Prepared by
Abt Associates
for Success Boston

Coaching for Completion

Final Report for Success Boston Coaching

Success Boston
COLLEGE COMPLETION INITIATIVE

About Success Boston

Launched in 2008, Success Boston is Boston's citywide college completion initiative. Together, the Boston Foundation, the Boston Public Schools, the City of Boston, the Boston Private Industry Council, 37 institutions of higher education, led by UMass Boston and Bunker Hill Community College, and local nonprofit partners are working to increase college completion for Boston's students. In 2014, the Boston Foundation received a grant from the Corporation for National and Community Service to expand transition coaching, a core program of Success Boston. This $6 million Social Innovation Fund award provided 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. In 2022, Success Boston partners recommitted to the postsecondary success of all of Boston's students, including the original goal of 70% college completion, and launched a new equity framework to guide the initiative. Central to it is a commitment to do whatever it takes to position all students, particularly Black and Latino students, for success, including a collective will to tackle structural barriers and build systems that are asset-based, deliver equitable outcomes, serve students effectively, and value their cultural wealth.

About Abt Associates

Abt Associates is a global consulting and research firm that combines data and bold thinking to improve the quality of people's lives. We partner with clients and communities to advance equity and innovation—from creating scalable digital solutions and combatting infectious disease, to mitigating climate change and evaluating programs for measurable social impact.

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The report would not have been possible without the contributions of many staff at Abt Associates, including Megan Bogia, Bry Pollack, and Missy Robinson.

This report contains content related to methods and descriptions of Success Boston Coaching that are identical or very similar to those that appear in previous reports (Linkow et al. 2015; Linkow, Didriksen et al. 2017; Linkow, Gamse et al. 2017; Linkow et al. 2019; Linkow et al. 2021), because those methods and descriptions remain applicable to this report. We have received permission from The Boston Foundation to reuse this content.

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Executive Summary

Success Boston began in 2008 as a citywide initiative to increase postsecondary education completion rates among graduates of Boston Public Schools (BPS). Funded by The Boston Foundation, Success Boston brings together BPS, local colleges and universities, the City of Boston, and a variety of nonprofit organizations. In 2022, the initiative renewed its goal of improving BPS graduates' postsecondary completion rates and adopted a new equity framework focused on systems-level, institutional, and structural changes in service of historically marginalized students, such as young men of color. Success Boston and 15 local higher education institutions recommitted to a postsecondary completion goal of 70 percent for all students as well as for every racial/ethnic student group. This rate is double the 35 percent completion rate when the initiative started (The Boston Foundation 2022).

Selected Study Findings

Across students in five BPS graduating classes (2013-2017), students who received Success Boston Coaching were:

- **18 percent more likely** to complete college in **four** years
- **12 percent more likely** to complete college in **five** years
- **similarly likely** to complete college in **six** years

relative to noncoached students.

However, more student support is needed to reach Success Boston's citywide 70 percent completion goal.

Transition coaching is a core strategy of Success Boston. The Success Boston Coaching (SBC) model matches recent graduates of BPS with a coach, who meets with them regularly during their first two years of college and supports them as they navigate academic, financial, and social barriers in college. By providing students with support in addressing the challenges they face, Success Boston Coaching aims to helps student succeed in, and ultimately complete, college.

To focus its efforts on students who could most benefit from the support, SBC serves primarily students from groups traditionally underrepresented in postsecondary education, such as members of underrepresented racial/ethnic minority groups and students from backgrounds of economic disadvantage. When SBC first began, starting with the Class of 2009, about 300 high school graduates from BPS received the coaching each year. In 2015, as part of a scale-up supported in part by a Social Innovation Fund grant from the Corporation for National and Community Service, SBC increased the number of students served per year to about 1,000 students per cohort. We refer to the period after this increase as the "post scale-up" period. More than 7,000 BPS graduates have received SBC since the coaching began more than a decade ago (The Boston Foundation 2022).

Why Coaching Matters

A college degree typically helps graduates earn more when they enter the labor force and is a key driver of economic mobility (Carnevale Cheah, and Wenzinger 2021; Irwin et al. 2022). However, many students who enroll in college do not finish—among students initially enrolled in bachelor's degree programs nationally in 2014, about three-fifths had completed their degree in six years (Sedmak 2022). Additionally, college attainment rates are lower for students of color and for students with low incomes. In 2020, 41 percent of White adults, compared with 28 percent and 21 percent of Black non-Hispanic and Hispanic adults, respectively, had earned a bachelor's degree (Cahalan et al. 2022). Bachelor's degree attainment rates by age 24 were about four times higher among students coming from households in the

highest income quartile compared to students coming from the households in the lowest quartile (59 percent compared to 15 percent) (Cahalan et al. 2022).

