the "comparison group." Next the chapter describes our approach to exploratory analysis—that is, how we examine *variation* in impacts, namely the relationship between *impacts* on students and *variation* in impacts according to student characteristics and features of coaching. The chapter then summarizes the data sources, outcomes, and measures of student characteristics used to explore how program impacts vary according to those characteristics.

3.1 Study Design

This study uses a quasi-experimental design in which outcomes are compared for students who participated in SBC (treatment group) versus students who did not (comparison group). This report examines impacts for students who graduated from BPS and surrounding districts between 2013 and 2016; who have been out of high school for four to seven years; and, who entered college in the fall of 2013, 2014, 2015, and 2016. The study created a comparison group of students who are as similar to the treatment students as possible, as explained in greater detail below.

3.1.1 How We Identified Students in the Sample

Students participating in the SBC program are identified in the program's administrative database. All students who appear in the database are considered SBC students for purposes of the evaluation. This inclusive definition means that all students who were initially recruited into the SBC program, and therefore appear in the program database, are eligible to be in the evaluation sample even though some did not have a single recorded interaction with a coach.[8] A total of 2,861 students are identified as SBC students in the 2013-2016 college-entering cohorts. The comparison group is identified from 49,759 high school graduates in the 2012-13, 2013-14, 2014-15, and 2015-16 school years from BPS and surrounding districts.

To be eligible for the evaluation sample, students had to:

- enroll in college in the fall after high school graduation;
- enroll in a college in which at least one SBC student and at least one potential comparison student were enrolled in that given year; and

[8] For example, in the 2016-17 academic year, 2 percent (37 students) of the 2015 and 2016 cohorts had no coaching interactions recorded in the program database.

- have no missing information on two key baseline characteristics used in the matching process: high school GPA and free/reduced-price lunch status.[9,10]

After applying the eligibility criteria, there were 2,197 SBC students and 11,238 non-SBC students who could be included in the evaluation sample.[11] Eligible students for the comparison group attended public high schools in BPS and 21 surrounding districts, plus an additional 12 charter schools.[12] Students included in the evaluation sample were selected through a *local and focal matching* process described in detail below.

3.1.2 How We Test Program Impacts Using a Matched Comparison Group

Overview of the Matched Comparison Group Design

In social science research, an *experimental* design is considered the gold standard approach for testing program impacts. Experimental designs use a lottery-like process known as "random assignment" to (1) form treatment and comparison groups, (2) present the treatment group with an intervention ("the treatment") and exclude the comparison group from the treatment, and (3) then compare outcomes for the two groups to test whether the treatment group has different (presumably better) outcomes than the comparison group. Because the two groups are formed randomly, they are expected to be statistically

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9 We consider high school GPA and free/reduced price lunch status to be key characteristics because the U.S. Department of Education's What Works Clearinghouse (WWC) requires that if outcomes cannot be measured pre-intervention (such as college completion and persistence), then baseline equivalence must be established on pre-intervention measures of both student academic achievement and student socioeconomic status. Establishing baseline equivalence on these measures is required in order for the study to be eligible to meet WWC (2019b) evidence standards.

10 A student's eligibility for free or reduced-price meals under the U.S. Department of Agriculture's school nutrition program is commonly used measure of a student's low-income status. However, starting in the 2014-2015 school year, the Massachusetts Department of Elementary and Secondary Education (DESE) adopted a new metric of economic disadvantage. This new "economic disadvantage" measure is based on a student's participation in one or more of the following assistance programs: the Supplemental Nutrition Assistance Program, the Transitional Assistance for Families with Dependent Children, the Department of Children and Families foster care program, and MassHealth (Massachusetts' Medicaid program) (Massachusetts Department of Elementary and Secondary Education 2015). Although this measure is now DESE's preferred income measure, it is not available for the earliest cohort (the 2013 cohort)—unlike free and reduced-price status, which is available for all cohorts. Consequently, in our analysis we use free and reduced-price status to measure low-income status across all cohorts for consistency.

11 For a detailed description of the sample eligibility for the 2013 and 2014 cohorts and the 2015 and 2016 cohorts, see *The Power of Coaching: Interim Report on the Impact of Success Boston's Transition Coaching on College Success* (Linkow et al. 2017a) and *The Story of Scaling Up: Interim Report on the Impact of Success Boston's Coaching for Completion* (Linkow et al. 2019) reports, respectively.

12 ***Districts*** that provided comparison students included Avon, Boston, Braintree, Brockton, Cambridge, Chelsea, Everett, Fitchburg, Lawrence, Lowell, Malden, Medford, Milton, Norwell, Norwood, Quincy, Randolph, Revere, Somerville, West Bridgewater, Weymouth, and Worcester. ***Charter schools*** that provided comparison students included Boston Collegiate Charter School, Boston Day and Evening Academy Charter, Boston Green Academy Horace Mann Charter School, Boston Preparatory Charter Public School, City on a Hill Charter Public School Circuit Street, Codman Academy Charter Public School, Edward M. Kennedy Academy for Health Careers (Horace Mann Charter School), MATCH Charter Public School, Mystic Valley Regional Charter School, Phoenix Charter Academy, Pioneer Charter School of Science, and South Shore Charter Public School.

equivalent in all relevant characteristics, so that any differences in outcomes can be attributed to the intervention and not to some other characteristic(s) that might have influenced both participation in the program and outcomes Those characteristics might be, for example, various dimensions of academic or non-academic achievement levels, including non-cognitive skills and such unobservable characteristics as motivation.

Because an experimental design was not possible for SBC, given partner organizations' capacity and the size of the potential participant population, we used one of the strongest *quasi-experimental* designs available. This design allows us to account for as many of the observable student background characteristics as possible, to help ensure that the treatment and comparison group students are statistically similar *before* participation in SBC.[13] For example, one potential difference in background characteristics between program participants and non-coached students could be academic readiness for college. Students who participate in SBC do so voluntarily; they could simply be more academically prepared to attend college than students who do not sign up for SBC. Differences such as these ("confounders") present an important methodological challenge. If we did see any differences in student outcomes between treatment and comparison group students, we would need a way of distinguishing whether those outcome differences were due solely to the treatment students' coaching, or whether they were also due (at least in part) to differences between treatment and comparison students' background characteristics.

We addressed this methodological challenge by choosing a quasi-experimental method that compares SBC students with a comparison group of similar students and that can account for as many of these confounders as possible. Guided by current methodological research on best practices for such studies, we used a *local and focal matching* process to construct the strongest comparison group possible (Bifulco 2012; Clair, Cook, and Hallberg 2014; Steiner, Cook, and Shadish 2011). The approach is "local" in that each SBC student is matched with one (and possibly multiple) non-SBC students from the same high school graduating class, from high schools with similar characteristics, and enrolled in the same college.[14] It is "focal" because treatment and comparison students are carefully matched based on similar baseline characteristics (e.g., gender, race/ethnicity, high school academic achievement, socioeconomic status) both empirically linked to the study's key outcomes and also potentially linked to receipt of coaching.

For this evaluation, we implemented local and focal matching by (1) defining "matching blocks"— that is, unique combinations of cohorts (2013, 2014, 2015, or 2016 high school graduation years) and postsecondary institutions; and (2) matching each SBC student with one and possibly multiple non-SBC students in their block who share similar baseline characteristics. These matching criteria yield a large number of matching characteristics, which we translate into estimated *propensity scores*, or the probability of participating in SBC. We describe the matching process below, and provide additional information on local and focal matching in Appendix A.

Estimation of the Propensity Scores

One of the simplest ways to match treatment and comparison groups would be to form matched pairs with the same baseline characteristics (i.e., exact matching). For example, we could match female students in

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[13] Varied recruitment strategies (referrals, organizations' pipelines, word-of-mouth) and staggered timing (end of high school, summer, or start of college) reduce the chance that unmeasured characteristics related to both participation in coaching and outcomes cause any impacts that are found.

[14] The matching blocks include students from BPS and nearby districts with similar characteristics to BPS.

the treatment group with female students in the comparison group. Though straightforward, this approach becomes infeasible as the number of characteristics used in the matching increases. Instead, we use *propensity score matching*, because it allows us to account for a diverse set of background characteristics and experiences within a single measure.

More specifically, a propensity score is a number that represents the likelihood of receiving the treatment, based on a student's background characteristics and experiences (Rosenbaum and Rubin 1983, 1984, 1985). For this study, drawing from student-level data from BPS and the Massachusetts Department of Elementary and Secondary Education (MA DESE), the propensity score represents the likelihood that an individual student participates in SBC, based on the following baseline characteristics:

- **Student demographics**: age, race/ethnicity, gender, free/reduced-price lunch status, disability status, and English language learner (ELL) status
- **Student high school achievement**: GPA, SAT scores, 10th-grade Massachusetts Comprehensive Assessment System (MCAS) scores, and number of advanced courses taken in high school
- **Student behavioral measures**: school absenteeism and number of suspensions
- **Characteristics of high schools**: college-going rate, high school-level average MCAS math and English scores[15]
- **Post-high school plans and college aspirations**: expected education plans after high school, whether the student felt prepared for college, whether the student was contacted by a post-high school organization, and when the student talked with parents about post-high school plans (available only for BPS graduates in the 2013 and 2014 cohorts)
- **Extracurricular activities in high school**: number of extracurricular activities and whether the student held a paid job in high school (available only for BPS graduates in the 2013 and 2014 cohorts)

(For a complete list of student and high school characteristics used in the propensity score model, see Exhibit A-4 in Appendix A.) We selected the specific variables listed above based on a comprehensive literature review and on information from coaching organizations about criteria they use when selecting and/or targeting students for their programs. (Exhibit A-2 and Exhibit A-3 in Appendix A summarize key features from the literature review.) Using this set of characteristics, we estimated a propensity score for each student in the matching blocks, including treatment students and potential comparison group students. Propensity scores can range from 0 to 1, with numbers closer to 1 representing a greater likelihood that a student receives the SBC treatment.

Conducting Matching

Once propensity scores were estimated, the next step involved matching SBC students in each matching block with potential comparison group students in the same block. Among the possible matching methods, we used *radius matching*, by matching each treatment student with all potential comparison students whose propensity scores were within the pre-specified range ("caliper") of his/her score (± 0.4 of the standard deviation of the propensity scores) in his/her block. We chose this method because it balances two important aspects of matching: closeness of the matches and size of the matched groups.

[15] We computed the high school-level averages using the student-level data provided by BPS and MA DESE.

Using a caliper ensures that a treatment student is matched with comparison students with sufficiently similar propensity scores. Including all comparison units within the caliper maximizes the size of the analytic sample and thus statistical power. (Appendix A provides additional information about the propensity score matching process.)

Assessing Baseline Balance

After matching SBC students to non-coached students, we checked to see whether the two groups were "balanced" (i.e., whether the treatment group was similar to the comparison group on background characteristics). Following Steiner et al. (2010) and Rubin (2001), we assessed the similarity ("balance") between the treatment and matched comparison students at baseline using the standardized difference in the means of the matching characteristics between treatment and comparison students. We required that the difference be less than 0.15 (or 15 percent of a) standard deviation (SD) in absolute value. This is more stringent than the U.S. Department of Education's What Works Clearinghouse's (2019a) requirement that baseline differences between quasi-experimental treatment and comparison groups to be less than 0.25 SD to meet its evidence standards.

We continued matching and checking baseline balance until satisfactory balance was achieved. In that process, when we found they had not balanced, the corresponding propensity score model was re-specified (e.g., by including interaction terms or higher-order terms) and the matching and baseline assessment processes were repeated. In order to achieve balance on key demographics, we also impose exact matching by gender (female or not) and by one race category (Black or not). When satisfactory balance was achieved for all matching covariates, we stopped and the resulting comparison group was treated as final.

We are examining several different outcomes, and *all* the possible data for every single student were not consistently available. For this reason, the various outcome findings reported in Chapter 4 are based on slightly different analytic samples. The reason for this is that data were not available for all students for all outcomes. For some outcomes, not enough time has elapsed for the outcome to be measured for all students. For example, the 2013 cohort is the only cohort for which had enough time elapsed for us to measure persistence into the seventh year of college. In the case of another outcome, credit accumulation, data were missing for some students primarily because data on that outcome are provided only by particular colleges. Nine colleges provided data for the evaluation on students entering college in fall of 2013 and fall of 2014; and 11 colleges (the nine plus two additional colleges) provided data on students entering in fall 2015 and fall 2016. Of the students who met the eligibility criteria to be included in the evaluation sample, the majority of students (77 percent) in the 2013 and 2014 cohorts, and half of the students (49 percent) in the 2015 and 2016 cohorts, first enrolled in one of these colleges in the fall immediately after their high school graduation.

To be thorough, we conducted matching and assessed baseline balance separately for each outcome. Before matching, the treatment and potential comparison group students differed on some background characteristics. However, by applying the matching techniques described above, we were able to minimize these differences. By confirming that the two groups were similar on observable characteristics such as these, we could rule out the possibility that these characteristics themselves accounted for any observed differences in outcome between SBC and non-coached students. For more information about baseline equivalence, including pre- and post-matching differences for each outcome and analysis, please see Appendix A.

3.1.3 How We Estimate the Average Impact of the Program for the Full Sample

In estimating outcomes for our primary research question, *What are the impacts of SBC on all students?*, we sought to balance two key interests. The first interest was in maximizing "statistical power"—our ability to detect any effects of SBC—which increases as the number of students in our analytic sample increases. Moreover, when an intervention is scaled up by a provider, it is a common practice in educational research to examine whether and how any impacts of the program might (or might not) change after the scale-up, as sometimes programs become more effective or less effective when they serve more students. As a result, our second interest was in exploring how the impacts of SBC changed (if at all) after the 2015 scale-up.[16] To balance these two interests, our models pool the two cohorts of students entering college before the scale-up (2013 and 2014) and also pool the two cohorts of students entering college after the scale-up (2015 and 2016). In Chapter 4, we present results for the two sets of cohorts separately.

To estimate the impacts of SBC on all students, we use a linear regression model that includes indicators for the matching blocks (defined based on student cohorts and postsecondary institutions) and student- and school-level matching characteristics. We estimate impacts separately for each outcome measure with the corresponding matched treatment and comparison groups. The model includes, as covariates, all matching characteristics used to construct the corresponding comparison group, in order to increase precision of the impact estimates and be doubly robust.[17] The models did not explicitly adjust the standard errors for the clustering of students within postsecondary institutions because we anticipated that such clustering was captured by the matching block indicators.[18] We conducted sensitivity tests with different covariate sets and alternate sample definitions, which yielded similar results (see Appendix B for more information).

3.1.4 How We Conduct Exploratory Analyses of Program Impacts

The second research question, *How, if at all, do the SBC impacts vary by student characteristics*, pertains to potential variation in the impact of SBC. We examined student baseline characteristics (e.g., students' demographic attributes and high school academic performance), measured before SBC students started receiving coaching. These variables explore variation in the strength of the impacts; for example, the impacts of SBC may be *greater* for female students relative to male students. To simplify the analyses and ease the interpretation of results, we used each baseline characteristic to divide students into two non-overlapping subgroups based on that characteristic. For example, we created a high school GPA variable where students are divided students into a higher high school GPA subgroup and a lower high school GPA subgroup based on where a student's high school GPA fell relative to the cutoff. We then calculated

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16 Prior reports (e.g., Linkow et al. 2017a; Linkow et al. 2019) have shown that the impacts of SBC on early college outcomes are generally larger for the students who entered college before the scale-up (the 2013 and 2014 cohorts) than for the students who entered college after the scale-up (the 2015 and 2016 cohorts).

17 Using the baseline characteristics in the matching process and also using them as covariates in the estimation of impacts yields a consistent estimator if *either* model is correct. That is, if the weights implied by matching are wrong but the regression model is right, the estimator is unbiased but inefficient; if the regression model is wrong but matching is correct, the estimate has excess variance but is consistent. Thus the combination is deemed to give the analyst two chances to get the "right" model specification (once in the propensity model and once in the impact model for the outcome measure). Therefore, these estimators are called "doubly robust," in the sense that they are robust to either of two types of mistakes (Bang and Robins 2005).

18 We tested the validity of this assumption by estimating hierarchical linear models that nest students within colleges. These models yielded virtually identical estimates.

separate impact estimates for the subgroups and assessed the magnitude and statistical significance of the *difference* in the subgroup-specific impact estimates.

We consider these to be *exploratory* analyses because the subgroup analyses include fewer students and therefore less statistical power than full-sample analyses. Thus, the differences in effects for the corresponding subgroups might not be fully attributable to a characteristic such as a student's gender. Furthermore, given the number of subgroups explored, it is possible that any statistically significant impacts found could be due to chance variation and are not true impacts. See Appendix B for an in-depth description of the analytic approaches used in these analyses.

3.2 Data Sources

The analyses rely on data from multiple sources: BPS, MA DESE, the National Student Clearinghouse, colleges in which students enrolled, and the SBC program database.

Boston Public Schools (BPS) provided student data for students who graduated from BPS high schools in the spring of 2013 or 2014, including high school academic measures, behavior, and demographic information (e.g., SAT, 10th-grade MCAS scores; coursework; absences and suspensions; race/ethnicity, gender).[19]

Massachusetts Department of Elementary and Secondary Education (MA DESE) provided student data for the entire state, including high school academic measures, behavior, and demographic information (e.g., SAT, 10th-grade MCAS scores; coursework; absences and suspensions; race/ethnicity, gender).

The **National Student Clearinghouse (NSC)** is a nonprofit organization that regularly collects enrollment and graduation information from colleges across the country. As of the fall of 2019, the NSC included data covering 97.4 percent of student enrollments at U.S. colleges and 98.6 percent of enrollments at Massachusetts colleges (NSC Research Center, 2020). Using NSC data allows us to access data for all students regardless of whether or not they transfer between colleges. For this evaluation, data on students' college enrollment and graduation come from the NSC, by way of BPS and MA DESE. As of the time of this report, NSC data were available for enrollments through fall 2019.

College administrative data were collected from the 11 colleges with more than 10 SBC students enrolled annually or strong partnerships with the Success Boston initiative. These administrative data on students include individual-level student records on college enrollment and persistence and academic achievement. Of the eligible treatment students, 95 percent of those in the 2013 and 2014 cohorts and 74

[19] BPS provided student data for 2013 and 2014 graduates because, prior to the scale-up, SBC served BPS graduates only. Thus, our 2013/2014 cohort sample consisted mainly of BPS graduates. (The only non-BPS students included in the 2013/2014 cohort sample were comparison students enrolled at the University of Massachusetts Boston. Because all University of Massachusetts Boston students who graduated from BPS receive coaching similar to SBC, SBC students who attended University of Massachusetts Boston were matched with comparison students who graduated from non-BPS high schools.)

After the scale-up, SBC began serving more students who graduated high school in surrounding districts outside of BPS, and our analytic sample also expanded to include more non-BPS comparison students. As a result, we rely more on MA DESE data for the 2015/2016 cohorts' baseline characteristics.

percent of those in the 2015 and 2016 cohorts were enrolled in these institutions immediately after graduating high school:

- Benjamin Franklin Institute of Technology
- Bridgewater State University
- Bunker Hill Community College
- Framingham State University (2015 and 2016 cohorts only)
- Massachusetts Bay Community College
- Northeastern University
- Roxbury Community College
- Salem State University
- Suffolk University
- University of Massachusetts Boston (UMass Boston)
- Wentworth Institute of Technology (2015 and 2016 cohorts only)

3.3 Measures

In this section, we describe the outcomes and then define the measures used in our exploratory analyses to test whether program impacts varied depending on student characteristics and features of coaching.

3.3.1 Outcome Measures

The outcomes for this evaluation fall into three domains: **completion, persistence,** and **achievement**. These outcomes are operationalized below. Because the completion domain has multiple outcomes measures, we further distinguish between *primary* and *exploratory* outcomes.

- ***Primary outcomes*** are those most closely related to the theory of change, which hypothesizes that the elements of one-on-one coaching that together address logistical, academic, financial, and emotional support topics can improve completion rates for traditionally underrepresented college students.
- ***Exploratory outcomes*** are also informed by the theory of change, as they may help explain why or why not impacts are detected on the completion rate outcomes.

Exhibit 3-1 lists details about each of the outcome measures, including when the outcome was measured relative to students' high school graduation, the cohort(s) for which the outcome is measured and for which impacts are presented in this report, our post-matching sample size, and the data source.[20] Wherever possible, administrative data from colleges supplement NSC data, to ensure that we limit the number of students for whom outcome data are missing.[21]

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[20] For earlier impacts for the 2013 and 2014 cohorts see Linkow et al. (2017b), and for earlier impacts for the 2015 and 2016 cohorts, see Linkow et al. (2019).

[21] Though NSC includes data on enrollments on almost every college nationally and in Massachusetts, individual student records from any given college might be missing because students can block the release of their records

Exhibit 3-1: Outcome measured in this report by domain

Domain	Outcome Measure	Primary or Exploratory	When Outcome is Measured (Years Post-High School)	Cohorts	Analytic Sample Size	Data Source
Completion	Completion after four years	E	4	2013/2014	2,512	College administrative data, NSC
	Completion after five years	P	5	2013/2014	2,512	College administrative data, NSC
	Completion after six years	E	6	2013	1,103	College administrative data, NSC
Persistence	Persistence into the fourth year	E	3.5	2013/2014	2,512	College administrative data, NSC
				2015/2016	5,863	
	Persistence into the fifth year	E	4.5	2013/2014	2,512	College administrative data, NSC
				2015	2,719	
	Persistence into the sixth year	E	5.5	2013/2014	2,512	College administrative data, NSC
	Persistence into the seventh year	E	6.5	2013	1,103	College administrative data, NSC
Academic Achievement	Credit accumulation after four years	E	4	2013/2014	2,166	College administrative data
				2015/2016	3,679	

NSC=National Student Clearinghouse.

Completion Outcomes

This study uses one *primary* outcome measure: completion after five years. There are two exploratory outcomes in this domain: completion after four years and completion after six years.

The ultimate goal of SBC is to increase the number of students who complete their degrees or certificates, and the impact of SBC on completion is the focus of this report. Completion is commonly measured as attaining a degree or other credential within 150 percent time, which would be three years for students enrolled in two-year colleges or six years for students enrolled in four-year colleges.[22] As noted above, we pool the data on students in the 2013 and 2014 cohorts to maximize power to detect any effects of SBC. The longest time point for which completion information is available for both the 2013 and the 2014 cohorts is five years after college entry. Because the students are enrolled at both 2-year and 4-year

under the Family Educational Rights and Privacy Act (FERPA) or because misspelled student names cause matching errors. NSC reports that, on average, 3.7 percent of students nationally and 1.7 percent of students attending colleges in Massachusetts blocked the release of their records for the 2016-17 school year, the most recent year for which block rate data are available (NSC Research Center, 2017). Research on the extent of matching errors shows the NSC algorithm to be robust to student name variants (Dynarski, Hemelt, and Hyman 2013).

[22] Six years (150% of time to completion for students pursuing four-year degrees) is also the maximum number of years students are able to receive federal Pell grant funds under federal law (U.S. Department of Education n.d.).

colleges, we examine completion for all students, regardless of where they initially enrolled, at the latest time available. As a result, our primary outcome measure in this report is completion after five years. We also explore completion after four years (for the 2013 and 2014 cohorts) and after six years (for the 2013 cohort only). We will present completion outcomes for the 2015 and 2016 cohorts in a future report.

Persistence Outcomes

This study examines four *exploratory* outcomes in the persistence domain: persistence into the fourth, fifth, sixth, and seventh year of college.

Persistence measures whether students who enrolled in college after their high school graduation returned to college in the fall of each successive academic year or had already completed a degree or certificate by the start of that fall. The persistence outcome includes completions to include all positive outcomes; students who have completed have persisted to the extent necessary. Exhibit 3-2 displays how each persistence measure is defined.

Exhibit 3-2: Annual persistence measures

College-Entering Cohort	Persisted into the Fourth Year	Persisted into the Fifth Year	Persisted into the Sixth Year	Persisted into the Seventh Year
2013	Enrolled in fall 2013 and enrolled in or completed by fall 2016	Enrolled in fall 2013 and enrolled in or completed by fall 2017	Enrolled in fall 2013 and enrolled in or completed by fall 2018	Enrolled in fall 2013 and enrolled in or completed by fall 2019
2014	Enrolled in fall 2014 and enrolled in or completed by fall 2017	Enrolled in fall 2014 and enrolled in or completed by fall 2018	Enrolled in fall 2014 and enrolled in or completed by fall 2019	NYA
2015	Enrolled in fall 2015 and enrolled in or completed by fall 2018	Enrolled in fall 2015 and enrolled in or completed by fall 2019	NYA	NYA
2016	Enrolled in fall 2016 and enrolled in or completed by fall 2019	NYA	NYA	NYA

NYA=data not yet available

Achievement Outcomes

This study examines one exploratory outcome in the achievement domain: Credit accumulation after four years.

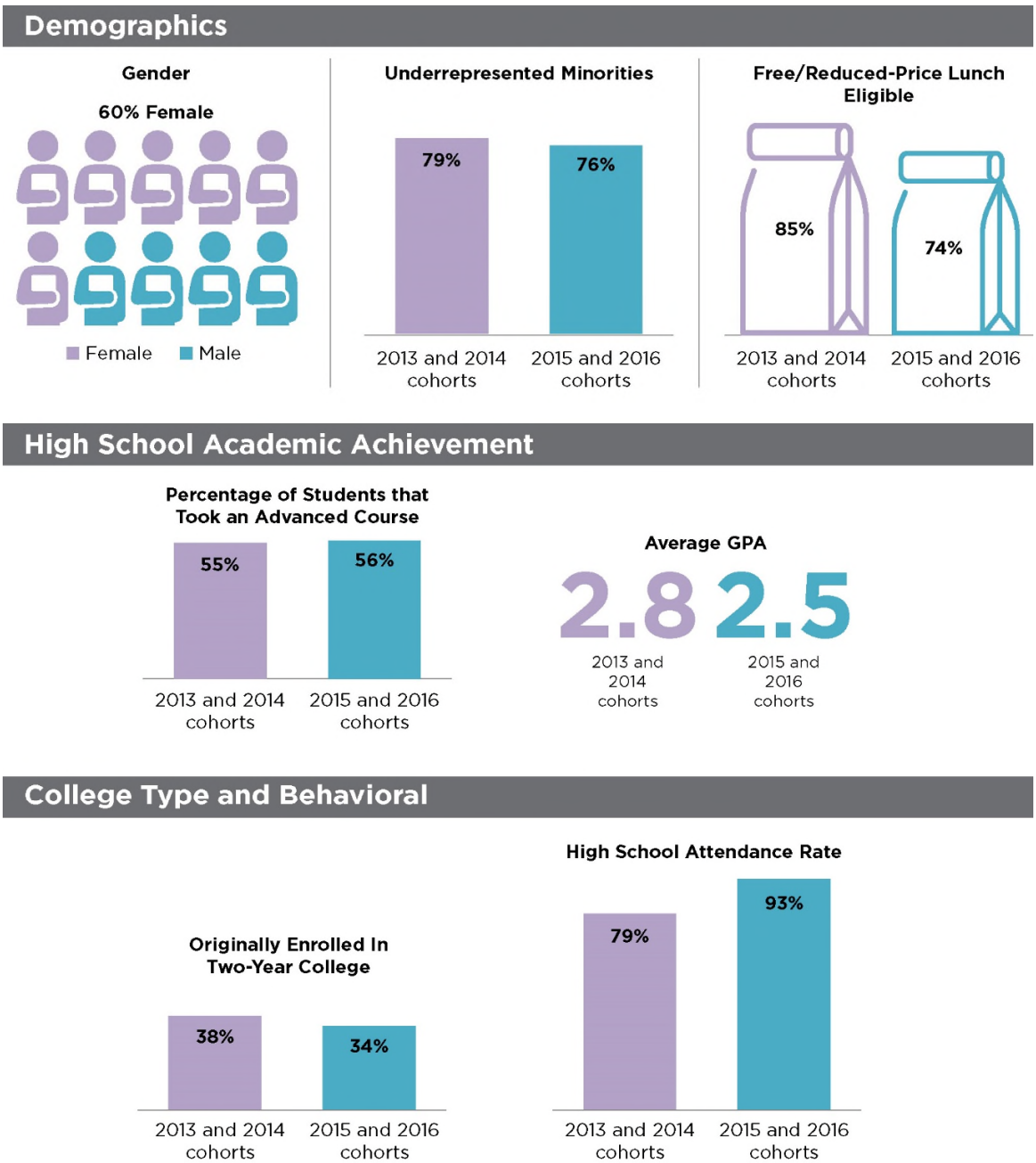
Credit accumulation is a count of the total number of credits successfully completed, as of the students' most recent semester at the end of their fourth year of college. The outcome is the proportion of the total number of credits completed, divided by the total number of credits needed to graduate. The number of credits needed to graduate varies from school to school; we followed the graduation requirements set by each institution.[23] Credit accumulation is determined after four years for all four cohorts to provide a standard metric across the cohorts. This outcome is estimated only for students who attended the 11 colleges providing data.

[23] When credits necessary to graduate vary by degree program, major, or school within a college, credits necessary to graduate from the most common major or largest school were used.

3.3.2 Student Characteristics

Exhibit 3-3 summarizes the means of key student characteristics for each set of cohorts' largest analytic sample from Exhibit 3-1: specifically, the 2,512-student analytic sample for the 2013 and 2014 cohorts and the 5,863-student analytic sample for the 2015 and 2016 cohorts.

Exhibit 3-3: Student characteristics at baseline



Note: "Underrepresented Minorities" denote, for the 2013 and 2014 cohorts Black non-Hispanic, Hispanic, Mixed Race, and Other; and for the 2015 and 2016 cohorts Black non-Hispanic, Hispanic, Native American, Mixed Race, and Other.

Exhibit Reads: In both the 2013/2014 and 2015/2016 cohorts, 60 percent of the students were female and about three-quarters of students were members of racial/ethnic groups historically underrepresented in higher education. Eighty-five percent of 2013/2014 cohort students, and 74 percent of 2015/2016 cohort students, were eligible for free/reduced price lunches. In each set of cohorts, 55 or 56 percent of students took at least one advanced course (including AP and IB courses) in high school. The 2013/2014 cohort students had an average high school GPA of 2.8 and average school attendance rate of 79 percent, whereas 2015/2016 cohort students had an average high school GPA of 2.5 and an average school attendance rate of 93 percent. Approximately one-third of students in both cohorts enrolled in a two-year college in the fall after high school graduation.

The scale-up included SBC students attending colleges in a more geographically diverse area than was true in earlier cohorts. As expected, some statistically significant differences emerged between the before- and after-scale-up sets of cohorts.[24] Looking at the statistically significant differences between the cohorts, the 2015/2016 cohorts had lower proportions of students who were members of underrepresented minorities and lower proportions of students eligible for free/reduced-price lunch, relative to the 2013/2014 cohorts. The average student in the 2015/2016 cohorts had a lower high school GPA, but had a higher SAT score. On average, 2015/2016 cohort students had higher school attendance rates, though also more suspensions. With respect to school-level characteristics, the average high school GPA was lower for the 2015/2016 cohorts, though 2015/2016 cohort students' high schools had higher college-going rates. Finally, students in the 2013/2014 cohorts enrolled in 26 different colleges in the fall after high school graduation, whereas students in the 2015/2016 cohorts enrolled in 47 different colleges. The full set of descriptive characteristics for the analytic samples for both sets of cohorts can be found in the right-hand panel of Exhibit A-8.

Impacts by Student Characteristics

We conducted several exploratory analyses to gain a deeper understanding about whether, and if so, how, observed impacts of SBC vary as a function of particular student characteristics. These analyses are exploratory because they investigate impacts on subsets of the sample. Because the overall study sample has been divided into subgroups, the statistical analyses may be less able to detect educationally meaningful program impacts than analyses based on the full sample.

We divided each student characteristic into just two subgroup categories, to maximize the sizes of the subgroups and therefore statistical power and to make comparisons between subgroups easier to interpret. We explored four student characteristics, created from MA DESE and BPS data. As summarized in Exhibit 3-4, these characteristics are (1) **gender** (categorized as *male* or *female*); (2) **underrepresented minority** (categorized as *traditionally underrepresented in postsecondary education* or *not*);[25] (3) **high**

[24] We tested for differences between the two sets of cohorts using regression analysis. Specifically, we regressed each student characteristic on an indicator (yes/no) variable for being in the 2015/2016 cohorts, applying the matching weights, and then looked at whether the coefficient on that 2015/2016 cohort indicator variable was significant at the 5 percent level.

[25] We defined *underrepresented minority* subgroups slightly differently for the two sets of cohorts, consistent with the decisions made in our interim impact reports (Linkow et al. 2017a; Linkow et al. 2019). For the 2013/2014 cohorts, we defined it as being Black non-Hispanic, Hispanic, or other/mixed race. For the 2015/2016 cohorts, we defined it as Black non-Hispanic, Hispanic, Native American, or other mixed/race. However, even with the addition of a Native American category in the 2015/2016 cohorts, the proportion of underrepresented minority students was still significantly lower than in the 2015/2016 cohorts.

school student GPA (categorized as *higher* for median >3.00 or *lower* for median ≤3.00);[26] and (4) **type of college** in which a student first enrolls (categorized as *two-year* or *four-year*). In addition to looking at impacts *between* two subgroups (e.g., impacts for students with high GPAs versus students with low GPAs), we also examined whether there are difference in impacts *within* the subgroups (e.g., GPAs for treatment group versus comparison students). (Appendix B provides details about the model for estimating these subgroup impacts.)

Exhibit 3-4: Student characteristic subgroups for subgroup impact analysis

Student Characteristic	Subgroups	
Gender	Female	Male
Underrepresented minority status	Underrepresented minority	Not underrepresented minority
High school academic achievement	Higher GPA	Lower GPA
Type of college	Two-year	Four-year

Note: GPA is defined as median high school GPA above or below 3.00. Underrepresented minority status differed by cohort: 2013/2014=Black non-Hispanic, Hispanic, or other/mixed race; 2015/2016=Black non-Hispanic, Hispanic, Native American, or other mixed/race.

These specific characteristics were selected because previous research indicates they are related to college completion, the ultimate goal of SBC. For example, female students complete college at higher rates (Shapiro et al. 2019); underrepresented minority group students complete college at lower rates than students not underrepresented in postsecondary education (U.S. Department of Education 2016; Haskins 2008; Bailey and Dynarski 2011); students with higher high school GPAs complete college at higher rates than students with lower GPAs (Belfield and Crosta 2012); and students first enrolling at four-year institutions complete a college degree at higher rates than students first enrolling at two-year institutions (Shapiro et al. 2019).

For the subgroup analyses, we begin by looking at the difference *between* the impacts for any two subgroups (women versus men, for example). If the between-subgroup difference is not statistically significant, then we can infer that program impact is similar for both subgroups (for example, no statistically significant gender subgroup difference would suggest SBC's impacts are similar for women versus for men). However, if the between-group difference is significant, this suggests that the program could be more or less impactful for particular subgroups. When this is the case, we then look *within* subgroups to estimate impacts (for example, among women, comparing female treatment students versus female comparison group students).

3.4 Limitations

The study faces methodological limitations related to (1) matching students across high schools and school districts, (2) its use of a quasi-experimental design rather than an experimental design, and (3) data availability.

First, students within a given college were matched across high schools and school districts. Because sample sizes were too small to allow for matching students from the same high school attending the same college, matching is within colleges and accounts for characteristics of high schools. Even with this expanded pool of potential comparison students, in some cases it was not possible to find a similar

[26] We defined *high school GPA* subgroups with respect to the median GPA among students who were eligible for matching (though might not have necessarily matched), so that similar numbers of students would be in the two subgroups. Having similarly sized subgroups increases our ability to detect any effects of SBC.

comparison student to match to a coached student (see Appendix Exhibit A-6 for details about the treatment group match rate by outcome). Thus, our impact estimates are estimates of the effect of SBC on students who could be matched—these are more likely to be students at colleges with more students from BPS and more students like the typical SBC student. The matching process addresses both differences in college experiences and high school characteristics to eliminate historical and locational differences (bias) in students' previous educational experiences. Moreover, in addition to using student-level and high-school-level baseline characteristics for matching, we also include these characteristics as covariates in our impact models, thereby employing a doubly robust process that increases the precision of our estimates (see Appendix Exhibit B-1).

A second limitation is that, because we were not able to use an experimental (random assignment) design for this study, it is possible that the local and focal matching approach did not sufficiently control for potentially confounding factors. However, we were able to achieve baseline equivalence on observed characteristics for each outcome sample (see Appendix Exhibit A-8). To the extent that the distribution of all important confounders is equalized across SBC students and the matched comparison group, our quasi-experimental design should produce impact estimates with minimal bias and good power, relative to other quasi-experimental designs.

Third, data were not available for all students for all outcomes. The impact models for outcomes in the completion and persistence domains are based on the most complete samples (from NSC data). By contrast, the achievement domain model uses data on credit accumulation available only for students in the evaluation sample who were enrolled in one of the 11 colleges that provided administrative data. Thus, students who never enrolled in one of these 11 colleges are excluded from the credit accumulation impact sample. Because of these differences in data availability, we also ran impacts on the most recent completion and persistence outcomes, this time using only students enrolled in the 11 colleges that provided data (that is, using the credit accumulation impact sample). Those results (see Appendix Exhibit B-2) tell a story similar to the one we present in the next chapter.

4. Does SBC Coaching Affect College Outcomes, and for Whom?

This chapter presents results from the study's impact analyses, which assess whether participation in SBC leads to better college outcomes for coached students, with an ultimate goal of helping more students complete their degrees. The results are presented separately for students in the 2013 and 2014 cohorts, who entered college prior to the scale-up, and for students in the 2015 and 2016 cohorts, who entered college after the after-scale-up.[27, 28] We follow students into college for as long as possible based on available data (through fall 2019).[29]

This chapter also explores how the impacts of SBC differ for particular subgroups of students (gender, underrepresented minority status, high school GPA, and college type). It is worth noting that these subgroup analyses are considered exploratory because they are based on subsets of the full sample; the smaller sample sizes mean the estimates are less precise and therefore limit our ability to detect statistically significant differences.

Key Findings

SBC does not affect completion. SBC students complete their degrees and other credentials at similar rates to those of non-coached students.

However, there are positive effects on some of the persistence measures, as well as on credit accumulation. Compared with their non-coached peers, SBC students are:

- between 4 and 8 percentage points more likely to persist into their *second* and *third* years of college
- potentially 3-6 percentage points more likely to persist into their *fourth*, *fifth*, and *sixth* years of college
- accumulating more credits needed for degree completion

The impacts of SBC do not often differ for subgroups of students.

The following sections detail results for primary and exploratory outcomes, with *completion after five years* being the only primary outcome. The findings are organized according to three outcome domains: **completion, persistence,** and **academic achievement**. For each outcome domain, we begin by presenting overall impacts and then present results from the subgroup analyses.

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27 We present the pooled impacts from the 2013 and 2014 cohorts and the pooled impacts from the 2015 and 2016 cohorts separately for two reasons. The first is consistency with how we have presented the findings in our previous interim impact reports (Linkow et al. 2017a; Linkow et al. 2019). The second reason is that starting with the 2015 cohort, SBC was expanded to serve more students, going from serving a few hundred Boston students per cohort to 1,000 students per cohort. Thus, presenting the 2013/2014 cohorts (before scale-up) separately from the 2015/2016 cohorts (after scale-up) allows us to examine how impacts of SBC might have changed (if at all) as the coaching program expanded to serve more students across more colleges.

28 Effects on early college outcomes for students in the 2017 cohort, for whom only two years have elapsed since high school graduation, can be found in Appendix C.

29 For example, completion after five years is examined for only the 2013 and 2014 cohort students because the 2015 and 2016 cohorts have not yet been out of high school for that many years. For 2013 and 2014 cohort students, six and five years, respectively, have elapsed between high school graduation and the most recent available data. For 2015 and 2016 cohort students, only four and three years, respectively, have elapsed between high school graduation and the most recent available data.

4.1 Completion

Success Boston coaches provide support to students on academic, financial, and social-emotional topics during their transition to college, with the goal of helping these students ultimately graduate from college. To assess whether SBC accomplishes this objective, this evaluation examines SBC impacts on students' completion of their degrees or certificates.[30] Because we have completion data covering only four and three years since high school graduation for the 2015 and 2016 cohorts, respectively, completions are examined for the 2013 and 2014 cohorts only.

4.1.1 Overall Impacts for Completion

Exhibit 4-1 illustrates completion rates at four, five, and six years after entering college. Completion rates increase over time for all students, with a particularly large increase occurring between students' fourth and fifth years of college. This increase could reflect that, on average, students in both the coached and comparison groups who complete their degree or certificate take 4½ years to do so.

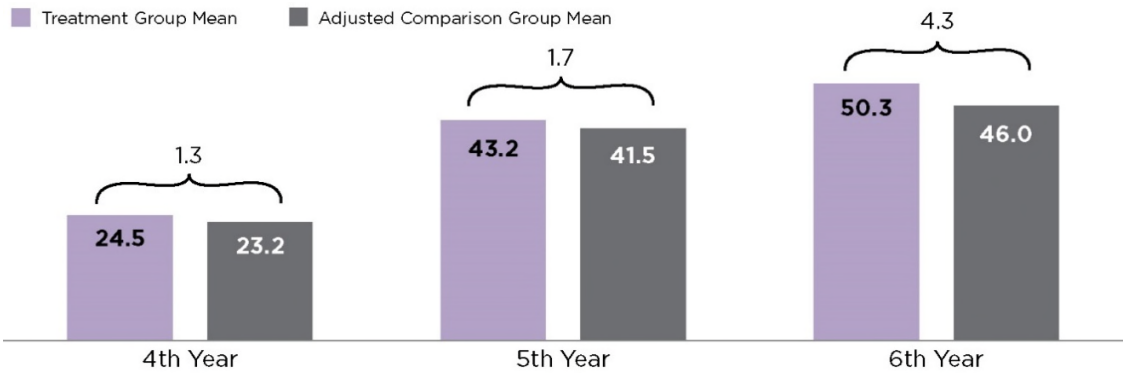
However, we do not detect significant effects of SBC on any completion outcomes, including our primary outcome of interest, completion of a degree or other credential after five years.[31] After five years, less than one-half of students (SBC students and non-coached students) have completed college. We also do not detect any significant differences in the percentages of SBC students and non-coached students completing their degree or other credential after four or six years, two of our exploratory outcomes. Even though the size of the differences between the SBC and coached groups increases over time, these differences do not reach statistical significance. However, the impact on completion after six years is measured only for the 2013 cohort and thus uses a smaller sample, with higher standard errors, making it more difficult to detect differences.

Students are enrolled on average for fewer than 8 semesters. This is consistent with the amount of time students are enrolled in college; on average SBC students were enrolled for 7.5 semesters whereas comparison students were enrolled 6.9 semesters.

[30] For completion as well as other outcomes, we present the impacts of SBC along with the treatment group means and adjusted comparison group means. The adjusted comparison group means are weighted (i.e., regression adjusted) based on baseline student characteristics to represent what the mean outcomes for treatment students would have been had they not received the intervention. As such, the adjusted comparison group means represent the mean outcomes that would have been observed for the treatment group in the absence of SBC.

[31] Completion after five years of college is the primary outcome because it is the longest time point since high school graduation where data are available for students in both the 2013 and the 2014 cohorts.

Exhibit 4-1: Impact of SBC on college completion four, five, and six years after entry, 2013/2014 cohorts



Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; and college administrative data
Note: N=2,512 for overall sample (n=678 for treatment and n=1,834 for comparison) for completion after the fourth and fifth years. N=1,103 for overall sample (n=302 for treatment and n=801 for comparison) for completion after the sixth year.
Adjusted comparison group means, impacts (treatment mean minus adjusted comparison mean), and statistical significance are drawn from the study's regression model.
Exhibit Reads: None of the impacts of coaching on completion after the fourth, fifth, or sixth years of college is statistically significant.

Nor do the impacts of SBC on completion five years after entering college, our primary outcome, differ by key student characteristics. There are no significant differences in impacts between different sets of subgroups. This suggests the impact of SBC on completion is similar for both men and women, for both underrepresented minority and non-underrepresented minority students, for both students with high and low high school GPAs, and for both students who originally enrolled at two- and at four-year colleges. Similarly, we do not find any significant subgroup differences in impacts on completion after four years or after six years. Appendix D presents the details of the subgroup impacts.