College students face a number of barriers to succeeding in college and completing a degree. These include administrative barriers, such as course registration, and academic barriers, such as being prepared for college coursework (Engle and Tinto 2008). Many students also struggle to afford college: even if students qualify for financial aid, it often does not cover all expenses, such as books and housing (Goldrick-Rab 2016; Urban Institute, n.d.). As a result, some students struggle with basic needs and face housing insecurity and food insecurity (American Association of Colleges and Universities 2020). The COVID-19 pandemic brought additional challenges, or amplified existing ones, for students who were enrolled in college in March 2020 or later. For example, many students struggled with virtual learning, social isolation, childcare concerns, and mental health issues (U.S. Department of Education 2021; Hotez et al. 2022). Coaching programs can help students overcome some of these challenges by providing consistent and regular support; in some cases, coaching can increase students' persistence and completion (Bettinger and Baker 2014; Barr and Castleman 2018).

About the Evaluation

Previous studies by Abt Associates have shown that SBC can help BPS graduates remain enrolled in college, especially during and immediately after the time students receive the coaching (Linkow, Gamse et al. 2017; Linkow et al. 2019; Linkow et al. 2021). That said, among BPS students in the Classes of 2013 and 2014 (the 2013 and 2014 cohorts), who started receiving coaching before SBC's scale-up in 2015, these effects on students' persistence in college did not translate into higher completion rates for coached students (Linkow et al. 2021).

The current report continues the work of those previous studies, following students who did and did not receive SBC, starting with the BPS graduating Class of 2013 (2013 cohort). Like the previous reports, this study compares the outcomes of BPS graduates who received the coaching versus a group of similar BPS graduates who did not receive it. By using this quasi-experimental design, the study assesses whether SBC had any effect on student outcomes.

As the fourth and final report in the Abt Associates series, this report looks at SBC's effects on students' four-, five-, and six-year postsecondary completion rates. It examines completion not only for BPS graduates in pre-scale-up cohorts (2013 and 2014 cohorts), but also for BPS graduates who did or did not receive SBC *after* the program's scale-up (2015, 2016, and 2017 cohorts).

The report examines the following research questions:

1. *What are the effects of SBC on students' completion rates, and on students' completion of specific credentials?*

2. *How, if at all, do these impacts vary by student characteristics?*

Findings

Students who received SBC had higher postsecondary completion rates four and five years after entering college than did students who did not receive the coaching. Looking at the combined cohorts (2013-2017), coached students were 4.6 percentage points (18 percent) more likely to have graduated after four years and 4.9 percentage points (12 percent) more likely to have graduated after five years than their uncoached peers. These effects on four- and five-year completion rates are meaningful because

completing college in four years or five years, rather than in six or more years, has multiple benefits for students, allowing them to avoid the costs of additional years of college (and potentially to take on less student loan debt) and enabling them to enter the labor market more quickly. At six years after entering college, differences in graduation rates between coached and noncoached students were no longer statistically significant, suggesting that some noncoached students had caught up to the coached students at this point.

Similar patterns are evident for the post-scale-up (2015-2017) cohorts: Coached students graduated in four years at rates that are higher than those of noncoached students by 5.6 percentage points (21 percent) and graduated in five years at rates that are higher by 6.0 percentage points (15 percent). None of these results differed significantly by student characteristics such as gender, race/ethnicity, high school grade point average, or level of college the student initially enrolled in (two- versus four-year).

The report also examined the effect of coaching on completion rates of associate degrees and bachelor's degrees separately. Among students across the combined cohorts, SBC had consistent significant effects on bachelor's degree completion rates. Interestingly, the effects are reversed among the post-scale up cohorts: coached students in the post-scale up cohorts are significantly more likely to earn associate degrees compared to their noncoached counterparts. These differences may be partially explained by a combination of the increased attention paid to coaching students in two-year colleges after the scale-up, and differences in comparison students' completion patterns before and after the scale-up.