4.2 Persistence

A key expectation of the SBC model is that students are more likely to persist in college as coaches help them navigate and manage the various challenges commonly experienced by students beginning college. To test this hypothesis, the evaluation examines SBC's impacts on students' persistence through college.[32] In this report, we provide an update on persistence outcomes previously reported, using data through fall 2019.[33]

[32] The persistence outcomes measure whether students who enrolled in college after their high school graduation returned to college in the fall of succeeding academic years. We report impacts through the most recent year after college entrance for each cohort, pooling impacts across the 2013 and 2014 cohorts and across the 2015 and 2016 cohorts, as noted above. For each persistence outcome, we count students as having persisted if they completed college with a degree or certificate by the time the outcome was measured. Completions are included in persistence because completions are the intended positive result of coaching.

[33] In Linkow et al. (2017b), we presented previous impacts on students' persistence into the second year of college for the 2013 and 2014 cohorts, and into the third year of college for the 2013 cohort. Impacts on students' persistence into the second year of college for the 2015 and 2016 cohorts and into the third year of college for the 2015 cohort, using data through the fall of 2017, are presented in Linkow et al. (2019).

4.2.1 Overall Impacts for Persistence

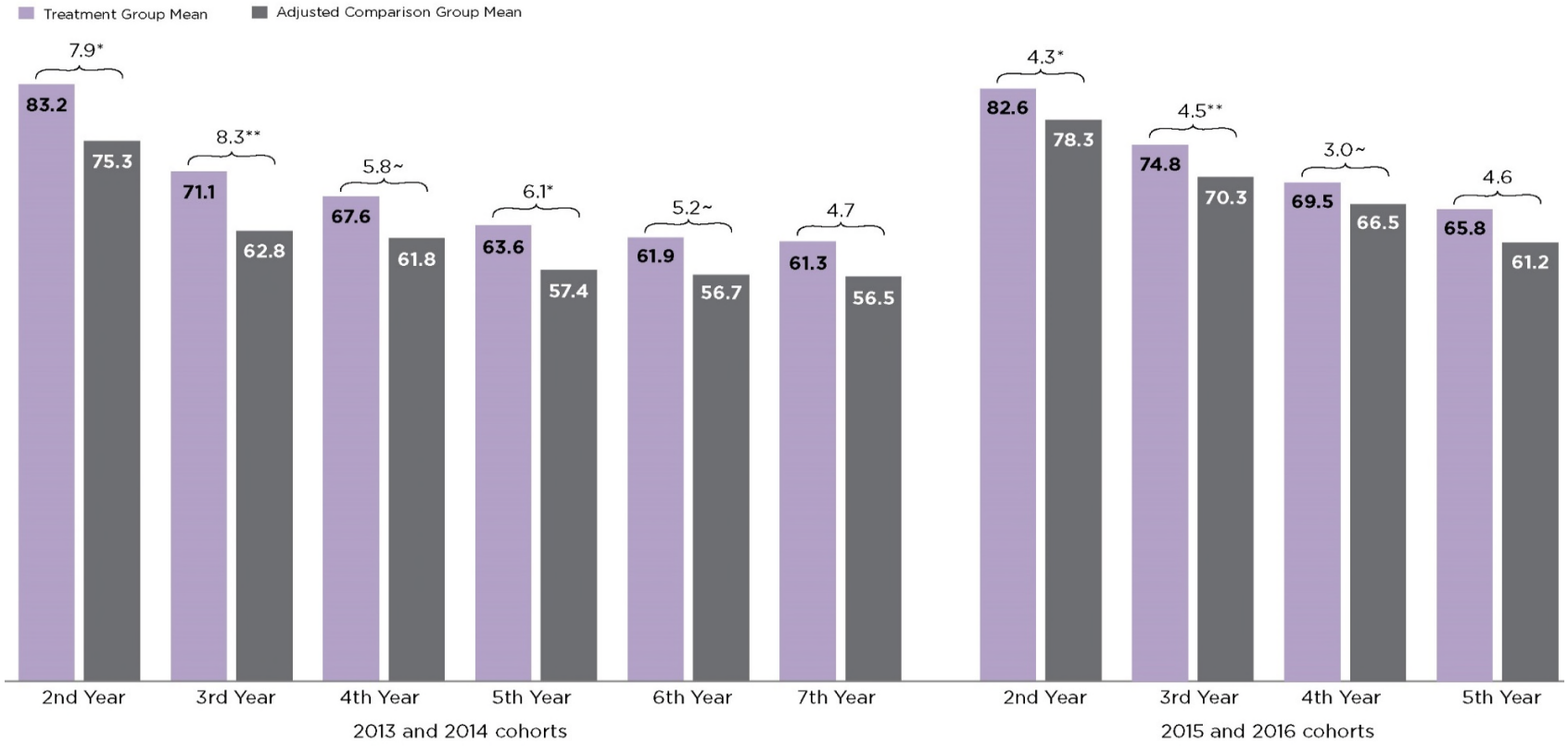
Exhibit 4-2 illustrates persistence rates from the start of the second year of college through to seven years later. Across all four cohorts, SBC students are about 3 to 8 percentage points more likely than their non-SBC peers to persist in (or complete) college. The impacts on persistence are larger in the second and third years after college entry and then decrease over time. These effects are statistically significant up to students' sixth year of college for the 2013/2014 cohorts, and up to students' fourth year of college for the 2015/2016 cohorts.[34]

For the 2013/2014 cohorts (before scale-up), SBC students are about 8 percentage points more likely to persist into the second and third years of college than are non-coached students, and both impacts are statistically significant ($p<.05$ and $p<.01$, respectively). However, by the beginning of the sixth year, the difference in persistence rates between SBC and non-SBC students is only about 5 percentage points, and is only marginally significant ($p<.10$).

Moving to the 2015/2016 cohorts, (after scale-up) we see that the results continue to follow a similar trend as the 2013/2014 cohorts, except that the magnitude of the effects appears smaller. Students who had access to coaching were about 4 percentage points more likely to persist into the second and third years. The effects begin to decrease in magnitude or lose their significance as students enter their fourth and fifth years of college. The decreased impacts for the 2015/2016 cohorts relative to the earlier cohorts could be related to the higher persistence rates for the 2015/2016 cohorts' comparison groups relative to those of the 2013/2014 cohorts' comparison groups at similar points in time, resulting in smaller differences between the 2015/2016 cohorts' coached and comparison groups than was true for the earlier cohorts.

[34] This work builds on Linkow et al. (2017b), which initially reported that SBC had a positive and statistically significant impact on persistence into the second and third years of college.

Exhibit 4-2: Impact of SBC on persistence into the second through seventh years of college, 2013/2014 cohorts and 2015/2016 cohorts



Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data
Notes: 2013 and 2014 cohorts: N=2,512 for overall sample (n=678 for treatment and n=1,834 for comparison) for persistence into the second through sixth years of college. N=1,103 for overall sample (n=302 for treatment and n=801 for comparison) for persistence into the seventh year of college.
2015 and 2016 cohorts: N=5,863 for overall sample (n=1,234 for treatment and n=4,629 for comparison) for persistence into the second through fourth years of college. N=2,719 for overall sample (n=561 for treatment and n=2,158 for comparison) for persistence into the fifth year of college.
Students are considered to persist if they enroll year to year or if they complete a degree or certificate. Adjusted comparison group means, impacts (treatment mean minus adjusted comparison mean), and statistical significance are drawn from the study's regression model.
~ Impact is significant at the 10 percent level. * Impact is significant at the 5 percent level. ** Impact is significant at the 1 percent level.
Exhibit Reads: For the 2013 and 2014 cohorts, the impacts of coaching on persistence into the second, third, fourth, fifth, and sixth years of college are each statistically significant. These impacts range from 5.2 to 8.3 percentage points. The impact of coaching on persistence into the seventh year of college is not statistically significant. For the 2015 and 2016 cohorts, the impacts of coaching on persistence into the second, third, and fourth years of college are each statistically significant. The impacts range from 3.0 to 4.5 percentage points. The impact of coaching on persistence into the fifth year of college is not statistically significant.

For most subgroups, the impacts of SBC on persistence did not differ *between* groups (e.g., low GPA versus high GPA) (see Appendix D). For those few instances where the impact estimates are significantly different between subgroups, they appear for the 2013/2014 cohorts only, and appear for only some of the six persistence outcomes examined. In these few instances, SBC appears to have greater impacts on persistence for women students (versus men) and students at four-year colleges (versus two-year colleges) at some points in time. However, when a large number of subgroup comparisons are made, as is true here, it is not unusual for a few estimates to be significant based on chance alone. Given that the significant subgroup differences do not appear consistently across outcomes, the significant findings observed here could also be due to chance. We did not find any differences in program impact on persistence between subgroups for the 2015/2016 cohorts.

4.3 Achievement

SBC also is designed to support students in achieving academic success and overcoming any academic challenges that they might face in college, ranging from difficult coursework to course selection and time management. By helping students cope with stressors related to the academic demands of college and access available campus supports, coaches can potentially help students improve their academic achievement. We examine the impact of SBC on our one exploratory outcome of academic achievement: *four-year credit accumulation*.[35]

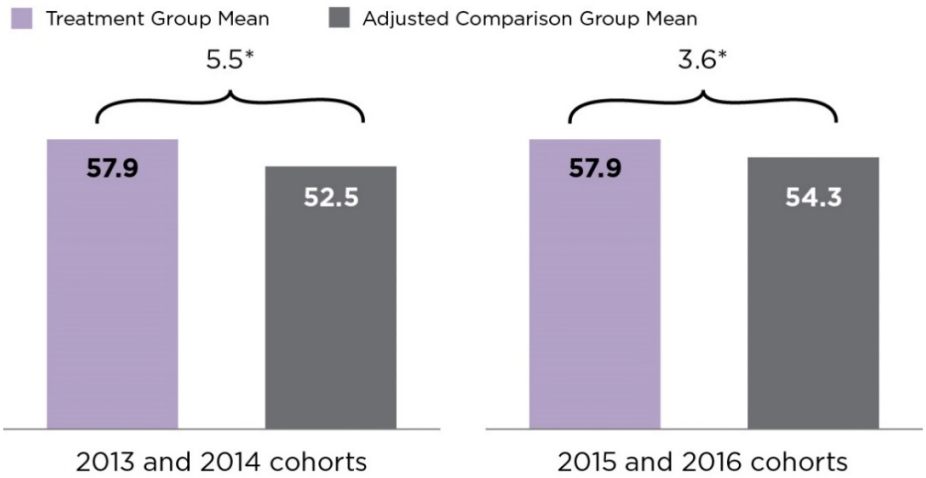
4.3.1 Overall Impacts for Credit Accumulation

Results show that SBC students complete more credits toward graduation than non-coached students (Exhibit 4-3). After four years of college, SBC students from the 2013/2014 cohorts completed 57.9 percent of the credits needed to graduate. However, non-coached students had completed only 52.5 percent of the credits needed to graduate. The 5.5 percentage point statistically significant impact is the equivalent of a 10 percent increase in credits accumulated.

Similarly, after four years of college, SBC students from the 2015-16 cohorts also earned 57.9 percent of their required credits to graduate. This rate was higher than that of non-coached students from the same cohorts, who had only completed 54.3 percent of credits. The 3.6 percentage point difference between SBC and non-coached students is statistically significant, and corresponds to about a 7 percent increase in credits accumulated.

[35] Because the number of credits needed to graduate varies from school to school, we define credit accumulation as the total number of credits successfully completed, divided by the total number of credits needed to graduate at that student's college. To provide a standard measure across students in different cohorts, who have been enrolled in college for different periods, we include in our credit accumulation measure only credits successfully completed during students' first four years of college. When credits necessary to graduate vary by major or school within a college, we use credits necessary to graduate from the most common major or largest school.

Exhibit 4-3: Impact of SBC on proportion of credits accumulated toward degree completion, 2013 through 2016 cohorts



Source: College administrative data
Note: 2013 and 2014 cohorts: N=2,166 for overall sample (n=649 for treatment and n=1,517 for comparison). 2015 and 2016 cohorts: N=3,679 for overall sample (n=838 for treatment and n=2,841 for comparison).
This exhibit shows total credits accumulated by the end of the student's fourth year of college as a proportion of the credits needed to complete a degree. Actual credits needed for graduation vary by college. Adjusted comparison group means, impacts (treatment mean minus adjusted comparison mean), and statistical significance are drawn from the study's regression model.
* Impact is significant at the 5 percent level.
Exhibit Reads: For students in the 2013 and 2014 cohorts, the impact of coaching on percentage of credits accumulated toward graduation is statistically significant at 5.5 percentage points. SBC students' mean percentage of credits accumulated toward graduation was 57.9 percent, compared with 52.5 percent for students who did not participate in coaching. Similarly, for students in the 2015 and 2016 cohorts, there was a statistically significant 3.6 percentage point impact of coaching on percentage of credits accumulated toward graduation. SBC students' mean accumulation of credits toward graduation was 57.9 percent, compared with 54.3 percent for non-coached students.

Similar to persistence, the impacts on credit accumulation did not differ for most subgroups (see Appendix D). For both the 2013/2014 and 2015/2016 cohorts, SBC appears to have similar impacts on credits accumulated for students with different high school GPAs, from underrepresented minority groups or not, and attending different types of colleges. For the 2015/2016 cohorts, the effects on credit accumulation also appear to be similar for men and women students.

Only the difference between men and women in the 2013/2014 cohorts emerged as significant. These results suggest that SBC had an effect on the credit accumulation of female students but no effect on the amount of credits that male students accumulated.

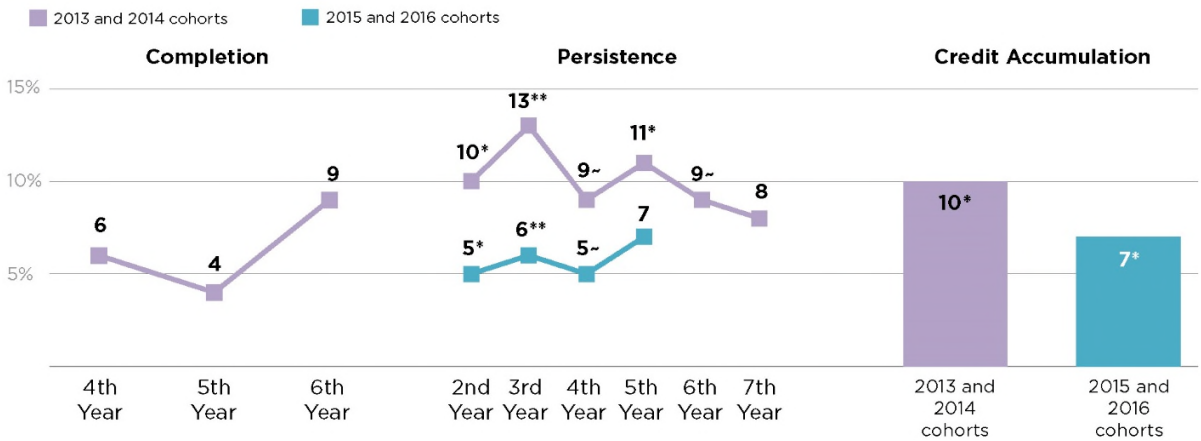
4.4 Learning Points

It is important to examine the magnitude of the estimated impacts, as some could suggest educationally meaningful changes. Exhibit 4-4 summarizes the magnitude of impacts of transition coaching on each outcome. The magnitude is expressed as the percent change for each outcome, which is the impact of SBC relative to the comparison group mean (i.e., the percentage point increase divided by the adjusted comparison mean or the percent change). Expressing magnitude this way provides a common unit for measuring impacts across outcomes.

Although not all impacts are statistically significant, they are consistently positive and could represent meaningful increases in college success.

- The impacts on completion are not statistically significant, but could represent substantively important increases in college completion. Coached students complete their credentials at 4 to 9 percent higher rates than non-coached students.
- There are significant positive impacts on persistence during the first few years after starting college, with SBC students persisting into the second year of college at 5 to 10 percent higher rates, and into the third year of college at 6 to 13 percent higher rates, relative to non-coached students. SBC's impacts on persistence appear to weaken as more time elapses since the coaching ended.
- SBC students acquire 7 to 10 percent more credits toward their degrees than comparison students during their first four years of college.

Exhibit 4-4: Percent change for each outcome



~ Impact is significant at the 10 percent level. * Impact is significant at the 5 percent level. ** Impact is significant at the 1 percent level.
Exhibit Reads: With respect to completion, there is no significant impact for the 2013 and 2014 cohorts on completion after each of the 4th, 5th, or 6th years of college. With respect to persistence, there are statistically significant impacts for the 2013 and 2014 cohorts of between 9 and 13 percent for each of persistence into the 2nd, 3rd, 4th, 5th, and 6th years, but no significant impact on persistence into the 7th year. For the 2015 and 2016 cohorts, there are significant impacts of between 5 and 6 percent on each of persistence into the 2nd, 3rd, and 4th years, but no significant impact on persistence into the 4th year. With respect to credit accumulation, there are statistically significant impacts of 10 percent for the 2013 and 2014 cohorts and 7 percent for the 2015 and 2016 cohorts.

Even with some gains in college success, Boston high school students with access to transition coaching completed college at a rate that is lower than that of all Boston students. The six-year college graduation rate for all BPS students from the Class of 2013 who entered college immediately after high school is 56.0 percent, compared with 50.3 percent for SBC students from that same class. However, the BPS college completion rate includes all students who entered college, including those who might have been better prepared for college[36] and those who entered more selective colleges that might provide generous financial aid packages. The completion rate for SBC students is also below the national six-year

[36] The average SAT score for those Class of 2013 BPS students was 1322 compared to 1215 for the SBC students from that same class.

completion rate of 59.7 percent for students starting college in the fall of 2013 (NSC Research Center 2019).

However, a more relevant comparison of SBC students' college completion rates may be with students who are likely to be most similar to them. Because a majority of Success Boston students are eligible for free and reduced-price lunch and attending college in the Greater Boston area, we examined the six-year credential completion rates of students attending colleges in urban settings who received Federal Pell Grants, which are awarded to students with substantial economic need. Overall, SBC students complete their degrees and certificates within six years at higher rates than do Pell Grant recipients at urban colleges nationally. Whereas 50 percent of SBC students have earned a credential after six years, only about 36 percent of Pell Grant recipients attending urban institutions earned a certificate or degree six years after entering college, based on 2019 Integrated Postsecondary Education Data System (IPEDS) data (National Center for Education Statistics, 2019).[37] The higher overall completion rate for SBC students may apply only to students at four-year colleges. The six-year completion rate for SBC students (66 percent; see Appendix D, Exhibit D-4) is higher than that of Pell Grant recipients at urban four-year institutions nationally (45 percent). However, SBC students who originally enrolled in two-year colleges and students at urban two-year institutions nationally both have six-year completion rates of about 26 percent (Exhibit D-4; National Center for Education Statistics, 2019).

Thus, although not quite reaching the overall local or national benchmarks for six-year college completion, SBC students (and their Boston peers in the comparison group) are completing college at higher rates than perhaps more similar students with economic need attending colleges in urban settings.

[37] This was calculated using the Summary Tables tool of IPEDS and data through August 31, 2019. It reflects the proportions of students who earned a certificate, associate's degree, or bachelor's degree six years after entering college, among Pell Grant recipients attending institutions in small, medium, or large cities. We included not only first-time, full-time students, but also first-time, part-time students, non-first-time, full-time students, and non-first-time, part-time students. This enables a fairer comparison with SBC students, who may transfer between institutions and may not be enrolled full time.

5. Discussion

Transition coaching provides a wide-ranging set of supports designed to improve a variety of students' college outcomes, including how long students persist in college, their academic achievement while in college, and ultimately, whether students complete a credential. The analyses summarized above examined how transition coaching might have affected outcomes related to students' progress toward their degrees, such as persistence and credit accumulation, as well as whether transition coaching increased students' college completion rates. Results from the rigorous, quasi-experimental design showed that transition coaching has positive impacts on important, yet intermediate, measures of college success: persistence and credit accumulation. However, there is not a significant impact on completion.

5.1 Two Trends Revealed

Looking at the outcomes across time and cohorts, two trends emerge. First, the impacts of transition coaching for the 2015/2016 cohorts are smaller than the impacts on the 2013/2014 cohorts at comparable points in time. Second, for both sets of cohorts, the impacts on persistence appear to weaken somewhat as more time elapses once coaching stops at the end of students' second year in college.

As described in Chapter 4, relative to their non-coached peers, SBC students who started college in 2013 or 2014—before the scale-up—persist into the second and third years at 10 and 13 percent higher rates, respectively; both effects are statistically significant. By the students' sixth year of college, coached students are persisting at a 9 percent higher rate than non-coached students; however, the impact is marginally significant, and there is no significant impact on persistence into the seventh year (only measured for one cohort).

A similar pattern emerges for students who entered college in 2015 or 2016, after the scale-up, though with smaller impacts in the earlier years. Among 2015 and 2016 college entrants, SBC students were significantly more likely to persist into the second year (5 percent more likely) and third year (6 percent more likely) of college. Similar to the earlier cohorts, in subsequent years, the effects are marginally significant for persistence into the fourth year, or not significant for persistence into the fifth year (measured only for one cohort).

SBC appears to have a positive effect on academic achievement in the first four years of college across all cohorts; the pattern holds here, too, with a larger effect observed for the earlier cohorts. Relative to students who did not receive SBC, in the first four years of college, coached students in the 2013 and 2014 cohorts earn 10 percent more credits, and coached students in the 2015 and 2016 cohorts earn 7 percent more credits.

In a previous interim impact report (Linkow et al. 2019), we addressed possible reasons why the impacts on early college outcomes might have been larger for the 2013 and 2014 cohorts relative to the 2015 and 2016 cohorts. First, the comparison groups in the 2015 and 2016 cohorts had better outcomes relative to the comparison groups in the 2013 and 2014, thus decreasing the size of the impacts for the later cohorts. This could be related to ***improvements in support services offered to all students*** by colleges serving SBC students. These services include comprehensive first-year support programs, financial support, mentoring programs, early warning systems, learning communities, free developmental courses, and other

types of supports and programs to help students succeed in college.[38] Thus, the availability of SBC and similar support services could be increasing student outcomes in the early college years across the board, not just for SBC students.