These findings suggest that the coaching program, borne from a variety of collaborative efforts across partners committed to a common cause, could be an important component in helping move citywide postsecondary completion toward its ambitious target rate of 70 percent. That said, although the city has made significant progress relative to the original 35 percent completion rate at the onset of the Success Boston initiative (The Boston Foundation 2022), six-year completion rates still fall short of the target, with only about 49 percent of coached students and 52 percent of all BPS graduates completing college in this time frame (Boston Opportunity Agenda 2022).[1] BPS students will continue to need support, perhaps through coaching extended beyond students' first two years in college or other coordinated efforts, for the city to achieve the initiative's goal.

[1] The 52 percent of BPS graduates is for the Class of 2014 and includes all BPS graduates; it is not limited to the coached students and comparison students included in this report's analysis.

1. Introduction

A college degree or certificate is important in today's economy for young adults' job prospects and earnings. College graduates have, on average, substantially higher annual and lifetime earnings than adults who do not have a college credential (Carnevale, Cheah, and Wenzinger 2021; Irwin et al. 2022). In addition, bachelor's degree earners have higher employment rates than adults with lower levels of educational attainment (Irwin et al. 2022; Bureau of Labor Statistics n.d.; Bureau of Labor Statistics 2022a). These higher employment rates and lower unemployment rates for bachelor's degree holders persisted even during the COVID-19 pandemic (Irwin et al. 2022; Bureau of Labor Statistics 2022a; Federal Reserve Bank of St. Louis 2022).

Historic and current rates of postsecondary education completion among Boston students are not likely to meet the growing demand for a college-educated workforce. The Bureau of Labor Statistics projects that between 2021 and 2031, the number of jobs requiring postsecondary credentials will grow at more than twice the rate as the number of jobs that do not require such a credential (Bureau of Labor Statistics 2022b, Table 1.7).[2] However, slightly more than half of the Boston students who graduated from high school in 2014 and entered college completed a credential six years later: 52 percent of Boston Public Schools (BPS) graduates and 59 percent Boston charter school graduates (Boston Opportunity Agenda 2022). A variety of trends, likely related to or exacerbated by the COVID-19 pandemic, also threaten the size of the college-educated workforce in Massachusetts. These range from increasing retirement rates among college-educated Baby Boomers to outmigration of college-educated workers from Massachusetts to COVID-19 pandemic-related learning loss among K-12 students (MassINC 2022).

Even when students enroll in college, many do not make it to completion. After entering college, students face a variety of academic, financial, social emotional, and other challenges that can keep them from their completing their credential, from insufficient academic preparation to navigating the financial aid system to not yet having the study, time management, or organizational skills needed to succeed in college (Engle and Tinto 2008). For students enrolled in college in 2020, 2021, or 2022, the pandemic posed additional and often unprecedented challenges, such as increased anxiety and loneliness, mental health concerns, academic challenges perhaps associated with virtual learning, and other financial and economic challenges (Goldrick-Rab et al. 2020; Means and Neisler 2020; Generation Lab 2020; Hiler, Fishman, and Nguyen 2021). These challenges particularly affected groups of students traditionally underrepresented in higher education, such as students of color, students with disabilities, and low-income students (Goldrick-Rab et al. 2020; U.S. Department of Education 2021; Means and Neisler 2020), exacerbating existing inequities in postsecondary education.

Even in the face of the challenges posed by the pandemic, the City of Boston and surrounding communities and institutions in the Greater Boston area have remained committed to improving postsecondary completion rates (The Boston Foundation 2022). The Success Boston initiative is a citywide collaboration set up to achieve this goal. Success Boston aims to help students from low-income backgrounds and 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 Boston Foundation n.d.). Success Boston involves collaboration among BPS, the Boston Foundation, the City of Boston, University of Massachusetts Boston, Bunker Hill Community College, other regional colleges and

[2] This is based on the authors' calculations using Bureau of Labor Statistics (2022b).

universities, uAspire, Boston Private Industry Council, and other local nonprofit organizations similarly committed to helping students in the surrounding areas succeed in college and beyond.

One key component of the Success Boston initiative is one-on-one transition coaching for students entering college in institutions in the Greater Boston area. Since 2009, Success Boston has provided this coaching to more than 7,000 students graduating from BPS (The Boston Foundation 2022). Success Boston Coaching (SBC) serves students for their first two years of college, with most students receiving coaching beginning in their first fall semester of college.[3] Through this coaching, combined with other efforts from colleges, BPS, and other partners, Success Boston aims to provide high school graduates in the Greater Boston area with the supports they need to complete college.