In addition, the scale-up of SBC meant ***serving students enrolled at more and more widely dispersed colleges,*** which could have limited the size of the 2015/2016 cohort impacts relative to the 2013/2014 cohort impacts. SBC students in the 2015 and 2016 cohorts enrolled at a larger number of colleges than had SBC students in the earlier cohorts (see Chapter 3). Consequently, SBC coaches likely needed to learn about a larger number of colleges, and to establish relationships with a larger number of staff at those colleges. Although coaches had similar numbers of interactions with students across the two sets of cohorts, the quality and types of support provided to SBC students might have varied more substantially after the scale-up, as SBC students were enrolled across a larger number of institutions that may have had varying capacities to support them. It is possible, for example, that SBC coaches might not have been as familiar with institution-specific resources available at some of the colleges that served only a small number of SBC students after scale-up. This could have limited the coaches' ability to, for example, make referrals to tutoring centers or connect students to college-specific support services.

Further, after the scale-up, there were more colleges with only a handful of SBC students enrolled. Colleges that serve large numbers of SBC students are likely to have strong systems of institutionalized support for SBC: at those institutions, the SBC program is more likely be established, well known, and integrated into campus support systems (see Linkow et al. 2019). However, this might not have been as true at other colleges serving smaller numbers of SBC students or those that first began serving SBC students after the scale-up.

Although the SBC program appears to be effective while the coaching is ongoing and perhaps shortly after coaching ends, the effects of SBC fade as more time elapses. We see no program effect on college completion. The magnitude of the differences in persistence rates, even into the seventh year of college, as well as the impacts on four-year credit accumulation, could signal that coaching provides students the skills and motivation they need to stick with college. Yet the lack of a statistically significant impact on

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[38] Many of colleges' support services have expanded in recent years.

For example, in the past few years, Bunker Hill Community College has expanded its learning communities—in which groups of students take one or more courses or other course covering related content together, often with additional support from coaches and peer mentors—to serve part-time students (Bombardieri 2018). Northeastern University has also began increasing financial assistance for BPS graduates from specific Boston neighborhoods, as well as enrolling more students from those neighborhoods in its Foundation Year program, which provides textbooks, laptops, meal plans, advising, tutoring, and other services to first-year students from Boston (Northeastern University 2015, n.d.). In addition to academic services, some colleges have also recently increased other forms of wrap-around support to help students succeed, for example, Bunker Hill's food pantry (Bunker Hill Community College 2019) and the University of Massachusetts Boston's addition of on-campus housing accompanied by Living Grants for low-income students (University of Massachusetts Boston Office of Communications 2019). Other forms of support, including financial support, include the Tuition Free Community College program, in which the City of Boston pays tuition, fees, and other college-related expenses for up to three years of college for low-income students attending local two-year colleges (Mayor's Office of Workforce Development n.d.), and Boston Mayor Marty Walsh's GRAD Last Mile Fund, a scholarship for students enrolled at Boston-area colleges who are entering their last semester of college (Cote 2018).

completion suggests that students seem to need more than two years of coaching at the start of college to get them over the finish line.

Other programs that increase college completion through coaching, advising, and mentoring include additional structures, requirements, and supports, including ***participation requirements, longer and/or more intensive services, and a financial aid component*** (see Exhibit 2-1). For example, the CUNY ASAP program, which served community college students, increased students' degree completion rate by 18 percentage points over a three-year period and by 10 percentage points over six years (Scrivener et al. 2015; Gupta 2017), with similarly promising results in the Ohio replication (Miller et al. 2020). The Dell Scholars program was found to have impacts on bachelor's degree completion of 6-10 percentage points within four years, and 9-13 percentage points within six years (Page et al. 2019). Project QUEST, which served low-income adults, was associated with a 16 percentage point impact on credential attainment after nine years (Roder and Elliott 2020).

Examining the components of these and other programs provides some insight on potential reasons for differences between our findings for SBC and those of other evaluations. One key aspect of many of the effective programs are rigorous requirements for program participation. For example, CUNY ASAP and Project QUEST each required full-time enrollment for participating students over the two or three years that students received the respective program's counseling or advising services. In addition, CUNY ASAP required students to meet regularly with advisors, with an average of 38 meetings over the first year, and to receive tutoring if students were having difficulty in classes or were enrolled in remedial courses (Scrivener et al. 2015). Because students who are enrolled full-time continuously could be able to accumulate credits toward their degrees at a faster rate than students not enrolled full-time continuously, full-time enrollment could help students complete their degrees sooner. The full-time enrollment requirements of CUNY ASAP and Project QUEST also could have deterred students who were less academically qualified, motivated, or otherwise less able to commit to the programs from participating in the them, resulting in a more committed or qualified group of program participants. Moreover, students in some of these programs received counseling weekly, in contrast to the one to two meetings per month for students receiving SBC (Linkow et al. 2019). These programs' rigorous participation requirements and higher frequency of advising or counseling by design, in contrast to SBC's lack of participation requirements and less frequent coaching, could help partly explain the other programs' positive effects on students' completion.

That these other programs provide financial assistance could also help explain their impacts on completion. CUNY ASAP provided student with free tuition, textbooks, and transportation. The Dell Scholars program offered each student as much as $20,000 in scholarship funding in addition to providing academic and social support for students. Project QUEST covered students' tuition and fees for courses, books, transportation, uniforms, licensing exams, and tutoring. In contrast, SBC does not offer tuition assistance to participants to supplement its coaching. The financial assistance provided by these other programs could have helped increased completion rates among their participants for whom financial challenges might have otherwise made it more difficult for them to graduate.

Relative to CUNY ASAP, Project QUEST, and Dell Scholars, which provide more intensive services, stricter participation requirements, and financial support, SBC represents a "lighter-touch" intervention without stringent participation requirements. The findings of this study are not dissimilar from those of the Opening Doors program (Scrivener and Weiss 2009), which examined both early college outcomes and credential completion. The Opening Doors program served community college students during their first year of college. Its main components were meetings with a counselor at least twice per semester to

discuss the student's academic progress and as much as $300 in stipends. Similar SBC, the Opening Doors program had positive impacts on course registration and credit accumulation while the program was ongoing, and for course registration immediately after the program ended. As more time elapsed, however, the effects on course registration faded, as did the positive effects on credit accumulation. The authors found no effect on three-year degree or other credential completion. These results for Opening Doors are consistent with our findings for SBC. That similarity suggests the potential for a relatively light touch intervention, with a moderate amount of advising but without a large financial component or rigorous participation requirements, to significantly improve student outcomes during and shortly after the end of the intervention. Those impacts might not be sustained over time or lead to increases in degree or certificate completion, however.

5.2 Future Considerations

Our results suggest that both SBC and non-coached students might be behind their peers nationwide—though, as noted in Chapter 4, not necessarily relative to economically disadvantaged students nationally—in progress toward their degrees or certificates. Further, in its current form, SBC does not appear to have a significant impact on college completion in four, five, or six years.

Although SBC students persist at higher rates in earlier college years than comparison students and accumulate more credits in their first four years of college, neither group of students appears to be progressing toward their degrees or certificates quickly enough to allow them to graduate in four, five, or six years. In the first four years after starting college at either a four-year or two-year institution, both SBC and comparison students have, on average, earned less than 60 percent of the credits they need to graduate. Thus, at their current pace, the average SBC student and average comparison student may need closer to seven years to complete their credentials.

The average SBC student has not enrolled in college for long enough or with the intensity needed to complete a degree within six years. In addition to the findings showing many students do not persist into the second year and beyond, an examination of total semesters enrolled shows both the average SBC student and the average comparison student are enrolled in college for only about three and a half years. Further, in those semesters when they are enrolled, many SBC and comparison students do not appear to be consistently enrolled full-time. A student enrolled taking a full-time course load consistently for three and half years might be expected to earn 87 percent (seven-eighths) of the credits required for a four-year degree in that time; a student pursuing a two-year degree or certificate and consistently enrolled full-time might be expected to earn 100 of the required credits and complete his or her credential before the three and half years elapse. By contrast, by the end of four years, the average SBC student has earned only 57.9 percent of credits, and the average comparison student has earned only 52.5 percent of credits. Thus, on average neither SBC nor comparison students are earning credits as quickly as they might be if they were consistently enrolled full-time.

However, SBC students, the majority of whom come from economically disadvantaged backgrounds and from racial/ethnic groups historically underrepresented in higher education, could be facing more challenges in transitioning to college than the average student. Many may confront financial challenges, may have to balance work or family responsibilities, or may face other challenges that prevent them from continuous enrollment, and therefore may struggle to focus academically and pass their classes. In addition, decreasing unemployment rates in Massachusetts between 2010 and 2019 (Federal Reserve Bank of St. Louis 2020) could have prompted some students in recent years to leave college and join the workforce rather than complete their degrees or certificates. Yet, SBC students in the 2013 cohort, whose six-year completion rate is approximately 50 percent according to our study, appear to be completing

college at higher rates than might be expected for graduates of high schools with high rate of students from low-income households and of high schools in urban areas.

That said, there is room for improvement in SBC students' graduation rates, and the experiences from some of the other programs examined may be instructive in this regard. More intensive supports—whether in the form of ***financial assistance, more frequent coaching, additional tutoring, or extending coaching in the later years of college***—might be necessary to help more SBC students complete college. Another option may be to incentivize SBC students to ***enroll in college full-time*** while they receive coaching to help them make faster progress toward completion. Promoting full-time enrollment while coaching is ongoing may be particularly effective if the ***length of the coaching program was also extended*** beyond the first two years of college. Such programmatic changes, however, may affect the composition of students receiving coaching; for example, students with full- or part-time jobs may experience difficulty remaining enrolled full-time. Further consideration of the tradeoffs involved may help inform programmatic decisions as to how SBC may best help college students in the future.

Appendix A. Propensity Score Matching Process

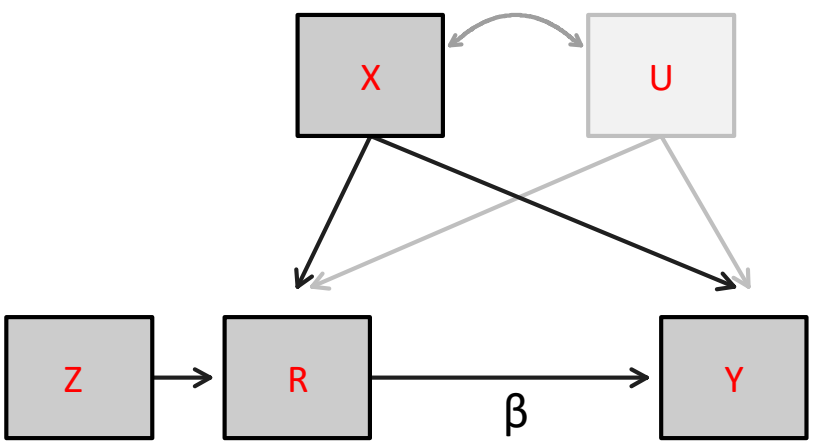
A simple comparison of the postsecondary outcomes of Massachusetts students who receive Success Boston Coaching (SBC) coaching versus Massachusetts students who did not receive SBC would likely provide a misleading picture of the effect of the SBC program, because such a comparison would not take key information into account. First, coached and non-coached students could have different individual and family characteristics. For example, students' academic achievement in high school or parental involvement might be directly related both to differences in students' interest in participating in the SBC coaching program and to their postsecondary outcomes. We refer to characteristics that affect both selection into the program and postsecondary outcomes as *confounding factors*, and these specific types of characteristics as *individual self-selection factors*.

A second type of confounding factor can arise when coached and non-coached students have been raised in different neighborhoods and had different high school experiences. For example, some coaching recipients could have had less academic support during high school, and that lack of support could have led them to seek help from an external organization. We refer to such confounders as *historical and locational factors*.

Another complication for comparing SBC and non-SBC students is that they could enroll in different colleges, which means exposure to various college-specific factors. For instance, colleges differ in their selectivity, quality of faculty and instruction, and peers' motivation and performance—any of which might influence students' outcomes in different ways. These are not confounders by definition (because they are observed *after* selection into coaching and they could not have determined whether a student participates in SBC or not), but they could still bias the estimated effects of SBC unless they are accounted for. Unlike the first two types of confounders, the influence of these college-specific factors occurs *at the same time* as the SBC coaching program is providing services; therefore, we refer to these as *contemporaneous sources of bias.*

Exhibit A-1 shows a stylized causal diagram of the nature of a set of confounders X, which affect both the receipt of coaching (receipt of treatment) R and the outcome Y, when we want to measure the direct impact of R on Y (this effect is denoted as β).

Exhibit A-1: Stylized causal diagram



If there are other confounders that are unobserved (U), the correction for bias in estimates of the effect β resulting from adjusting for X could be incomplete. One might also use factors Z that influence receipt of coaching R but have no direct impact on the outcome Y, called *excluded instruments*, in an instrumental variables (IV) estimator. But in many cases, an IV estimator relying on factors Z will have unacceptably high variance, on top of which it is very hard to claim with confidence that any observed variable satisfies both of these requirements (i.e., influences R but has no direct impact on Y) unless the variable is randomly assigned.

Ideally, we would like to randomly assign R. However, in the absence of random assignment, we wish to adjust for as many factors in X as we can, and hope either that (1) variables in U have small correlations with R and Y, such that the variables in U are unlikely to bias our estimates, or that (2) the variables in U are highly correlated with X, such that adjusting for X can substantially decrease bias due to confounders U.

For this study, it was not feasible to conduct an experimental design (or randomized control trial) that would yield two groups of students balanced on all observable and unobservable confounders. As a result, we use a quasi-experimental design that (1) compares SBC students with a comparison group of similar students and (2) can account for as many of the observable confounders as possible. Guided by the current methodological research on best quasi-experimental design practices, we constructed a comparison group using local and focal matching. That is, we matched SBC students to non-coached comparison students such that the matches were both:

1) *local* matches: the comparison cases drawn from the same settings as the treatment cases to the extent possible, and

2) *focal* matches: matching was done using baseline characteristics that we believe to predict both selection into treatment and the outcome.

We matched each SBC student with at least one and possibly multiple non-SBC students from the same cohort. Each match graduated from high schools with similar characteristics, enrolled in the same college (local matching), and shared similar baseline characteristics that are empirically linked to our outcomes of interest and also potentially to receipt of SBC coaching (focal matching). Given the large number of matching characteristics, we implemented matching using estimated propensity scores. These scores represent the conditional probability of students getting SBC coaching (given covariates), thereby incorporating all the relevant influence of the confounders on selection into treatment in one variable.[39] The assumption then is that factors Z affect receipt of coaching R conditional on X, but we need not observe Z. For example, some students might, through happenstance, hear about coaching and become more open to participating, and these students will be more likely to participate, even conditional on all X variables or the propensity score that captures the influence of X variables.

[39] One way to conduct matching is to form matched pairs that have the same baseline characteristics, which is also known as *exact matching*. Though this approach can be desirable, it sometimes becomes infeasible if too many baseline variables are used in the exact matching process. This "curse of dimensionality" problem is sometimes solved by performing the matching on a function of the baseline variables, instead of targeting exact matches on all matching variables. Rosenbaum and Rubin (1983) use the probability of being assigned to treatment given covariates as this function, which they call the *propensity score*.

The next section of the appendix describes the matching process and construction of the comparison group in detail. Section A.1 explains our local and focal matching approach in more depth; Section A.2 presents how the propensity scores were estimated; Section A.3 provides details on the matching process; and Section A.4 shows how we assessed the quality of the matches.

A.1 Implementation of Local and Focal Matching

A.1.1 Local Matching

The postsecondary outcomes of interest for this evaluation (including persistence in college, and eventually, attainment of a postsecondary credential) are directly dependent on the extent to which students' high schools prepare them for college-level coursework; the difficulty of coursework; accessibility of student support at different colleges; and students' interactions with college teaching staff, administrators, and peers. Therefore, in this context, "local matching" would ideally be implemented by matching SBC students with non-SBC students who both attend the same college and graduate from the same high school in the same year (i.e., the matching process would be conducted separately, using "matching blocks" of unique combinations of high school, college, and cohort). Matching on high school attempts to account for historical and locational differences between the SBC and non-SBC students. Matching on college controls for contemporaneous sources of bias–that is, college-related factors that are independent of the SBC program, differ across colleges, and potentially affect outcomes of interest (e.g., difficulty of coursework). Finally, matching on SBC cohort would account for differences in the overall characteristics of each cohort, and for potential differences in the coaching organizations' selection processes and changes in college-related factors from one year to the next.

Unfortunately, small cell sizes made exact matching on high schools and colleges untenable. In a number of high school/college combinations, there are no potential comparison students with whom treatment students might be matched; in other combinations, there are only one or two comparison students for many treatment students. Given our focus on postsecondary outcomes, we tried to address this problem by privileging the colleges where students first enrolled (in the fall after their high school graduation) as our primary matching block, and by pooling high schools into groups of schools with similar characteristics. However, this approach did not solve the issue, and there were still a number of high-school-group-by-college blocks that lacked a sufficient number of potential comparison students to implement the other important aspect of our matching strategy, focal matching.

The matching process we ultimately implemented entails matching within college-by-cohort blocks, using propensity scores that are conditional on high school characteristics (e.g., school-level averages of math and English language arts MCAS scores, GPA, and college-going rate) as a proxy for exact matching on high schools. With matching within the college-by-cohort blocks, we aim to control for the college-related contemporaneous sources of bias. By matching on the high school characteristics, we aim to control for the historical and locational sources of bias.

Because of SBC's focus on serving Boston students who enroll in college in the first fall after high school graduation, we selected comparison students from high schools in Boston Public Schools (BPS) and other nearby Massachusetts districts with similar characteristics to BPS, as described in Chapter 3. The process of selecting comparison students differed slightly for the 2013 and 2014 cohorts relative to the 2015 and 2016 cohorts, related in part to the size of the SBC cohorts before and after the 2015 program scale-up.

- For the 2013 and 2014 cohorts, we drew students from BPS high schools to serve as potential comparison students for SBC students, with the exception of SBC students who first matriculated

at University of Massachusetts Boston (UMB). For SBC students who first enrolled at UMB, we drew comparison students from districts surrounding BPS instead of from BPS.[40]

- In 2015, SBC was expanded under the scale-up, increasing SBC from serving approximately 300 students per cohort to approximately 1,000 students per cohort. Under this scale-up, three times as many students received coaching starting in 2015. For that reason, for the 2015 and 2016 cohorts we drew comparison students from both BPS and surrounding districts to ensure we had a sufficiently large comparison group.

A.1.2 Focal Matching

Focal matching entails matching SBC students with non-SBC students who have similar values for individual self-selection confounders—that is, student-level factors related both to the outcomes of interest and to the pairing of SBC students with specific coaching organizations. As mentioned above, we matched SBC and non-SBC students using propensity scores, which represent students' probability of receiving SBC coaching and are calculated as a function of the selection confounders.

When calculating propensity scores, a tension exists between including too many variables and including too few. On the one hand, it is tempting to use every student characteristic available to calculate a propensity score, such that treatment and comparison groups will be balanced on the greatest number of possible confounders. On the other hand, the more variables incorporated into a propensity score, the greater the likelihood that some may not be as balanced as would be using a more parsimonious set of matching variables. Focusing on a smaller set of particularly important variables therefore increases the efficiency of the propensity score. This efficiency allows us to construct matched treatment and comparison groups that are more balanced on those student characteristics that pose the greatest threat of bias.

We conducted a thorough literature review to determine pre-treatment (baseline) factors that were shown to be related to our outcomes of interest. Exhibits A-2 and A-3 present the results of this review. We also collected information from coaching organizations about criteria they use when selecting and/or targeting students for their programs. Most organizations indicated that they do not follow a strict selection process based on observable student characteristics when recruiting students.[41] To avoid missing some important confounders, we decided in the estimation of the propensity scores to use all of the relevant variables

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[40] All BPS students attending UMB Boston are assigned a coach—some through Success Boston, others by UMB staff. As such, considering non-SBC students from BPS as potential matches would be inappropriate. Therefore, for SBC students attending UMB, we selected comparison students from among other UMB students from districts with similar characteristics to BPS. We chose comparison districts were by comparing median incomes with Boston's median among those districts both that were within the top 20 sending districts to UMB in either 2011 or 2012, and that contained at least one high school consistently sending no fewer than 10 students in any year and no fewer than 15 students a year, on average, to UMB between 2009 and 2013.

[41] One coaching organization indicated that it had eligibility criteria that included high school GPA and socioeconomic status indicators.

yielded by the literature review and available in the administrative datasets.[42] Exhibit A-4 lists these variables.[43]

Exhibit A-2: Postsecondary education outcomes literature reviewed

Source	Characteristic(s) Discussed
Advisory Committee on Student Financial Assistance (2013)	ACT scores; full-time status; SES/affordability; spending per student
Allen (1999)	Motivation to finish school
Bridgeman, McCamley-Jenkins, and Ervin (2000)	SAT scores
Brown and Lee (2005)	Race/ethnicity
Buchmann and DiPrete (2006)	Gender
Cabrera, Nora, Castañeda (1992)	SES
Camara and Echternacht (2000)	High school GPA; SAT scores
DeAngelo et al. (2011)	Age; first-generation college-goer status; gender; institutional commitment (level of confidence in, and satisfaction with, institutional choice); parental education; postsecondary student achievement; race/ethnicity; SES/affordability; students' residency (on or off campus, near or far from campus)
DeBerard, Spielmans, and Julka (2004)	Early college performance; gender; high school GPA; SAT scores; social support
Dennis, Phinney, and Chuateco (2005)	High school GPA
Durkin and Kircher (2010)	Faculty hiring practices; full-time status; spending per student
Feldman (1993)	High school GPA; full-time status; race/ethnicity
Fletcher and Tienda (2010)	Race/ethnicity
Flores, Batalovo, and Fix (2012)	English language learner status
Frazier et al. (2007)	Learning differences
Gramling (2013)	Full-time status; high school GPA; race/ethnicity; SES/affordability
Harklau, Losey and Siegal (1999)	English language learner status
Horn and Kojaku (2001)	Difficulty of high school curricula
Ishitani and DesJardins (2002)	Financial aid; parental education; SES
Kao and Thompson (2003)	Race/ethnicity
Lotkowski, Robbns, and Noeth (2004)	Academic skills, confidence, goals; ACT scores; financial aid; high school GPA; institutional commitment (level of confidence in, and satisfaction with, institutional choice); institutional selectivity; motivation to finish school; SES; social integration
Osborne (2002)	Gender; race/ethnicity

[42] Some of the variables yielded by the literature review pertain to students' experiences in postsecondary institutions (e.g., employment and on-campus residence). Because these variables are post-treatment and could be influenced by coaching, we did not include them in the matching process.