Success Boston Coaching serves students for their first two years of college, with most students receiving coaching beginning in their first fall semester of college.

1.1 About Success Boston Coaching

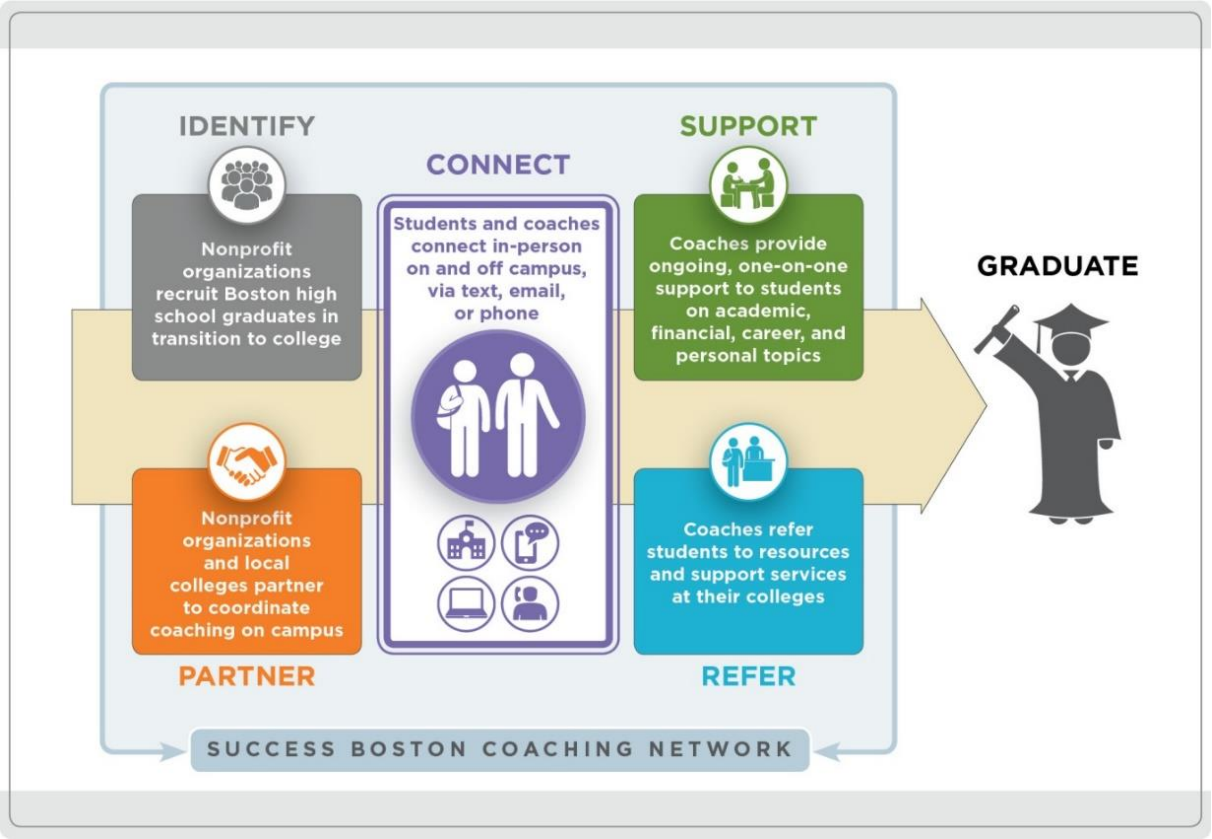
Starting with the high school graduating Class of 2009, Success Boston has provided transition coaching to BPS high school graduates, many of whom are from groups traditionally underrepresented in college. In the first few years of SBC, the program served approximately 300 students per year.

In 2015, under a "scale-up" effort supported in part by a Social Innovation Fund grant from the Corporation for National and Community Service, SBC expanded from serving several hundred Boston young adults in each high school graduating class to about 1,000 students per cohort. Beginning with the 2015 cohort, Success Boston also accorded more significant and intentional focus on the coaching of students at two-year colleges as well as on supporting students who are young men of color. For example, after the scale-up, Success Boston devoted more time at summer and monthly coaching meetings to discussing how to support community college students specifically, and also sought to recruit more young men of color for coaching. In addition, at five colleges, including four community colleges, the initiative introduced higher education liaisons: college staff members whose primary function is to support Success Boston coaches and orient them to resources, activities, and deadlines on each campus. To be consistent with prior evaluation reports and how the program is known among 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's one-on-one coaching focuses on working with students on 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. By providing this support, SBC aims to reduce barriers to college success and ultimately help students complete college, particularly for students from groups traditionally underrepresented in higher education. A network of partner organizations, colleges, and coaches work together to provide this transition coaching to students. The Boston Foundation convenes, coordinates, and facilitates communication across SBC's network of partners, thereby serving as the backbone organization of the initiative.