[43] The data source(s) for the matching characteristics reflects the nature of the students in our sample. As noted above, the 2013 and 2014 cohort students were mainly from BPS, with the exception of students first enrolled at UMB, for whom we drew comparison students from surrounding districts. As a result, for the 2013 and 2014 cohorts we use BPS data for baseline matching characteristics for non-UMB students, and data from the Massachusetts Department of Elementary and Secondary Education (MA DESE) for baseline data for non-UMB students. Because the 2015 and 2016 cohort students were more likely to be from districts surrounding BPS (as opposed to from BPS itself) than was true in the 2013 and 2014 cohorts, we use MA DESE data for the baseline matching characteristics for the 2015 and 2016 cohorts.

Source	Characteristic(s) Discussed
Seidman (2005)	Early college performance; financial aid; gender; high school GPA; on-campus employment; parental education; race/ethnicity; SAT scores; SES; social integration; students' residency (on or off campus, near or far from campus)
Steele (2003)	Race/ethnicity
Trainin and Swanson (2005)	Learning differences
Vogel and Adelman (1992)	Learning differences
Wagner et al. (2005)	Learning differences and other disabilities
Zwick and Skylar (2005)	High school GPA; race/ethnicity; SAT scores

SES=socioeconomic status.
Note: SES measured by free/reduced-price lunch status.

Exhibit A-3: Summary of postsecondary education outcomes literature

Characteristic Discussed	Associated with Outcome		
	Postsecondary Completion	Annual Persistence	Academic Achievement
Academic skills, confidence, goals		X	X
ACT scores	X	X	X
Age	X		
Difficulty of high school curricula (at an individual student level; e.g., number of honors courses taken, etc.)		X	X
Early college performance		X	X
English language learner status	X	X	X
Financial aid	X	X	X
Full-time status	X	X	
Gender	X	X	X
High school GPA	X	X	X
Institutional selectivity		X	
Learning differences	X	X	X
Motivation to finish school	X	X	Mixed
On-campus employment		X	
Parental education / first-generation college-goer status	X	X	X
Postsecondary student achievement	X		
Race/ethnicity	X	X	X
SAT scores	X	X	X
SES	X	X	X
Social integration/support		X	X
Spending per student	X		
Students' residency (on or off campus, near or far from campus)	X	X	

SES=socioeconomic status.

Exhibit A-4: Matching characteristics

Variable	Domain	Data Sources for 2013-2014 Cohorts	Data Sources for 2015-2016 Cohorts
Age	Demographics	BPS and MA DESE	MA DESE
Gender			
Disability status			
Race/ethnicity			
SES			
Ever designated as English language learner			
High school suspensions and detentions	Behavioral indicators	BPS and MA DESE	MA DESE
High school attendance			
High school GPA	High school performance	BPS and MA DESE	MA DESE
SAT scores			
10th-grade MCAS scores			
Advanced course taking in high school			
Timing, source, and type of information received about postsecondary education and career options (only for non-UMB students in 2013 and 2014 cohorts)*	Knowledge and Motivations about Postsecondary Education	BPS Exit Survey	N/A

BPS= Boston Public Schools; MA DESE=Massachusetts Department of Elementary and Secondary Education; MCAS=Massachusetts Comprehensive Assessment System; SES=socioeconomic status.

* Because the measures of students' motivation and knowledge about postsecondary education from BPS Exit Surveys were not available for the 2013 and 2014 cohort students from other Massachusetts districts, we performed a separate propensity score calculation—without postsecondary education knowledge indicators—among UMB students. The BPS Exit Survey variables were also not available for students in the 2015 and 2016 cohorts, for whom the MA DESE data rather than BPS data were our data source for matching variables.

We addressed missing values for the matching characteristics (with the exception of free/reduced-price lunch status—a proxy for SES—and high school GPA, for which there were no missing data among students in the analysis sample) using the "dummy variable method" (Rosenbaum and Rubin 1984; Stuart 2010).[44]

A.2 Estimation of Propensity Scores

We estimated propensity scores via six logistic regression models across the 2013 and 2014 cohorts and the 2015 and 2016 cohorts described in Exhibit A-5.

[44] For variables included in the propensity score estimation models, missingness rates ranged from 0 percent to 12 percent. The dummy variable method entails replacing the missing values with the sample means and including a dummy variable indicating such values. As Stuart (2010) points out, propensity scores calculated in this manner would match both on observed covariate values and on missing data patterns.

Exhibit A-5: Logistic Regression Models by Cohort

Cohort	Logistic Regression Model
2013 and 2013 cohorts[a,b]	Logistic model that includes all covariates in Exhibit A-4 above estimated with all SBC students from the 2013 cohort except those who enrolled in UMB (treatment students) and non-SBC students from the 2013 BPS cohort who enrolled in the same colleges as the treatment students (potential comparison students)
	Logistic model that includes all covariates listed in Exhibit A-4 estimated with all SBC students from the 2014 cohort except those who enrolled in UMB (treatment students) and non-SBC students from the 2014 BPS cohort who enrolled in the same colleges as the treatment students (potential comparison students)
	Logistic model that includes all covariates listed in Exhibit A-4 except those from BPS Exit Surveys, estimated with SBC students from the 2013 cohort who enrolled in UMB and non-SBC students who graduated in 2013 from high schools in similar Massachusetts districts surrounding BPS and who enrolled in UMB
	Logistic model that includes all covariates listed in Exhibit A-4 except those from BPS Exit Surveys, estimated with SBC students from the 2014 cohort who enrolled in UMB and non-SBC students who graduated in 2014 from high schools in similar Massachusetts districts surrounding BPS and who enrolled in UMB.
2015 and 2016 cohorts[c]	Logistic model that includes all covariates listed above, plus high school-level averages of GPA, 10th-grade MCAS scores, and college-going rate, estimated with all SBC students from the 2015 cohort (treatment students) and non-SBC students from the 2015 cohort who enrolled in the same colleges as the treatment students (potential comparison students).
	Logistic model that includes all covariates listed above, plus high school-level averages of GPA, 10th-grade MCAS scores, and college-going rate, estimated with all SBC students from the 2016 cohort (treatment students) and non-SBC students from the 2016 cohort who enrolled in the same colleges as the treatment students (potential comparison students).

BPS= Boston Public Schools; MCAS=Massachusetts Comprehensive Assessment System.

[a] As mentioned previously, we estimated different propensity score models for the UMB students and for students from other colleges in the 2013 and 2014 cohorts, because potential comparison students for the treatment students in UMB lacked the BPS Exit Survey variables. We estimated separate models for the 2013 cohort and the 2014 cohort to capture potential changes in the selection processes employed by the coaching organizations between the two years.

[b] We included higher-order terms of and interactions between selected variables (e.g., Math MCAS scores squared, interactions between race/ethnicity indicators and SAT scores) to achieve better balance in some cases.

[c] We estimated separate models for the 2015 and 2016 cohorts to capture potential changes in the selection processes employed by the coaching organizations between the two years.

A.3 Conducting Matching and Assessing Quality of the Matches

Matching Methods

We acknowledge that there are many variants of propensity score matching that differ by whether matching is conducted with replacement, how many comparison units are matched with each treatment unit, and whether common support is enforced for each treatment unit (Caliendo and Kopeinig 2008; Smith and Todd 2005; Stuart 2010). We implemented *radius matching*, which entails matching each treatment student with all potential comparison students whose propensity scores are within the pre-specified caliper of his/her score (± 0.4 of the standard deviation [SD] of the propensity scores) in his/her block. For the 2015 and 2016 cohorts only, we also imposed *exact matching* using two baseline covariates, *female* and *Black*, to improve balance on those characteristics for those cohorts specifically. For all cohorts, we conducted matching with replacement, and matching weights captured the number of comparison units each treatment unit was matched with and vice versa. Treatment students who did not have any potential comparison students within their propensity score caliper were unmatched and excluded from the estimation of SBC effects.

We chose this method as our primary method because it balances the two important aspects of matching: closeness of the matches and the size of the matched groups. Using a caliper ensures that a treatment student is matched with a comparison student with a sufficiently similar propensity score and that treatment students without any such matches are excluded. Including all comparison units within the caliper maximizes the size of the analytic sample and statistical power. The baseline characteristics of the analytic sample reported in Chapter 3 and the impact results reported in Chapter 4 are obtained with the matched groups yielded by this method.

Exhibit A-6 shows the sizes of the matched treatment and comparison groups for each outcome measure across the 2013/2014 cohorts and the 2015/2016 cohorts. For each set of cohorts (2013/2014 or 2015/2016), the most recent persistence outcome and most recent completion outcome have the same sample and are thus grouped together (for example, completion in six years and persistence into the seventh year, currently available for the 2013 cohort only). The remaining persistence and completion outcomes have the same sample and are thus grouped together (for example, completion in four or five years or persistence into the second through sixth years for the 2013/2014 cohorts).

Across all measures, between 5 and 17 percent of the SBC students were unmatched for not having a sufficiently similar comparison student. Coached students are more likely to be from groups traditionally underrepresented in college; this made it more difficult to identify adequate comparison students for all coached students. However, to maintain the study's internal validity, it was necessary to include only the coached students for whom we could identify statistically similar comparison students.

Exhibit A-6: Sample sizes for each outcome

	2013 and 2014 cohorts			2015 and 2016 cohorts		
	Completion in 4, 5 Years; Persistence into 2nd, 3rd, 4th, 5th, 6th Years	Persistence into 7th Year; Completion in 6 Years	Credit Accumulation	Persistence into 2nd, 3rd, and 4th Years	Persistence into 5th Year	Credit Accumulation
Matched treatment students (n)	678	302	649	1,234	561	838
Matched treatment students (%)	95	93	95	83	83	85
Non-matched treatment students (n)	37	22	32	246	113	144
Non-matched treatment students (%)	5	7	5	17	17	15
Matched comparison students (n)	1,834	801	1,517	4,629	2,158	2,841
Matched comparison students (%)	82	81	96	52	50	82
Non-matched comparison students (n)	397	186	59	4270	2185	644
Non-matched comparison students (%)	18	19	4	48	50	18

A.4 Matching Diagnostics

The most important step in matching is to examine to what extent matching worked, by checking the balance of the matched treatment and comparison groups. As explained in more detail below, we assessed the balance of the match by examining the distribution of the propensity scores in the matched treatment and comparison groups. We also assessed the standardized difference of each matching variable between the two groups.

We used an iterative process to pick the final matched groups for each outcome measure. This process entailed (1) fitting the propensity score model with the matching covariates as described in Section A.2; (2) conducting matching as described in Section A.3; and (3) assessing baseline balance. If balance was satisfactory, we deemed the matched groups as final and used them in the estimation of effects. We conducted this process separately for each outcome measure.

When balance was not satisfactory initially, the strategies taken to correct any initial imbalances differed slightly by cohort.

- For the 2013/2014 cohorts, if balance was not satisfactory initially, we modified the propensity model in step 3 to include higher-order terms and interactions of the unbalanced matching variances. We repeated the whole process until satisfactory balance was achieved.
- For the 2015/2016 cohorts, if balance was not satisfactory initially, we modified the matching mechanism (e.g., by requiring exact matching for the terms with the unbalanced matching variances). We then repeated the whole process until we achieved satisfactory balance.

Exhibit A-7a provides evidence for the balance of the final matched groups for students in the 2013/2014 cohorts for the outcome measures *completion after four years* and *five years* and *persistence into the second, third, fourth, fifth,* and *sixth years*, all of which share the same sample. Exhibit A7-b provides evidence for the balance of the final matched groups for students in the 2015/2016 cohorts for the outcome measures *persistence into the second, third,* and *fourth years*, all of which share the same sample. The balance of the matched groups is similar for the other outcomes for the two sets of cohorts.

In each of Exhibit A-7a and Exhibit A-7b, the left-hand panel shows that before matching, distributions of propensity scores for treatment students and potential comparison students were somewhat different, with the latter being more skewed to the right than the former. The right-hand panel in each exhibit shows that matching yields matched treatment and comparison groups with overlapping propensity score distributions.

Exhibit A-7a: Distributions of propensity scores for completion in four and five years and persistence into the second through sixth years, 2013 and 2014 cohorts

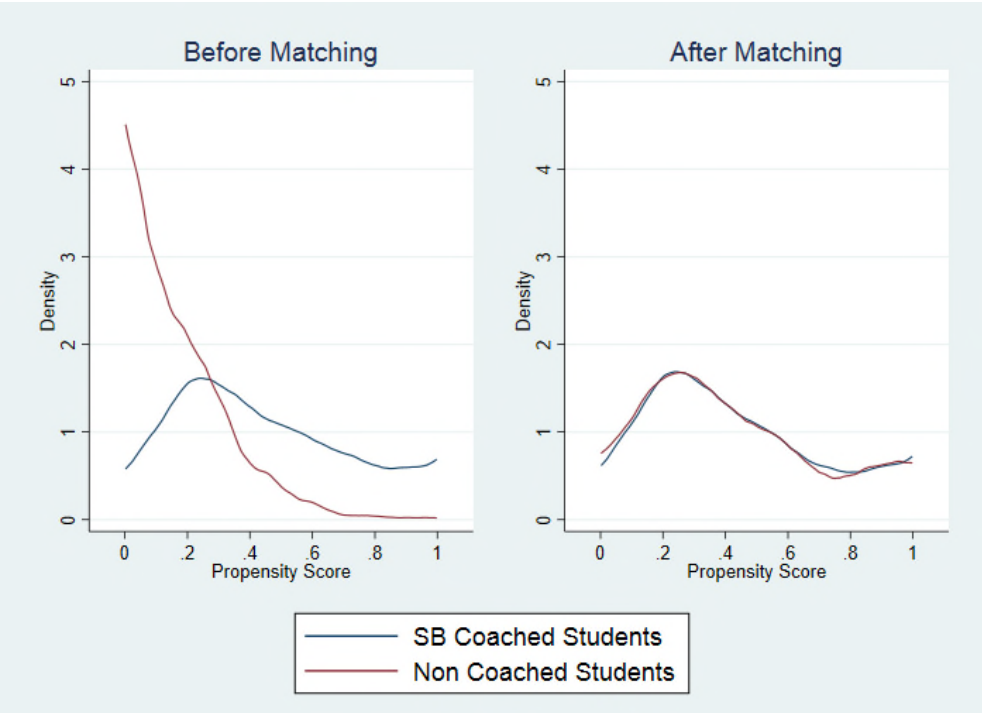
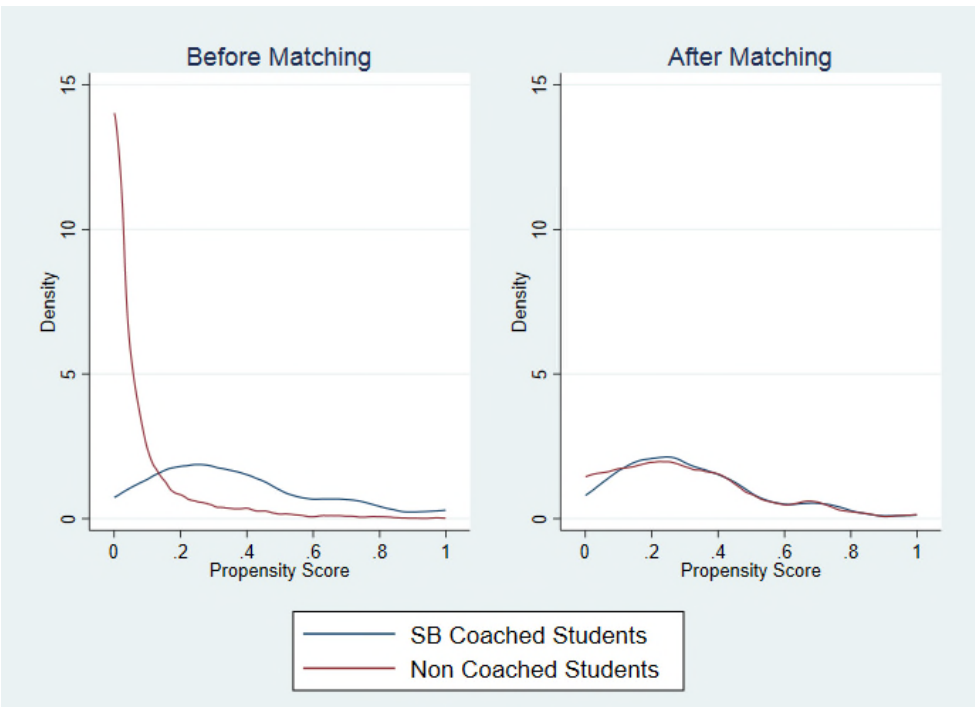


Exhibit A-7b: Distributions of propensity scores for persistence into the second through fourth years, 2015 and 2016 cohorts



The literature on propensity score matching suggests that having similar propensity score distributions within the matched groups is a necessary but not sufficient condition for having balanced groups (King and Nielsen 2016; Morgan and Winship 2014). Following Rosenbaum and Rubin (1985) and What Works Clearinghouse (2014), we explicitly assessed to what extent matching improved the covariate balance. We did this by examining the standardized differences in the means of each matching covariate between the treatment students and potential comparison students prior to matching and between the matched groups after matching.

We calculated the standardized differences ("effect sizes") as follows: For each matching covariate, we first fit a weighted regression model that used the matching covariate as the dependent variable and the treatment group indicator and indicators for matching blocks (for local matching) as independent variables. We then calculated the standardized difference as the ratio of the coefficient on the treatment indicator to the pooled standard deviation of the matching covariate across the treatment students and potential comparison students. To establish baseline balance between the treatment students and matched comparison students, we required the standardized differences to be less than 15 percent of a standard deviation in absolute value[45] for all matching variables.

Exhibit A-8 shows the standardized baseline differences before and after matching for each outcome measure with radius matching.

As an example, let's examine the differences for the sample for completion in four and five years and for persistence into the second through sixth years for the 2013 and 2014 cohorts (all the same sample). The "Standardized Difference" column in the left-hand "Before Matching" panel shows that the pre-matching differences for some variables are notably large: at the student level, -0.38 standard deviation (SD) for White, 0.36 SD for free/reduced price lunch eligible, -0.29 SD for SAT score, and -0.25 SD for English Language arts MCAS score; at the school level, -0.27 SD for high school-level average math MCAS score and -0.28 SD for high school-level average GPA. The second column shows that matching reduced all of the pre-matching differences that were larger than the 0.15 SD threshold we established without distorting the balance for the variables that had been balanced prior to matching. Of the 24 matching variables, the post-matching differences were smaller than 0.05 SD (in absolute value) for 20 variables, between 0.05 and 0.10 SD for three other variables, and between 0.10 and 0.15 SD for the remaining one variable.

The balance estimates for the other outcomes in Exhibit A-8 were also all below 0.15 SD, for both the 2013/2014 and 2015/2016 cohorts. Based on these results, we deemed the matched treatment and comparison groups balanced and used them in the estimation of SBC effects.

[45] Note that this 0.15 criterion is more stringent than what is used by the What Works Clearinghouse, which requires the baseline differences between quasi-experimental treatment and comparison groups be less than 0.25 SD to meet WWC evidence standards.