[3] Seventy-one percent of students who started college in fall 2014 and 87 percent of students who started college in 2015 first interacted with their coaches during the first fall semester of college (Linkow et al. 2015; Linkow, Didriksen et al. 2017).

Exhibit 1-1. Success Boston Coaching model



Note: This graphic appears in Linkow, Gamse et al. (2017), Linkow et al. (2019), and Linkow et al (2021).

Exhibit 1-1 illustrates how Success Boston Coaching operates through this network. First, each nonprofit coaching organization ***identifies*** and recruits BPS high school graduates to participate in the SBC program and receive transition coaching from the coaches it employs. SBC is designed to serve recent BPS graduates who enroll in two-year colleges and four-year colleges in the Greater Boston area but who are most likely to drop out or stop out of college before earning a degree or credential. As a result, Success Boston prioritizes identifying and recruiting low-income, first-generation-college students of color, due to the historically lower postsecondary completion rates for these groups of students (Bailey and Dynarski 2011; Cataldi, Bennett, and Chen 2018; National Center for Education Statistics 2019).

The nonprofit coaching organizations use a variety of methods to recruit students into SBC. These include nonprofit organizations' middle school and high school programming pipelines, referrals from high school guidance counselors and other community organizations, word of mouth, and outreach on college campuses. Colleges and universities in the Greater Boston area also referred students to the nonprofit coaching organizations.[4]

After the nonprofit organizations recruit students into SBC, the organizations and their coaches ***partner*** with more than a dozen local colleges in the Greater Boston area to coordinate and deliver coaching to

[4] On a 2015 survey, students reported learning about SBC through a range of sources, from presentations by the nonprofit organizations at their high schools to conversations with friends or with staff members at high schools, colleges, afterschool programs, or summer programs (Linkow, Didriksen et al. 2017).

those students on college campuses. In each year of the program, up to nine local nonprofit coaching organizations provide SBC coaching, with the coaching activities typically beginning during students' first fall semester of college and lasting through the end of the student's second year of college.[5]

Coaches ***connect*** with students one-on-one—either in person or through email, text, or phone—to help them throughout their first two years of college. They provide ongoing ***support*** to students on life skills, study skills, help-seeking skills, and academic skills to help them navigate college, as well as job and career mentoring to help prepare them to enter the workforce after college. In addition, coaches ***refer*** students to tutoring, financial aid, career assistance, and other services on their campuses. They help students develop meaningful relationships with peers, faculty, staff members, and other individuals in their college communities; set goals; access networks and resources; learn about college culture; and make college life feasible.

In addition to the help from the nonprofit coaching organizations, SBC also receives support on financial issues through uAspire, a national nonprofit organization that works to increase knowledge and resources to make college affordable. uAspire provides direct support to SBC students in filling out financial aid forms and runs a text message campaign for SBC students that sends them information and reminders related to financial aid throughout their first year of college, with the option to reply back to receive help from a uAspire staff member. uAspire also offers professional development to SBC coaches on financial aid-related topics and processes. [6]

The SBC model therefore represents a system-wide collaborative effort to serve students in their first two years in college, helping them overcome any obstacles they might face in college, and providing them with key supports and resources to help them complete their degrees and enter the workforce.

1.2 About This Report

Given the importance of the Success Boston postsecondary completion initiative in Boston and surrounding communities and the Boston Foundation's investment in BPS students' postsecondary success, the Foundation contracted with Abt Associates to conduct a comprehensive evaluation of the SBC transition coaching program. The study examines how SBC was implemented, and what effects, if any, SBC has had on students' postsecondary success and completion. This longitudinal study follows five cohorts of students who initially enrolled in college each fall, from 2013 through 2017, immediately after graduating from high school. It looks at whether students who received SBC were more successful in the short term and long term in college than a group of similar peers who did not receive SBC.