Exhibit A-8. Standardized baseline differences by outcome, radius matching

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standard-zed Difference
2013 and 2014 Cohorts														
Outcomes: Completion after 4 and 5 Years; Persistence into 2nd, 3rd, 4th, 5th, and 6th Years														
Demographics														
Age	715	2,231	18.27	18.19	0.82	0.82	0.076	678	1,834	18.27	18.32	0.82	0.90	-0.052
Female	715	2,231	0.60	0.53	0.49	0.50	0.173	678	1,834	0.60	0.61	0.49	0.49	-0.022
English language learner	715	2,231	0.15	0.10	0.36	0.30	0.151	678	1,834	0.15	0.15	0.36	0.35	0.015
Free/reduced-price lunch eligible	715	2,231	0.87	0.71	0.34	0.45	0.361	678	1,834	0.87	0.84	0.34	0.37	0.083
Student has a high-incidence disability	715	2,231	0.06	0.07	0.23	0.26	-0.070	678	1,834	0.06	0.05	0.24	0.23	0.019
Student has a low-incidence disability	715	2,231	0.06	0.04	0.24	0.19	0.112	678	1,834	0.06	0.05	0.23	0.21	0.038
Black	715	2,231	0.41	0.36	0.49	0.48	0.141	678	1,834	0.41	0.42	0.49	0.49	-0.034
White	715	2,231	0.06	0.19	0.24	0.39	-0.378	678	1,834	0.07	0.08	0.25	0.27	-0.048
Asian/Pacific Islander	715	2,231	0.16	0.18	0.37	0.38	-0.027	678	1,834	0.15	0.11	0.36	0.32	0.124
Hispanic	715	2,231	0.36	0.27	0.48	0.44	0.177	678	1,834	0.36	0.38	0.48	0.48	-0.026
Native American	715	2,231	0.00	0.00	0.06	0.05	0.028	678	1,834	0.00	0.00	0.05	0.05	0.004
Other/Multiracial	715	2,231	0.01	0.01	0.07	0.09	-0.037	678	1,834	0.01	0.01	0.08	0.07	0.011
Achievement in High School														
SAT score (2400)	648	1,949	1233.07	1363.81	251.07	306.21	-0.288	612	1,580	1240.11	1245.24	247.15	254.07	-0.011
10th grade English MCAS scaled score	710	2,207	-0.53	-0.22	0.93	0.97	-0.253	673	1,812	-0.52	-0.48	0.93	0.99	-0.049
10th grade math MCAS scaled score	709	2,208	-0.08	0.06	0.89	0.92	-0.039	672	1,811	-0.08	-0.08	0.88	0.89	0.005
High school GPA	715	2,231	2.82	2.82	0.70	0.73	0.017	678	1,834	2.81	2.80	0.69	0.68	0.013
Student took an advanced course	711	2,215	0.57	0.50	0.50	0.50	0.225	674	1,818	0.55	0.55	0.50	0.50	0.002
Number of advanced courses taken	711	2,215	1.02	0.94	1.18	1.22	0.166	674	1,818	1.00	1.02	1.18	1.23	-0.015
Behavioral														

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standard-zed Difference
Percentage of school days student was present	694	2,173	79.86	80.79	32.45	32.16	0.027	658	1,777	79.10	79.03	33.14	33.01	0.001
Number of suspensions	715	2,231	0.04	0.06	0.24	0.51	-0.071	678	1,834	0.04	0.05	0.24	0.28	-0.007
High School Characteristics														
High school average English MCAS score	650	2,101	33.81	36.63	7.95	8.64	-0.184	616	1,730	33.97	34.28	7.95	7.25	-0.027
High school average math MCAS score	650	2,101	47.83	50.30	6.07	6.48	-0.274	616	1,730	47.88	48.31	6.07	5.62	-0.063
High school average GPA	715	2,231	2.41	2.54	0.38	0.43	-0.279	678	1,834	2.42	2.41	0.38	0.36	0.016
High school college-going rate	715	2,231	0.59	0.62	0.28	0.25	-0.116	678	1,834	0.60	0.60	0.28	0.27	0.005
Outcomes: Completion in 6 Years; Persistence into 7th Year														
Demographics														
Age	324	987	18.32	18.24	0.86	0.86	0.076	302	801	18.33	18.37	0.86	0.92	-0.049
Female	324	987	0.59	0.52	0.49	0.50	0.141	302	801	0.57	0.60	0.50	0.49	-0.056
English language learner	324	987	0.15	0.10	0.36	0.30	0.158	302	801	0.15	0.15	0.36	0.36	0.010
Free/reduced-price lunch eligible	324	987	0.83	0.70	0.38	0.46	0.296	302	801	0.83	0.78	0.38	0.41	0.115
Student has a high-incidence disability	324	987	0.06	0.09	0.24	0.28	-0.115	302	801	0.06	0.07	0.24	0.25	-0.025
Student has a low-incidence disability	324	987	0.06	0.03	0.25	0.18	0.173	302	801	0.06	0.05	0.23	0.22	0.024
Black	324	987	0.40	0.37	0.49	0.48	0.109	302	801	0.39	0.43	0.49	0.49	-0.070
White	324	987	0.05	0.18	0.22	0.38	-0.414	302	801	0.05	0.08	0.22	0.26	-0.087
Asian/Pacific Islander	324	987	0.18	0.16	0.38	0.37	-0.027	302	801	0.17	0.15	0.38	0.36	0.041
Hispanic	324	987	0.37	0.28	0.48	0.45	0.230	302	801	0.38	0.34	0.49	0.47	0.089
Native American	324	987	0.01	0.00	0.08	0.06	0.044	302	801	0.01	0.00	0.08	0.07	0.032
Other/Multiracial	324	987	0.00	0.01	0.00	0.07	-0.099	302	801	0.00	0.00	0.00	0.05	-0.063
Achievement in High School														
SAT score (2400)	293	854	1216.08	1320.00	253.55	278.52	-0.309	271	677	1222.36	1228.08	253.51	256.59	-0.017
10th grade English MCAS scaled score	322	976	-0.50	-0.28	0.89	0.99	-0.208	300	792	-0.50	-0.42	0.90	0.94	-0.087

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standard-zed Difference
10th grade math MCAS scaled score	321	976	-0.11	-0.01	0.89	0.89	-0.063	299	790	-0.11	-0.10	0.89	0.92	-0.008
High school GPA	324	987	2.85	2.78	0.70	0.71	0.064	302	801	2.83	2.79	0.70	0.69	0.053
Student took an advanced course	322	982	0.57	0.45	0.50	0.50	0.248	300	796	0.54	0.52	0.50	0.50	0.048
Number of advanced courses taken	322	982	1.10	0.83	1.25	1.20	0.205	300	796	1.04	1.01	1.24	1.32	0.020
Behavioral														
Percentage of school days student was present	313	950	63.74	64.53	42.76	42.98	0.046	291	765	61.39	61.25	43.44	43.17	-0.001
Number of suspensions	324	987	0.02	0.04	0.17	0.26	-0.070	302	801	0.03	0.03	0.18	0.22	-0.020
High School Characteristics														
High school average English MCAS score	296	936	33.89	35.41	7.91	7.98	-0.130	275	763	34.02	34.08	7.94	6.74	0.001
High school average math MCAS score	296	936	47.80	49.45	6.04	6.14	-0.223	275	763	47.80	47.97	6.06	5.27	-0.023
High school average GPA	324	987	2.38	2.48	0.39	0.39	-0.239	302	801	2.38	2.38	0.39	0.34	0.016
High school college-going rate	324	987	0.51	0.55	0.23	0.20	-0.138	302	801	0.52	0.52	0.22	0.20	0.007
Outcome: Credit Accumulation														
Demographics														
Age	681	1,576	18.27	18.21	0.81	0.87	0.080	649	1,517	18.27	18.33	0.81	0.90	-0.067
Female	681	1,576	0.59	0.51	0.49	0.50	0.168	649	1,517	0.59	0.60	0.49	0.49	-0.027
English language learner	681	1,576	0.16	0.11	0.36	0.31	0.150	649	1,517	0.15	0.15	0.36	0.36	0.003
Free/reduced-price lunch eligible	681	1,576	0.87	0.72	0.34	0.45	0.379	649	1,517	0.87	0.85	0.34	0.36	0.060
Student has a high-incidence disability	681	1,576	0.06	0.08	0.23	0.28	-0.073	649	1,517	0.06	0.05	0.23	0.23	0.016
Student has a low-incidence disability	681	1,576	0.06	0.04	0.24	0.20	0.116	649	1,517	0.06	0.05	0.23	0.21	0.044
Black	681	1,576	0.41	0.35	0.49	0.48	0.149	649	1,517	0.40	0.43	0.49	0.49	-0.049
White	681	1,576	0.06	0.19	0.25	0.40	-0.384	649	1,517	0.07	0.07	0.25	0.25	0.004

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standard-zed Difference
Asian/Pacific Islander	681	1,576	0.16	0.16	0.37	0.37	-0.019	649	1,517	0.16	0.11	0.36	0.32	0.133
Hispanic	681	1,576	0.36	0.29	0.48	0.45	0.161	649	1,517	0.36	0.38	0.48	0.49	-0.044
Native American	681	1,576	0.00	0.00	0.07	0.06	0.028	649	1,517	0.00	0.00	0.06	0.05	0.008
Other/Multiracial	681	1,576	0.01	0.01	0.08	0.09	-0.036	649	1,517	0.01	0.01	0.08	0.08	0.001
Achievement in High School														
SAT score (2400)	617	1,316	1226.95	1312.01	247.54	278.43	-0.317	587	1,271	1232.56	1239.20	243.30	249.43	-0.013
10th grade English MCAS scaled score	677	1,553	-0.55	-0.35	0.93	1.00	-0.259	645	1,495	-0.54	-0.49	0.93	1.00	-0.058
10th grade math MCAS scaled score	676	1,553	-0.09	-0.11	0.88	0.90	-0.027	644	1,494	-0.09	-0.09	0.88	0.88	0.001
High school GPA	681	1,576	2.82	2.75	0.69	0.74	0.026	649	1,517	2.81	2.79	0.68	0.68	0.025
Student took an advanced course	678	1,560	0.57	0.42	0.50	0.49	0.243	646	1,501	0.55	0.55	0.50	0.50	0.001
Number of advanced courses taken	678	1,560	1.01	0.74	1.17	1.13	0.183	646	1,501	0.99	1.02	1.17	1.24	-0.023
Behavioral														
Percentage of school days student was present	661	1,520	79.23	75.10	33.10	36.76	0.030	630	1,462	78.54	78.26	33.73	33.78	0.007
Number of suspensions	681	1,576	0.05	0.08	0.24	0.58	-0.061	649	1,517	0.05	0.05	0.24	0.28	-0.002
High School Characteristics														
High school average English MCAS score	616	1,476	33.76	34.79	7.86	7.32	-0.185	587	1,426	33.89	34.30	7.91	7.18	-0.043
High school average math MCAS score	616	1,476	47.79	49.34	6.00	5.89	-0.286	587	1,426	47.84	48.32	6.02	5.59	-0.074
High school average GPA	681	1,576	2.41	2.52	0.37	0.43	-0.284	649	1,517	2.42	2.42	0.38	0.36	0.006
High school college-going rate	681	1,576	0.59	0.61	0.28	0.27	-0.106	649	1,517	0.60	0.60	0.28	0.27	-0.006
2015 and 2016 Cohorts														
Outcomes: Persistence into 2nd, 3rd, and 4th Years														
Demographics														
Age	1,480	8,899	18.21	18.04	0.72	0.63	0.164	1,234	4,629	18.20	18.21	0.71	0.74	-0.026
Female	1,480	8,899	0.60	0.54	0.49	0.50	0.175	1,234	4,629	0.60	0.60	0.49	0.49	0.000

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standard-zed Difference
English language learner	1,480	8,899	0.10	0.05	0.30	0.21	0.168	1,234	4,629	0.10	0.10	0.29	0.30	-0.007
Free/reduced-price lunch eligible	1,480	8,899	0.75	0.56	0.43	0.50	0.325	1,234	4,629	0.74	0.74	0.44	0.44	-0.010
Student has a high-incidence disability	1,480	8,899	0.08	0.05	0.28	0.22	0.081	1,234	4,629	0.08	0.08	0.28	0.27	0.008
Student has a low-incidence disability	1,480	8,899	0.02	0.03	0.14	0.16	-0.066	1,234	4,629	0.02	0.03	0.15	0.17	-0.051
Black	1,480	8,899	0.44	0.24	0.50	0.43	0.415	1,234	4,629	0.42	0.42	0.49	0.49	0.000
White	1,480	8,899	0.07	0.35	0.25	0.48	-0.536	1,234	4,629	0.08	0.08	0.27	0.27	-0.002
Asian/Pacific Islander	1,480	8,899	0.15	0.18	0.35	0.39	-0.066	1,234	4,629	0.16	0.17	0.37	0.38	-0.029
Hispanic	1,480	8,899	0.32	0.21	0.47	0.40	0.210	1,234	4,629	0.33	0.31	0.47	0.46	0.028
Native American	1,480	8,899	0.00	0.00	0.06	0.05	0.014	1,234	4,629	0.00	0.00	0.06	0.07	-0.011
Other/Multiracial	1,480	8,899	0.01	0.02	0.12	0.13	-0.021	1,234	4,629	0.01	0.01	0.11	0.12	-0.009
Achievement in High School														
SAT score (2400)	1,360	8,031	1304.04	1436.20	285.70	300.63	-0.242	1,124	4,164	1309.08	1293.43	283.78	284.82	0.059
10th grade English MCAS scaled score	1,410	8,559	-0.29	0.07	0.93	0.90	-0.230	1,169	4,425	-0.28	-0.33	0.92	0.96	0.054
10th grade math MCAS scaled score	1,418	8,592	-0.04	0.18	0.93	0.88	-0.118	1,178	4,441	-0.05	-0.03	0.92	0.89	-0.019
High school GPA	1,480	8,899	2.46	2.89	0.87	0.71	-0.459	1,234	4,629	2.52	2.54	0.82	0.83	-0.021
Student took an advanced course	1,480	8,899	0.57	0.55	0.50	0.50	0.157	1,234	4,629	0.56	0.56	0.50	0.50	0.012
Number of advanced courses taken	1,480	8,899	1.07	1.31	1.27	1.62	-0.008	1,234	4,629	1.08	1.10	1.29	1.39	-0.015
Behavioral														
Percentage of school days student was present	1,479	8,881	93.08	93.88	6.56	6.26	-0.059	1,233	4,624	93.08	93.05	6.69	7.38	0.004
Number of suspensions	1,480	8,899	0.18	0.34	0.71	1.49	-0.087	1,234	4,629	0.19	0.18	0.74	0.67	0.008
High School Characteristics														
High school average English MCAS score	1,480	8,898	-0.42	-0.14	0.63	0.44	-0.480	1,234	4,629	-0.40	-0.38	0.63	0.56	-0.036

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standard-zed Difference
High school average math MCAS score	1,480	8,899	-0.18	-0.04	0.63	0.45	-0.209	1,234	4,629	-0.17	-0.16	0.63	0.56	-0.032
High school average GPA	1,480	8,899	2.25	2.73	0.54	0.34	-1.135	1,234	4,629	2.32	2.37	0.46	0.48	-0.106
High school college-going rate	1,480	8,899	0.68	0.67	0.18	0.13	0.132	1,234	4,629	0.67	0.67	0.19	0.16	-0.009
Outcome: Persistence into 5th Year														
Demographics														
Age	674	4,343	18.24	18.05	0.72	0.63	0.201	561	2,158	18.23	18.25	0.71	0.75	-0.028
Female	674	4,343	0.59	0.54	0.49	0.50	0.179	561	2,158	0.58	0.58	0.49	0.49	0.000
English language learner	674	4,343	0.11	0.05	0.31	0.21	0.222	561	2,158	0.10	0.12	0.30	0.32	-0.063
Free/reduced-price lunch eligible	674	4,343	0.72	0.56	0.45	0.50	0.230	561	2,158	0.71	0.69	0.46	0.46	0.034
Student has a high-incidence disability	674	4,343	0.08	0.05	0.27	0.22	0.045	561	2,158	0.08	0.09	0.27	0.28	-0.030
Student has a low-incidence disability	674	4,343	0.02	0.02	0.14	0.16	-0.090	561	2,158	0.02	0.03	0.14	0.17	-0.050
Black	674	4,343	0.46	0.23	0.50	0.42	0.453	561	2,158	0.42	0.42	0.49	0.49	0.000
White	674	4,343	0.07	0.35	0.26	0.48	-0.514	561	2,158	0.08	0.09	0.28	0.29	-0.020
Asian/Pacific Islander	674	4,343	0.15	0.19	0.36	0.39	-0.036	561	2,158	0.17	0.19	0.38	0.39	-0.041
Hispanic	674	4,343	0.30	0.21	0.46	0.41	0.135	561	2,158	0.31	0.28	0.46	0.45	0.069
Native American	674	4,343	0.00	0.00	0.05	0.06	-0.027	561	2,158	0.00	0.01	0.04	0.08	-0.069
Other/Multiracial	674	4,343	0.01	0.01	0.11	0.12	-0.028	561	2,158	0.01	0.01	0.09	0.11	-0.039
Achievement in High School														
SAT score (2400)	610	3,943	1304.30	1441.22	283.96	302.58	-0.218	505	1,925	1314.59	1292.29	279.30	289.85	0.079
10th grade English MCAS scaled score	634	4,122	-0.33	0.09	0.95	0.91	-0.249	524	2,030	-0.30	-0.37	0.94	1.02	0.072
10th grade math MCAS scaled score	633	4,142	-0.15	0.16	0.94	0.88	-0.172	524	2,036	-0.12	-0.07	0.92	0.91	-0.059
High school GPA	674	4,343	2.39	2.86	0.81	0.68	-0.524	561	2,158	2.44	2.48	0.80	0.77	-0.048
Student took an advanced course	674	4,343	0.56	0.54	0.50	0.50	0.221	561	2,158	0.56	0.56	0.50	0.50	-0.002
Number of advanced courses taken	674	4,343	0.99	1.27	1.18	1.62	0.016	561	2,158	1.01	1.06	1.22	1.30	-0.037

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standard-zed Difference
Behavioral														
Percentage of school days student was present	673	4,332	93.04	93.94	6.35	6.07	-0.059	560	2,153	93.25	93.66	6.35	6.42	-0.064
Number of suspensions	674	4,343	0.17	0.31	0.63	1.35	-0.106	561	2,158	0.19	0.16	0.67	0.57	0.050
High School Characteristics														
High school average English MCAS score	674	4,342	-0.43	-0.12	0.63	0.44	-0.550	561	2,158	-0.41	-0.39	0.63	0.59	-0.035
High school average math MCAS score	674	4,343	-0.27	-0.05	0.63	0.45	-0.331	561	2,158	-0.24	-0.21	0.62	0.59	-0.036
High school average GPA	674	4,343	2.21	2.71	0.44	0.33	-1.344	561	2,158	2.27	2.31	0.43	0.43	-0.102
High school college-going rate	674	4,343	0.68	0.68	0.17	0.12	0.101	561	2,158	0.69	0.68	0.18	0.14	0.008
Outcome: Credit Accumulation														
Demographics														
Age	982	3,485	18.25	18.10	0.74	0.67	0.183	838	2,841	18.22	18.24	0.70	0.77	-0.023
Female	982	3,485	0.58	0.50	0.49	0.50	0.195	838	2,841	0.58	0.58	0.49	0.49	0.000
English language learner	982	3,485	0.12	0.06	0.32	0.24	0.175	838	2,841	0.11	0.13	0.31	0.33	-0.047
Free/reduced-price lunch eligible	982	3,485	0.76	0.59	0.43	0.49	0.307	838	2,841	0.75	0.76	0.43	0.43	-0.010
Student has a high-incidence disability	982	3,485	0.09	0.06	0.29	0.24	0.075	838	2,841	0.09	0.08	0.29	0.28	0.023
Student has a low-incidence disability	982	3,485	0.03	0.03	0.16	0.17	-0.050	838	2,841	0.03	0.03	0.16	0.16	-0.008
Black	982	3,485	0.44	0.25	0.50	0.43	0.398	838	2,841	0.42	0.42	0.49	0.49	0.000
White	982	3,485	0.07	0.33	0.25	0.47	-0.541	838	2,841	0.08	0.08	0.27	0.27	-0.007
Asian/Pacific Islander	982	3,485	0.13	0.18	0.34	0.38	-0.135	838	2,841	0.14	0.17	0.35	0.38	-0.089
Hispanic	982	3,485	0.34	0.22	0.47	0.41	0.248	838	2,841	0.35	0.32	0.48	0.47	0.069
Native American	982	3,485	0.00	0.00	0.06	0.06	0.014	838	2,841	0.00	0.00	0.03	0.07	-0.056
Other/Multiracial	982	3,485	0.02	0.02	0.12	0.12	-0.008	838	2,841	0.02	0.01	0.12	0.10	0.055
Achievement in High School														
SAT score (2400)	882	3,153	1269.43	1358.00	267.02	268.06	-0.246	746	2,552	1283.18	1247.80	261.15	258.41	0.123

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standard-zed Difference
10th grade English MCAS scaled score	936	3,338	-0.38	-0.11	0.93	0.92	-0.196	798	2,710	-0.34	-0.46	0.91	0.97	0.122
10th grade math MCAS scaled score	941	3,349	-0.16	0.04	0.92	0.84	-0.158	802	2,721	-0.14	-0.11	0.91	0.88	-0.043
High school GPA	982	3,485	2.42	2.81	0.86	0.71	-0.436	838	2,841	2.48	2.53	0.83	0.81	-0.053
Student took an advanced course	982	3,485	0.53	0.46	0.50	0.50	0.183	838	2,841	0.53	0.52	0.50	0.50	0.019
Number of advanced courses taken	982	3,485	0.97	0.94	1.25	1.35	0.067	838	2,841	0.99	0.95	1.27	1.28	0.025
Behavioral														
Percentage of school days student was present	982	3,482	92.84	93.67	6.62	6.46	-0.086	838	2,838	92.92	93.10	6.64	7.20	-0.026
Number of suspensions	982	3,485	0.17	0.28	0.68	1.22	-0.122	838	2,841	0.17	0.19	0.72	0.71	-0.027
High School Characteristics														
High school average English MCAS score	982	3,485	-0.51	-0.17	0.59	0.42	-0.660	838	2,841	-0.48	-0.45	0.60	0.55	-0.069
High school average math MCAS score	982	3,485	-0.28	-0.07	0.59	0.42	-0.422	838	2,841	-0.26	-0.22	0.60	0.53	-0.088
High school average GPA	982	3,485	2.24	2.71	0.52	0.36	-1.129	838	2,841	2.30	2.36	0.46	0.48	-0.131
High school college-going rate	982	3,485	0.65	0.66	0.18	0.12	-0.006	838	2,841	0.65	0.66	0.18	0.15	-0.028

Appendix B. Details About the Estimation of Effects and Sensitivity Analyses

B.1 Analytic Approach for Estimating the Average Impact of the Program

To address the primary research question about the impact of SBC on all students, we estimated the following model with the full analytic sample (all SBC students and matched comparison students from the two cohorts with valid data):

(Eq. 1) $Y_{ij} = \pi_0 + \pi_1 T_{ij} + \sum_{b=1}^{B-1} \pi_{(1+b)} I_{ij}^{b} + \sum_{n=1}^{N} \pi_{(B+n)} X_{ij}^{n} + \varepsilon_{ij}$

where:

Y_{ij}= outcome measure for student *i* in matching block *j*.

T_{ij} = treatment indicator for student *i* in block *j*, which equals 1 if student *i* is an SBC student and 0 otherwise.

I_{ij}^{b} = indicator variable for the b^{th} matching block for student *i*. It equals 1 if student *i* is a member of the b^{th} block and 0 otherwise. A matching block was defined by the college and cohort.[46]

X_{ij}^{n} = n^{th} matching characteristic or covariate for student *i* in block *j*. Similar to the propensity score models, missing values of the covariates were addressed using the dummy variable method.[47]

ε_{ij} = random error term for student *i* in school *j*, which is assumed to be normally distributed with mean 0 and variance of σ_{ε}^{2}.

We estimated this model separately for each outcome measure using the matching weights specific to each outcome measure. Because treatment students and potential comparison students with missing outcome data were not included in the matching process, they were not included in the estimation of the effects. In the estimated model, the coefficient estimate on the treatment indicator, π_1, was interpreted as the average impact of participating in SBC coaching.

Two aspects of the model in Equation 1 are worthy of further explanation. First, the model does not include a separate random error term for college to capture potential clustering of outcome measures within colleges, because we anticipate that such clustering (i.e., the dependence of outcomes of students from the same college) will be fully explained by the matching block indicators already included in the model.[48] Similarly, the model does not include a separate indicator for students in any cohort, because the block indicators are cohort-specific.

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[46] For the 2013 and 2014 cohorts, all of the students attending a college except UMB, a matching block was defined by the college and cohort. Students attending UMB were placed into two blocks (one for each cohort).

[47] Free/reduced-price lunch and GPA baseline covariates are identified as primary by the U.S. Department of Education's What Works Clearinghouse, and therefore we did not impute them using the dummy variable method. Students missing values on either of these two covariates are dropped from the analysis.

[48] We tested the validity of this assumption by estimating hierarchical linear models that nest students within colleges. The variance of the college random effect was essentially zero for all outcome measures, and the hierarchical linear models yielded very similar estimates to the single-level model in Equation 1.

Second, the independent variables of the model included the matching characteristics that were available for all students and used in the matching process. The purpose of this was to increase the precision of the effect estimates (because these covariates were expected to explain some of the residual variance of the outcome measures) and be doubly robust (Bang and Robins 2005).[49,50] Section B.3 presents results from alternative specifications that did not control for the matching covariates.

B.2 Analytic Approach for Exploratory Subgroup Analyses

As described in Chapter 4, we examined pre-treatment student characteristics that were exogenous (not related to program participation or effects) and available for both the treatment students and comparison students (gender, race/ethnicity, high school GPA, and type of college). We examined the extent to which program effects were related to exogenous student characteristics using a slightly modified version of the impact model in Equation 1 to include the interaction of the treatment indicator T_{ij} and the characteristic that is being tested. To simplify the analyses and ease the interpretation of the results, we transformed each continuous and categorical variable into a binary variable. Specifically, when examining race/ethnicity, we created a binary variable for being a member of a *minority that was underrepresented in postsecondary education*, which was set to 1 for Black, Hispanic, Native American, and Other/Multiracial students, and 0 for the remaining students.[51] When examining high school GPA, the binary variable *higher high school GPA* was set to 1 for students whose high school GPA was greater than 3.00 (the median GPA) on a four-point scale,[52] and 0 for the remaining students.

We specified the modified version of the impact model that included the interaction term as follows:

$$\text{(Eq. 2)} \quad Y_{ij} = \pi_0 + \pi_1 T_{ij} + \pi_2 T_{ij} M_{ij} + \sum_{b=1}^{B-1} \pi_{(2+b)} I_{ij}^{b} + \sum_{n=1}^{N} \pi_{(1+B+n)} X_{ij}^{n} + \varepsilon_{ij}$$

In Equation 2, M_{ij} denotes the binary student characteristic. As an example, assume that M_{ij} was an indicator for female students (set to 1 if student i was female and to 0 if student i was male). In this case, the estimate of π_1 captures the effect estimate for male students, and the estimate of π_2 captures the difference in the estimated effects between women and men. The effect estimate for women can be calculated by adding the two coefficients.

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[49] Using the baseline characteristics in the matching process and *also* using them as covariates in the estimation of impacts is deemed to give the analyst two chances to get the "right" model specification (once in the propensity model and once in the impact model for the outcome measure). Therefore, these estimators are called "doubly robust."

[50] We considered using a second set of covariates that were measured post high school and potentially associated with the outcomes of interest, such as the location of students' residencies during college (on or off campus, near or far from campus) and whether they held an on-campus job. We decided not to use them, as we were not confident they were exogenous (not influenced by participating in SBC coaching).

[51] There was a small difference in how the group of underrepresented minority category was defined for the different cohorts. Specifically, Native American students were included in the underrepresented minority category for the 2015 and 2016 cohorts, but not for the 2013 and 2014 cohorts. We maintained the different definitions so that within the two groups of cohorts we could track outcomes for the same subgroups of students over time.

[52] We used the four-point scale commonly used in grading systems, where a GPA of 0 corresponds with an average grade of an "F" and a GPA of a 4.0 corresponds with an average grade of an "A".

Chapter 4 of the report summarizes the estimated subgroup effects and the differences between the subgroup effects. Appendix D shows more details for these results, including standard errors of the subgroup effects and sample sizes.

B.3 Robustness Checks and Sensitivity Analyses

Recall that the results presented in Chapter 4 for the full sample were produced by the impact model that used all of the matching covariates, with the matched comparison group yielded by radius matching. We conducted additional analyses testing the robustness of these results to alternative model specifications and sample definitions. This subsection summarizes the results of these sensitivity analyses.

The first analysis assessed the robustness of the reported results to covariates used in the impact model given in Equation 1. Specifically, we estimated two alternative versions of this model: (1) no matching covariates or matching blocks, and (2) with matching blocks but no matching covariates.

Results are presented in Exhibit B-1 for the most recent outcomes for each set of cohorts. Within each set of cohorts, the first panel in this exhibit repeats the results from our preferred specification (from Chapter 4), whereas the second and third panels use the alternative specifications described above. Exhibit B-1 shows that the magnitudes of the effect estimates change slightly when matching blocks and matching covariates are included. The inclusion of additional covariates helps with the precision of effect estimates—standard errors of the preferred specification were 4-12 percent lower than those from the model that did not control for any covariates or matching blocks.

Exhibit B-1 Robustness checks, by included covariates

Outcome	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Effect Size	Standard Error	Sample Size
2013 and 2014 cohorts						
Matching Blocks and All Matching Covariates (Preferred Specification)						
Completion after…						
5 Years	43.22	41.55	1.67	0.03	2.96	2,512
6 Years	50.33	45.99	4.34	0.09	4.44	1,103
Persistence into the...						
6th Year of College	61.95	56.71	5.24~	0.11	3.00	2,512
7th Year of College	61.26	56.53	4.73	0.10	4.48	1,103
Academic Achievement						
Credit Accumulation	57.91	52.46	5.45*	0.15	2.22	2,166
No Covariates (Alternative Specification 1)						
Completion after…						
5 Years	43.22	41.11	2.11	0.04	3.38	2,512
6 Years	50.33	44.77	5.56	0.11	4.84	1,103
Persistence into the...						
6th Year of College	61.95	56.36	5.59~	0.11	3.27	2,512
7th Year of College	61.26	55.47	5.79	0.12	4.94	1,103
Achievement						
Credit Accumulation	57.91	51.60	6.32*	0.18	2.53	2,166

Outcome	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Effect Size	Standard Error	Sample Size
No Covariates, Controlling for Matching Blocks (Alternative Specification 2)						
Completion after…						
5 Years	43.22	41.11	2.11	0.04	3.13	2,512
6 Years	50.33	44.77	5.56	0.11	4.74	1,103
Persistence into the...						
6th Year of College	61.95	56.36	5.59~	0.11	3.12	2,512
7th Year of College	61.26	55.47	5.79	0.12	4.91	1,103
Academic Achievement						
Credit Accumulation	57.91	51.60	6.32*	0.18	2.47	2,166
2015 and 2016 cohorts						
Matching Blocks and All Matching Covariates (Preferred Specification)						
Persistence into the...						
4th Year of College	69.53	66.48	3.05~	0.07	1.76	5,863
5th Year of College	65.78	61.21	4.56	0.09	2.86	2,719
Academic Achievement						
Credit Accumulation	57.95	54.35	3.60*	0.11	1.68	3,679
No Covariates (Alternative Specification 1)						
Persistence into the...						
4th Year of College	69.53	66.86	2.67	0.06	1.98	5,863
5th Year of College	65.78	63.00	2.78	0.06	3.23	2,719
Academic Achievement						
Credit Accumulation	57.95	54.79	3.16~	0.09	1.89	3,679
No Covariates, Controlling for Matching Blocks (Alternative Specification 2)						
Persistence into the...						
4th Year of College	69.53	66.86	2.67	0.06	1.92	5,863
5th Year of College	65.78	63.00	2.78	0.06	3.25	2,719
Academic Achievement						
Credit Accumulation	57.95	54.79	3.16~	0.09	1.85	3,679

[a] The covariates include gender, English language learner status, free/reduced price lunch status, MCAS math and English language arts scores, SAT score, high school GPA, number of suspensions, high school attendance rate, race/ethnicity (Black, White, Hispanic, Native American, Asian/Pacific Islander, Other/mixed race), age, whether student took advanced courses in high school, and number of advanced courses taken.

~ Indicates statistical significance at the 10 percent level.

* Indicates statistical significance at the 5 percent level.

** Indicates statistical significance at the 1 percent level.

Finally, the estimates presented in Chapter 4 for the completion and persistence outcomes, using the full sample, were estimated using National Student Clearinghouse data, supplemented by college administrative data. Exhibit B-2 shows the estimates for each cohort set's most recent persistence outcomes (and, for the 2013-2014 cohorts, most recent completion outcomes), but using the reduced sample that includes only students from the 11 colleges in the college administrative dataset. For the 2013 and 2014 cohorts, the point estimates of the effects are smaller for completion in five years and in six

years, under the reduced sample. However, the estimates in both the reduced and full samples tell a similar overall story of no significant effects of SBC on completion. Similarly, for persistence into the seventh year for the 2013 cohort only, and for persistence into the fifth year for the 2015 cohort only, we see smaller point estimates in the reduced sample but no significant effects in either sample.

However, two of the impacts that were marginally statistically significant, at the 10 level, in the model with the full sample are not statistically significant in smaller, college administrative sample. The smaller size of the college administrative sample could be the reason why the impacts on persistence into the sixth year (2013/2014 cohorts) and persistence into the fourth year (2015/2016 cohorts) are not statistically significant in this reduced sample. Smaller sample sizes tend to have larger standard errors, reducing our ability to detect significant impacts.

Exhibit B-2: National Student Clearinghouse outcomes for college administrative data sample

Outcome	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size
2013 and 2014 cohorts					
Completion after … (Reduced Sample)					
5 Years	42.22	41.39	0.83	3.10	2,166
6 Years	49.48	46.60	2.89	4.67	1,007
Persistence into the … (Reduced Sample)					
6th Year of College	61.63	56.64	5.00	3.14	2,166
7th Year of College	60.82	57.47	3.35	4.62	1,007
2015 and 2016 cohorts					
Persistence into the ... (Reduced Sample)					
4th Year of College	67.30	65.99	1.32	2.22	3,679
5th Year of College	63.70	60.52	3.19	3.55	1,967

Appendix C. Impacts for Students Entering College in Fall 2017

In addition to the results presented in the body of the report, we also examined the impacts on early college outcomes for students who first enrolled in college in fall 2017. This appendix includes the first set of impacts on the 2017 cohort and thus begins with a brief summary of our methodology.

C.1. Study Design

The study design used to evaluate the impact of SBC for the 2017 cohort was very similar to the design used for the 2013 through 2016 cohorts. We used a quasi-experimental design to examine the impacts of SBC for Boston students who entered college in the fall of 2017, comparing the outcomes of coached students with the outcomes of comparison students who have similar baseline characteristics. As for the earlier cohorts, we used the SBC program's administrative database to identify the students who received SBC. To be eligible for our sample, students needed to meet the criteria described in Section 3.1.1. In total, 797 coached students and 4,906 non-coached students met those criteria and thus were eligible for matching.

We used data provided by the Massachusetts Department of Elementary and Secondary Education (MA DESE) on baseline characteristics for all students in the 2017 cohort to conduct this matching. For the 2017 cohort as well as the earlier cohorts, we implemented local and focal matching, matching each SBC student with at least one non-SBC student enrolled in the same college (the matching block). We estimated the propensity scores using the same baseline variables that we used for the 2013-2016 cohorts.[53] We then used *radius matching*, matching each coached student with all potential comparison students in that student's matching block who had propensity scores within ± 0.4 of the standard deviation of the propensity scores. For the 2017 cohort, we also conducted exact matching on two baseline characteristics: free or reduced price lunch-eligible in high school and Hispanic. By using this matching specification, we were able to achieve balance between the baseline characteristics of matched treatment students and matched comparison students, for each outcome measure examined (as described in further detail below).

C.2 Outcome Measures

To examine four outcomes across three domains, we used administrative data received from the 11 partner colleges listed in Section 3.2, which enrolled 72 percent of SBC students who were eligible for matching. The outcomes were also measured using data from the National Student Clearinghouse. Exhibit C-1 summarizes the outcomes and the post-matching sample size for each outcome or the analytic sample sizes. These outcomes are similar to those presented for the earlier cohorts in the interim outcome reports (see Linkow 2017b and Linkow et al. 2019).

[53] Although we used the same matching characteristics, we used composite SAT score out of 1600 for the 2017 cohort, rather than out of 2400 as was used for the 2013-2016 cohorts. The reason for this change was that the vast majority of students in the 2017 cohort took the redesigned SAT, first administered in the spring of 2016, which had a combined reading and writing section (rather than separate reading and writing sections), resulting in a total possible score of 1600 rather than 2400 (The College Board, 2014).

Exhibit C-1: Outcome domains and measures for 2017 cohort

Domain	Outcome Measure	Definition	Years Post–High School	Analytic Sample Size	Data Source
Persistence	Persistence into the 2nd year	Enrolled in fall 2017 and enrolled in or completed by fall 2018	1.5	3,191	NSC, College administrative data
	Persistence into the 3rd year	Enrolled in fall 2017 and enrolled in or completed by fall 2019	2.5	3,191	NSC, College administrative data
Academic Achievement	Credit accumulation after three years	Total number of credits successfully completed through spring 2020, divided by the total number of credits needed to graduate	3	1,797	College administrative data
Financial Aid	FAFSA renewal in second year of college	Student submitted a FAFSA to receive aid for 2018-19 academic year	2	1,750	College administrative data

C.3 Assessing Balance and Student Characteristics

A critical element of our study design is identifying a group of comparison students who have similar observable characteristics at baseline to coached students. This helps reduce potential bias from confounding factors when we estimate impacts on each outcome. As with the earlier cohorts, not all students had data for all outcome measures, resulting in slightly different samples for each outcome measure. For each outcome sample, we calculated the standardized differences for each matching covariate, to assess whether the coached students and non-coached students in our analysis looked similar to each other with respect to that covariate.

For the 2017 cohort as well as the earlier cohorts, we required the standardized differences between the treatment students and matched comparison students to be less than 15 percent of a standard deviation in absolute value for all matching covariates. Exhibit C-2 shows the 2017 cohort students' standardized baseline differences before matching (in the left-hand panel) and after matching (in the right-hand panel) for each outcome measure with radius matching. For each of the analytic samples we examined—for persistence into the first and second years, credit accumulation, and FAFSA renewal—matching reduced all pre-matching differences between the two groups to less than 0.15 SD. Because we were able to attain balance between the matched treatment and comparison groups, we used these samples to estimate the effects of SBC.

In addition to showing balance, the right-hand panel of Exhibit C-2 also shows the treatment and comparison group post-matching means for each matching covariate, for each outcome sample. Looking at the 2017 sample for the persistence outcomes (the largest analytic sample):

- three-fifths of the students were women,
- about three-quarters of the students were eligible for free or reduced price lunches in high school,
- about four-fifths were members of underrepresented minorities,
- on average, students had a high school GPA equivalent to a C+,
- a slight majority took at least one advanced course in high school, and
- approximately 35% of students originally enrolled at two-year colleges (not shown in exhibit).

Exhibit C-2. Standardized baseline differences by outcome for 2017 cohort, radius matching

	Before Matching							After Matching						
Matching Variables	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference
Outcomes: Persistence into 2nd and 3rd Years														
Demographics														
Age	797	4,906	18.21	18.05	0.71	0.62	0.164	691	2,500	18.21	18.19	0.71	0.71	0.032
Female	797	4,906	0.60	0.55	0.49	0.50	0.158	691	2,500	0.60	0.60	0.49	0.49	0.000
English language learner	797	4,906	0.13	0.06	0.34	0.23	0.237	691	2,500	0.12	0.12	0.32	0.32	-0.005
Free/reduced-price lunch eligible	797	4,906	0.77	0.54	0.42	0.50	0.376	691	2,500	0.75	0.74	0.44	0.44	0.012
Student has a high-incidence disability	797	4,906	0.09	0.05	0.28	0.23	0.091	691	2,500	0.08	0.08	0.28	0.27	0.028
Student has a low-incidence disability	797	4,906	0.01	0.03	0.11	0.17	-0.129	691	2,500	0.01	0.02	0.11	0.14	-0.054
Black	797	4,906	0.44	0.27	0.50	0.44	0.381	691	2,500	0.44	0.44	0.50	0.50	0.000
White	797	4,906	0.04	0.33	0.21	0.47	-0.563	691	2,500	0.05	0.05	0.22	0.22	0.007
Asian/Pacific Islander	797	4,906	0.15	0.16	0.35	0.37	-0.041	691	2,500	0.16	0.16	0.37	0.37	-0.007
Hispanic	797	4,906	0.36	0.22	0.48	0.41	0.233	691	2,500	0.33	0.33	0.47	0.47	0.006
Native American	797	4,906	0.00	0.00	0.06	0.06	0.006	691	2,500	0.00	0.00	0.07	0.07	-0.001
Other/Multiracial	797	4,906	0.01	0.02	0.12	0.14	-0.049	691	2,500	0.01	0.02	0.12	0.13	-0.013
Achievement in High School														
SAT score (1600)	633	3,444	980.43	1040.57	169.60	173.23	-0.248	540	1,780	986.35	991.38	170.36	169.57	0.002
10th grade English MCAS scaled score	769	4,786	-0.24	0.05	0.86	0.84	-0.225	670	2,424	-0.21	-0.24	0.85	0.88	0.026
10th grade math MCAS scaled score	769	4,793	-0.01	0.14	0.88	0.86	-0.100	669	2,424	0.00	-0.02	0.88	0.85	0.021
High school GPA	797	4,906	2.33	2.85	0.93	0.79	-0.501	691	2,500	2.40	2.35	0.86	0.90	0.049
Student took an advanced course	797	4,906	0.58	0.54	0.49	0.50	0.195	691	2,500	0.59	0.54	0.49	0.50	0.089
Number of advanced courses taken	797	4,906	1.22	1.25	1.54	1.62	0.079	691	2,500	1.20	1.04	1.50	1.41	0.112
Behavioral														

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference
Percentage of school days on which student was present	796	4,906	92.40	93.18	6.85	6.59	-0.075	691	2,500	92.32	92.23	6.92	7.72	0.012
Number of suspensions	797	4,906	0.23	0.32	0.93	1.55	-0.023	691	2,500	0.23	0.27	0.95	0.93	-0.039
High School Characteristics														
High school average English MCAS score	797	4,905	-0.34	-0.16	0.60	0.42	-0.313	691	2,500	-0.33	-0.32	0.61	0.56	-0.015
High school average math MCAS score	797	4,906	-0.13	-0.06	0.60	0.43	-0.103	691	2,500	-0.12	-0.11	0.60	0.55	-0.028
High school average GPA	797	4,906	2.09	2.68	0.64	0.45	-1.047	691	2,500	2.16	2.19	0.55	0.60	-0.056
High school college-going rate	797	4,906	0.70	0.68	0.18	0.13	0.165	691	2,500	0.70	0.70	0.18	0.16	-0.013
Outcome: Credit Accumulation														
Demographics														
Age	495	1,824	18.22	18.11	0.71	0.64	0.103	457	1,340	18.19	18.23	0.70	0.69	-0.052
Female	495	1,824	0.60	0.52	0.49	0.50	0.204	457	1,340	0.61	0.56	0.49	0.50	0.116
English language learner	495	1,824	0.13	0.07	0.34	0.26	0.146	457	1,340	0.12	0.13	0.32	0.34	-0.037
Free/reduced-price lunch eligible	495	1,824	0.77	0.59	0.42	0.49	0.329	457	1,340	0.77	0.77	0.42	0.42	0.000
Student has a high-incidence disability	495	1,824	0.08	0.06	0.27	0.24	0.016	457	1,340	0.07	0.09	0.26	0.29	-0.069
Student has a low-incidence disability	495	1,824	0.01	0.03	0.11	0.16	-0.128	457	1,340	0.01	0.02	0.11	0.12	-0.016
Black	495	1,824	0.40	0.25	0.49	0.44	0.343	457	1,340	0.41	0.38	0.49	0.49	0.055
White	495	1,824	0.06	0.31	0.23	0.46	-0.545	457	1,340	0.06	0.05	0.24	0.22	0.045
Asian/Pacific Islander	495	1,824	0.13	0.16	0.33	0.37	-0.122	457	1,340	0.14	0.17	0.34	0.38	-0.100
Hispanic	495	1,824	0.39	0.25	0.49	0.43	0.284	457	1,340	0.38	0.38	0.49	0.48	0.000
Native American	495	1,824	0.00	0.00	0.06	0.06	0.019	457	1,340	0.00	0.00	0.07	0.07	-0.002
Other/Multiracial	495	1,824	0.02	0.02	0.13	0.15	-0.038	457	1,340	0.02	0.02	0.13	0.13	0.001
Achievement in High School														
SAT score (1600)	385	1,280	968.00	1011.07	150.70	154.94	-0.233	360	944	970.47	964.06	149.36	156.34	0.068
10th grade English MCAS scaled score	480	1,773	-0.27	-0.05	0.86	0.83	-0.154	447	1,294	-0.24	-0.36	0.83	0.85	0.145

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference
10th grade math MCAS scaled score	480	1,773	-0.05	0.06	0.84	0.81	-0.068	447	1,294	-0.04	-0.12	0.83	0.84	0.092
High school GPA	495	1,824	2.30	2.76	0.93	0.80	-0.482	457	1,340	2.33	2.35	0.90	0.87	-0.022
Student took an advanced course	495	1,824	0.55	0.48	0.50	0.50	0.210	457	1,340	0.56	0.54	0.50	0.50	0.032
Number of advanced courses taken	495	1,824	1.10	0.98	1.42	1.39	0.134	457	1,340	1.09	1.04	1.39	1.43	0.036
Behavioral														
Percentage of school days on which student was present	494	1,824	92.14	92.82	6.87	6.94	-0.071	457	1,340	92.16	92.03	6.87	8.15	0.017
Number of suspensions	495	1,824	0.21	0.23	0.95	1.01	-0.047	457	1,340	0.20	0.27	0.92	1.00	-0.069
High School Characteristics														
High school average English MCAS score	495	1,824	-0.38	-0.18	0.59	0.42	-0.366	457	1,340	-0.37	-0.38	0.59	0.53	0.015
High school average math MCAS score	495	1,824	-0.19	-0.08	0.58	0.41	-0.200	457	1,340	-0.17	-0.17	0.57	0.51	-0.004
High school average GPA	495	1,824	2.05	2.62	0.65	0.47	-1.032	457	1,340	2.09	2.17	0.62	0.60	-0.138
High school college-going rate	495	1,824	0.68	0.68	0.19	0.13	0.047	457	1,340	0.69	0.69	0.19	0.15	-0.047
Outcome: FAFSA Renewal														
Demographics														
Age	477	1,761	18.22	18.10	0.70	0.64	0.118	444	1,306	18.20	18.23	0.71	0.69	-0.038
Female	477	1,761	0.61	0.52	0.49	0.50	0.215	444	1,306	0.62	0.56	0.49	0.50	0.120
English language learner	477	1,761	0.13	0.07	0.34	0.26	0.152	444	1,306	0.12	0.13	0.33	0.34	-0.033
Free/reduced-price lunch eligible	477	1,761	0.77	0.59	0.42	0.49	0.329	444	1,306	0.77	0.77	0.42	0.42	0.000
Student has a high-incidence disability	477	1,761	0.07	0.06	0.26	0.24	-0.013	444	1,306	0.07	0.09	0.25	0.29	-0.093
Student has a low-incidence disability	477	1,761	0.01	0.02	0.10	0.16	-0.138	444	1,306	0.01	0.01	0.11	0.12	-0.028
Black	477	1,761	0.39	0.25	0.49	0.43	0.328	444	1,306	0.40	0.38	0.49	0.48	0.045
White	477	1,761	0.06	0.31	0.23	0.46	-0.543	444	1,306	0.06	0.05	0.24	0.21	0.060

Matching Variables	Before Matching							After Matching						
	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference	Treatment N	Comparison N	Treatment Mean	Comparison Mean	Treatment SD	Comparison SD	Standardized Difference
Asian/Pacific Islander	477	1,761	0.13	0.17	0.34	0.37	-0.120	444	1,306	0.14	0.18	0.35	0.38	-0.097
Hispanic	477	1,761	0.40	0.24	0.49	0.43	0.296	444	1,306	0.38	0.38	0.49	0.49	0.000
Native American	477	1,761	0.00	0.00	0.06	0.05	0.040	444	1,306	0.00	0.00	0.07	0.06	0.020
Other/Multiracial	477	1,761	0.02	0.02	0.13	0.15	-0.036	444	1,306	0.02	0.02	0.13	0.13	-0.001
Achievement in High School														
SAT score (1600)	376	1,247	971.09	1014.50	150.25	153.24	-0.234	353	925	972.83	968.30	148.98	154.10	0.063
10th grade English MCAS scaled score	464	1,718	-0.26	-0.04	0.86	0.83	-0.156	435	1,266	-0.23	-0.36	0.83	0.85	0.144
10th grade math MCAS scaled score	463	1,716	-0.04	0.08	0.85	0.81	-0.066	434	1,265	-0.03	-0.11	0.84	0.84	0.090
High school GPA	477	1,761	2.31	2.78	0.92	0.78	-0.491	444	1,306	2.34	2.37	0.89	0.87	-0.023
Student took an advanced course	477	1,761	0.56	0.48	0.50	0.50	0.220	444	1,306	0.56	0.55	0.50	0.50	0.034
Number of advanced courses taken	477	1,761	1.13	1.01	1.44	1.40	0.143	444	1,306	1.12	1.06	1.40	1.44	0.038
Behavioral														
Percentage of school days on which student was present	476	1,761	92.39	92.94	6.65	6.68	-0.054	444	1,306	92.34	92.00	6.71	8.19	0.043
Number of suspensions	477	1,761	0.21	0.23	0.96	1.01	-0.047	444	1,306	0.20	0.25	0.92	0.95	-0.051
High School Characteristics														
High school average English MCAS score	477	1,761	-0.37	-0.17	0.59	0.42	-0.357	444	1,306	-0.36	-0.37	0.59	0.53	0.022
High school average math MCAS score	477	1,761	-0.17	-0.07	0.58	0.41	-0.188	444	1,306	-0.16	-0.17	0.58	0.51	0.002
High school average GPA	477	1,761	2.06	2.62	0.64	0.46	-1.050	444	1,306	2.09	2.17	0.62	0.60	-0.138
High school college-going rate	477	1,761	0.69	0.68	0.18	0.13	0.072	444	1,306	0.69	0.70	0.18	0.15	-0.040

C.4 Impacts

SBC had modest impacts on the 2017 cohort students' persistence into the second and third years of college, credits accumulated, and FAFSA renewal (Exhibit C-3).[54] Across all four outcomes, the impact of SBC is in a positive direction, yet the impact does not consistently reach the study's threshold for statistical significance. The estimation models have limited power to detect significant differences between coached and non-coached students because the 2017 cohort is not pooled with another cohort in the model; thus the sample is smaller than it would be if the 2017 cohort were pooled with another cohort.

For students who entered college in the fall of 2017, SBC does not appear to have any impact on persistence into the second year, which differs from the statistically significant effects found for earlier cohorts. However, SBC students in the 2017 cohort are 4.0 percentage points more likely to persist into the third year of college relative to non-coached students. This impact is marginally significant at the 10 percent level. The magnitude of the impact on persistence into the third year for the 2017 cohort is smaller than the impact found for the 2013/2014 cohorts (8.3 percentage points) but similar to that of the 2015/2016 cohorts (4.5 percentage points) (see Chapter 4). Consistent with the trend found in the 2015/2016 cohort results, the comparison group students in the 2017 cohort seem to be catching up to the coached students' persistence rates.

The 2017 cohort did not have any significant effect on the percentage of credits accumulated towards graduation after three years. Both SBC and comparison students have completed a little less than half of the credits needed for graduation at their respective institutions. The smaller magnitude and lack of statistical significance differ from the impacts on credits accumulated for earlier cohorts.[55] For all cohorts, however, the results suggest that based on their current pace, many students in both the SBC and comparison groups might need longer than 150 percent of normal time to complete their degrees or certificates (longer than three years for students at two-year colleges, and six years for students at four-year colleges).

Consistent with results for the earlier cohorts, SBC had a positive impact on second-year FAFSA renewal for the 2017 cohort. The impact of about 5 percentage points is marginally significant at the 10 percent level and the magnitude of the impact is slightly smaller than that found for the earlier cohorts (7.0 percentage points for the 2013/2014 cohorts and 6.2 percentage points for the 2015/2016 cohorts).

Exhibit C-3: Impacts of SBC on persistence, credit accumulation, and FAFSA renewal, all students, 2017 cohort

Outcome	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Effect Size	Standard Error	Sample Size
Persistence						
Persistence into 2nd Year of College	79.31	77.04	2.27	0.05	2.06	3,191
Persistence into 3rd Year of College	72.94	68.93	4.00~	0.09	2.30	3,191
Academic Achievement						
Credit Accumulation After 3 Years	46.75	44.40	2.35	0.09	1.69	1,797
Financial Aid						

[54] We controlled for the same covariates in the 2017 cohort impact models as we did in the impact models for the 2013/2014 and 2015/2016 cohorts.

[55] Note that credit accumulation was measured at different time points for earlier cohorts: after two years in Linkow et al. (2017a) and after four years in Chapter 4.

FAFSA Renewal	75.9	70.68	5.22~	0.12	2.9	1,750

~ Indicates statistical significance at the 10 percent level.

As with the earlier cohorts, we also examined impacts by student characteristic subgroups: gender, underrepresented minority status, high school GPA, and whether the student first enrolled in a two-year or four-year college. Here too we first looked at differences in impacts between the two categories in each subgroup; then, where there were differences, we looked within the subgroups.

The subgroup impacts are presented in Exhibits C-4 through C-7.[56] These exploratory analyses suggest that SBC could be more effective for 2017 cohort students who first enrolled at two-year colleges, relative to students who first enrolled at four-year colleges, with respect to credits accumulated and FAFSA renewal. There are significantly higher impacts for two-year college students, and two-year college students have positive impacts that are significant at the 5 percent level for these two outcomes. However, these results should be considered at most suggestive, as it is possible that some results could be significant by chance alone when we conduct a large number of comparisons.

In conclusion, these findings suggest that SBC might have moderate positive effects on some early college outcomes for the 2017 cohort, though the magnitudes of these impacts are generally lower than for previous cohorts. We will continue to follow the 2017 cohort's progress through college and present impacts on later outcomes in a future report.

[56] As with the 2013/2014 and 2015/2016 cohorts, for the 2017 cohort we defined the "higher" and "lower" high school GPA subgroups with respect to whether a student's high school GPA fell below the median high school GPA among students who were eligible to be included for the analysis. For the 2017 cohort, this median GPA was 2.95.

Exhibit C-4. Impacts of SBC on persistence, credit accumulation, and FAFSA renewal by gender, 2017 cohort

Outcome	Female					Male					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Persistence											
Persistence into 2nd Year of College	83.13	81.03	2.11	2.66	1,698	73.55	71.04	2.51	3.26	1,493	-0.41
Persistence into 3rd Year of College	78.31	74.65	3.67	2.96	1,698	64.86	60.35	4.51	3.66	1,493	-0.84
Academic Achievement											
Credit Accumulation After 3 Years	48.90	45.72	3.18	2.22	1,009	43.48	41.38	2.10	2.57	830	1.09
Financial Aid											
FAFSA Renewal	80.07	72.83	7.25	3.89	997	69.41	65.16	4.25	4.29	787	3.00

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level.

Exhibit C-5. Impacts of SBC on persistence, credit accumulation, and FAFSA renewal by underrepresented minority status, 2017 cohort

Outcome	Underrepresented Minority					Not Underrepresented Minority					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Persistence											
Persistence into 2nd Year of College	75.60	75.08	0.51	2.48	1,950	93.15	84.36	8.79*	3.07	1,241	-8.28*
Persistence into 3rd Year of College	68.81	65.03	3.78	2.79	1,950	88.36	83.51	4.85	3.34	1,241	-1.07
Academic Achievement											
Credit Accumulation After 3 Years	45.25	42.94	2.31	1.99	1,099	53.28	48.79	4.48	2.72	740	-2.18
Financial Aid											
FAFSA renewal	74.08	67.86	6.23	3.47	1,058	83.72	78.16	5.56	4.65	726	0.67

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level.

Exhibit C-6. Impacts of SBC on persistence, credit accumulation, and FAFSA renewal by high school GPA, 2017 cohort

Outcome	High GPA in High School					Low GPA in High School					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Persistence											
Persistence into 2nd Year of College	90.00	90.07	-0.07	2.64	1,370	74.64	71.43	3.20	2.69	1,821	-3.27
Persistence into 3rd Year of College	80.95	83.03	-2.08	3.45	1,370	69.44	62.93	6.51*	2.92	1,821	-8.58
Academic Achievement											
Credit Accumulation After 3 Years	57.63	55.50	2.13	2.67	750	42.33	39.39	2.93	2.06	1,089	-0.80
Financial Aid											
FAFSA renewal	86.92	79.62	7.30	4.63	742	71.38	65.88	5.50	3.54	1,042	1.79

Notes: High GPA defined as cumulative high school GPA of above 2.95; low GPA defined as 2.95 or below.
Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level.

Exhibit C-7. Impacts of SBC on persistence, credit accumulation, and FAFSA renewal by college type, 2017 cohort

Outcome	Students Initially Enrolled at a Two−Year College					Students Initially Enrolled at a Four−Year College					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Persistence											
Persistence into 2nd Year of College	62.34	55.40	6.94	4.45	969	88.27	88.47	-0.19	2.08	2,222	7.13
Persistence into 3rd Year of College	56.90	48.81	8.09	4.41	969	81.42	79.57	1.85	2.66	2,222	6.24
Academic Achievement											
Credit Accumulation After 3 Years	47.73	38.37	9.35*	3.52	574	46.26	47.00	-0.74	1.75	1,265	10.09*
Financial Aid											
FAFSA renewal	61.38	46.14	15.24*	5.52	520	83.11	81.47	1.64	3.31	1,264	13.60*

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level.

Appendix D. Variation across Student Characteristics for 2013 through 2016 Cohorts

Exhibit D-1: Impacts of SBC on completion, persistence, and credit accumulation by gender, 2013 and 2014 cohorts

Outcome	Female					Male					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Completion											
Completion After 4 Years	27.72	26.47	1.25	3.66	1,375	19.71	18.36	1.35	3.34	1,137	-0.10
Completion After 5 Years	48.27	47.34	0.93	4.01	1,375	35.77	33.00	2.76	4.08	1,137	-1.83
Completion After 6 Years	57.80	49.79	8.01	5.73	594	40.31	41.05	-0.74	6.65	509	8.75
Persistence											
Persistence into 2nd Year of College	86.14	77.90	8.24*	3.46	1,375	78.83	71.49	7.34	3.86	1,137	0.90
Persistence into 3rd Year of College	75.74	62.76	12.98*	4.11	1,375	59.49	60.43	-0.94	4.27	1,137	13.92*
Persistence into 4th Year of College	74.50	64.25	10.25*	3.82	1,375	57.30	58.24	-0.94	4.39	1,137	11.19*
Persistence into 5th Year of College	69.55	62.70	6.85	3.94	1,375	54.74	49.67	5.07	4.59	1,137	1.78
Persistence into 6th Year of College	69.55	62.31	7.24	3.91	1,375	50.73	48.46	2.27	4.51	1,137	4.98
Persistence into 7th Year of College	70.52	59.43	11.09	5.75	594	48.84	52.93	-4.10	6.66	509	15.19
Academic Achievement											
Credit Accumulation After 4 Years	62.94	53.57	9.38*	3.02	1,144	50.76	50.92	-0.17	3.01	1,022	9.54*

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level

Exhibit D-2: Impacts of SBC on completion, persistence, and credit accumulation by underrepresented minority status, 2013 and 2014 cohorts

Outcome	Underrepresented Minority					Not Underrepresented Minority					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Completion											
Completion After 4 Years	20.23	20.44	-0.21	2.94	1,655	38.96	31.97	6.99	4.84	857	-7.20
Completion After 5 Years	37.40	38.15	-0.75	3.35	1,655	62.99	52.17	10.82	5.71	857	-11.57
Completion After 6 Years	43.83	42.16	1.67	5.19	750	73.13	59.53	13.6	7.80	353	-11.93
Persistence											
Persistence into 2nd Year of College	79.77	72.51	7.26*	3.14	1,655	94.81	84.61	10.20*	4.39	857	-2.94
Persistence into 3rd Year of College	63.93	58.47	5.46	3.51	1,655	87.01	72.30	14.71*	5.99	857	-9.25
Persistence into 4th Year of College	62.40	59.33	3.07	3.33	1,655	85.06	69.12	15.94*	6.03	857	-12.87
Persistence into 5th Year of College	57.63	54.15	3.48	3.46	1,655	83.77	67.57	16.20*	5.80	857	-12.72
Persistence into 6th Year of College	57.25	54.09	3.17	3.42	1,655	77.92	64.83	13.09*	5.83	857	-9.93
Persistence into 7th Year of College	56.17	53.15	3.02	5.24	750	79.1	68.45	10.65	8.06	353	-7.63
Academic Achievement											
Credit Accumulation After 4 Years	53.71	48.91	4.80	2.58	1,450	71.9	63.91	7.99*	3.79	716	-3.20

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level.

Exhibit D-3: Impacts SBC on completion, persistence, and credit accumulation by high school GPA, 2013 and 2014 cohorts

Outcome	High GPA in High School					Low GPA in High School					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Completion											
Completion After 4 Years	36.52	32.18	4.34	3.79	1,136	15.32	16.32	-1.00	2.67	1,376	5.34
Completion After 5 Years	61.77	60.56	1.22	4.64	1,136	29.09	27.47	1.62	3.80	1,376	-0.40
Completion After 6 Years	68.84	64.86	3.98	6.44	489	34.76	30.87	3.89	5.85	614	0.09
Persistence											
Persistence into 2nd Year of College	92.83	84.21	8.62*	2.97	1,136	75.84	68.52	7.32*	3.29	1,376	1.30
Persistence into 3rd Year of College	82.59	72.6	9.99*	3.88	1,136	58.96	53.52	5.44	3.60	1,376	4.55
Persistence into 4th Year of College	82.59	73.27	9.32*	3.68	1,136	56.10	53.02	3.08	3.57	1,376	6.24
Persistence into 5th Year of College	77.82	68.45	9.37*	3.88	1,136	52.73	49.03	3.70	3.58	1,376	5.67
Persistence into 6th Year of College	77.47	72.65	4.82	4.21	1,136	50.13	44.97	5.16	4.14	1,376	-0.34
Persistence into 7th Year of College	75.36	73.58	1.79	6.07	489	49.39	42.95	6.44	6.20	614	-4.66
Academic Achievement											
Credit Accumulation After 4 Years	68.77	63.25	5.52	3.41	937	49.57	44.29	5.28	3.02	1,229	0.24

Note: High GPA defined as cumulative high school GPA of above 3.00; low GPA defined as 3.00 or below.
Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level

Exhibit D-4: Impacts of SBC on completion, persistence, and credit accumulation by college type, 2013 and 2014 cohorts

Outcome	Students Initially Enrolled at a Two-Year College					Students Initially Enrolled at a Four-Year College					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Completion											
Completion After 4 Years	14.12	16.90	-2.78	2.72	980	30.73	26.95	3.78	3.82	1,532	-6.56
Completion After 5 Years	19.61	22.77	-3.16	3.08	980	57.45	52.80	4.64	4.39	1,532	-7.80
Completion After 6 Years	26.27	29.45	-3.18	5.35	469	65.76	56.53	9.23	6.33	634	-12.42
Persistence											
Persistence into 2nd Year of College	66.67	64.08	2.59	3.70	980	93.14	82.03	11.11*	3.60	1,532	-8.52
Persistence into 3rd Year of College	47.45	47.78	-0.33	3.94	980	82.27	70.16	12.11*	4.31	1,532	-12.44*
Persistence into 4th Year of College	44.31	43.93	0.38	3.99	980	81.56	72.51	9.05*	4.10	1,532	-8.67
Persistence into 5th Year of College	39.22	42.97	-3.75	3.88	980	78.25	66.08	12.17*	4.27	1,532	-15.92*
Persistence into 6th Year of College	41.57	39.12	2.45	3.89	980	74.23	67.28	6.96	4.19	1,532	-4.50
Persistence into 7th Year of College	42.37	44.25	-1.88	5.71	469	73.37	64.34	9.03	6.26	634	-10.91
Academic Achievement											
Credit Accumulation After 4 Years	47.66	46.43	1.23	2.71	927	64.3	56.15	8.14*	3.19	1239	-6.92

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level

Exhibit D-5. Impacts of SBC on persistence and credit accumulation by gender, 2015 and 2016 cohorts

Outcome	Female					Male					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Persistence											
Persistence into 2nd Year of College	85.58	82.60	2.97	1.96	3,156	78.05	71.84	6.21*	2.60	2,707	-3.24
Persistence into 3rd Year of College	80.46	73.52	6.94*	2.20	3,156	66.26	65.39	0.87	2.70	2,707	6.06
Persistence into 4th Year of College	75.07	72.58	2.48	2.23	3,156	61.18	57.27	3.91	2.86	2,707	-1.42
Persistence into 5th Year of College	72.62	69.77	2.85	3.82	1,426	56.36	49.47	6.88	4.40	1,293	-4.04
Academic Achievement											
Credit Accumulation After 4 Years	61.90	57.66	4.24	2.30	1,912	52.38	49.69	2.69	2.42	1,767	1.55

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level

Exhibit D-6. Impacts of SBC on persistence and credit accumulation by underrepresented minority status, 2015 and 2016 cohorts

Outcome	Underrepresented Minority					Not Underrepresented Minority					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Persistence											
Persistence into 2nd Year of College	80.53	75.47	5.06*	1.95	3,220	89.12	87.32	1.79	2.37	2,643	3.27
Persistence into 3rd Year of College	71.38	66.14	5.24*	2.10	3,220	85.71	83.40	2.31	2.71	2,643	2.93
Persistence into 4th Year of College	65.43	62.97	2.46	2.17	3,220	82.65	77.77	4.88	2.80	2,643	-2.42
Persistence into 5th Year of College	61.72	57.51	4.22	3.58	1,510	77.62	72.1	5.53	4.58	1,209	-1.31
Academic Achievement											
Credit Accumulation After 4 Years	55.79	52.26	3.53	2.05	2,043	65.8	61.95	3.84	2.66	1,636	-0.3

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level.

Exhibit D-7. Impacts of SBC on persistence and credit accumulation by high school GPA, 2015 and 2016 cohorts

Outcome	High GPA in High School					Low GPA in High School					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Persistence											
Persistence into 2nd Year of College	91.34	88.11	3.23	2.21	2,513	78.66	73.88	4.79*	2.07	3,350	-1.55
Persistence into 3rd Year of College	84.78	81.73	3.04	2.70	2,513	70.34	65.07	5.27*	2.16	3,350	-2.22
Persistence into 4th Year of College	81.10	80.61	0.49	2.64	2,513	64.36	60.09	4.27	2.28	3,350	-3.78
Persistence into 5th Year of College	78.81	80.26	-1.45	4.91	1,054	60.98	53.97	7.00*	3.50	1,665	-8.46
Academic Achievement											
Credit Accumulation After 4 Years	69.77	66.05	3.72	2.91	1,479	53.15	49.59	3.56	2.07	2,200	0.15

Notes: High GPA defined as cumulative high school GPA of above 3.00; low GPA defined as 3.00 or below.
Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level

Exhibit D-8. Impacts of SBC on persistence and credit accumulation by college type, 2015 and 2016 cohorts

Outcome	Students Initially Enrolled at a Two-Year College					Students Initially Enrolled at a Four-Year College					Difference
	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Standard Error	Sample Size	
Persistence											
Persistence into 2nd Year of College	65.80	60.31	5.48	3.48	1,753	91.27	87.63	3.63*	1.57	4,110	1.85
Persistence into 3rd Year of College	57.48	51.45	6.04	3.33	1,753	83.76	80.01	3.75	1.95	4,110	2.28
Persistence into 4th Year of College	50.59	46.66	3.93	3.45	1,753	79.34	76.74	2.59	2.00	4,110	1.34
Persistence into 5th Year of College	50.98	45.60	5.38	5.21	856	74.23	70.13	4.10	3.40	1,863	1.28
Academic Achievement											
Credit Accumulation After 4 Years	51.69	44.68	7.01*	3.00	1,275	62.02	60.65	1.37	1.99	2,404	5.63

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education; college administrative data.
* Indicates statistical significance at the 5 percent level

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