This longitudinal study follows five cohorts of students who initially enrolled in college in each fall, from 2013 through 2017. It looks at whether students who received SBC were more successful in college than a group of similar peers who did not receive SBC.

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5 The Success Boston Coaching model includes coaching over the first two years of students' postsecondary education. However, at least one of the nonprofit coaching organization partners has a program model that includes coaching for additional years—and coaches at all organizations continue to support students informally after the second year.

6 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, Didriksen et al. 2017) provide additional information about student recruitment, coaching activities, and implementation.

Earlier reports focused on implementation of SBC (Linkow et al. 2015; Linkow, Didriksen et al. 2017) and on effects of SBC on students' success in their first two years of college (Linkow, Gamse et al. 2017; Linkow et al. 2019). Another report (Linkow et al. 2021) examined SBC's effects on students' postsecondary completion, persistence, and credit accumulation after four years of college. That report could examine postsecondary completion only for students in the first two cohorts of this evaluation, those students who enrolled in college in 2013 or 2014 (the 2013 and 2014 cohorts), because they were the only cohorts who had had enough time to complete their credentials as of the time of that report.

Now that sufficient time has passed to examine long-term outcomes for most of the students in this evaluation, this report takes a comprehensive look at the effects of the SBC program on students' postsecondary completion. Specifically, this report examines the effects of SBC on postsecondary completion for the five cohorts combined: the pre-scale-up cohorts (2013 and 2014) and the post-scale-up cohorts (2015, 2016, and 2017). In addition, to complement the 2021 report's focus on the pre-scale-up cohorts' completion, and because it is a common practice to examine how a program's effects change after the program is scaled up, this report also examines SBC's effects on the three post-scale-up cohorts' completion. Finally, as an exploratory analysis, the report also examines how SBC affects students' completion of different types of credentials, such as bachelor's degrees and associate degrees.

This final report examines the following research questions:

1. *What are the effects of SBC on students' completion rates, and on students' completion of specific credentials?*

2. *How, if at all, do these impacts vary by student characteristics?*

In the next chapter, Chapter 2, we provide an overview of the relevant literature about the barriers and challenges college students like those served by SBC can face, both before and during the COVID-19 pandemic, as well as about the effects of other transition coaching and advising programs. Chapter 3 summarizes the study design, analysis approach, data sources, and measures. Chapter 4 presents our findings about the effects of SBC on students' postsecondary completion outcomes, for all five cohorts together and for the post-scale-up cohorts only. We also explore whether these impacts vary by student characteristics. In our final chapter, Chapter 5, we discuss our findings and offer recommendations and considerations for the future.

2. Barriers to College Success and Effects of Efforts to Improve Student Outcomes

Students who come from households with low incomes and identify as being from racial/ethnic minority groups—such as those SBC serves—face specific barriers to college enrollment and completion. To address barriers and develop a more equitable postsecondary education system, communities, institutions of higher education, and policymakers, among others, have identified and implemented a variety of strategies with varying degrees of success. This chapter summarizes the barriers to college enrollment and completion many students face. It then provides an overview of existing research on the effects of coaching and advising programs similar to Success Boston Coaching (SBC) on college students outcomes, as well as the literature on the effects of the SBC program in particular.

2.1 College Enrollment and Completion Trends

In the United States, a college degree is one of the most effective tools to promote economic mobility: children with college degrees are more likely to earn more than their parents, compared to their counterparts without degrees (Isaacs, Sawhill, and Haskins 2008; Urahn et al. 2012; Chetty et al. 2017). College graduates typically earn higher wages, which can add up to hundreds of thousands of dollars of lifetime earnings (Card 1999; Tamborini, Kim, and Sakamoto 2015; Lobo and Burke-Smalley 2018). They are also more likely to be employed (Irwin et al. 2022; Ma, Pender, and Welch 2019) and experience higher job growth (Carnevale, Rose, and Cheah 2011). In addition, there are several social and health outcomes associated with earning a college degree. For example, college graduates are more likely to hold health insurance through their employer, are less likely to smoke, are more likely to exercise, have higher life expectancies, are more likely to vote, and are more likely to volunteer (Ma, Pender, and Welch 2019; Meara, Richards, and Cutler 2008).

College enrollment and completion rates are lower for students from low-income backgrounds and for students belonging to certain racial/ethnic minority groups.

These inequities are evident in Boston students' postsecondary completion patterns, too.

Mirroring inequities in other areas of society, college enrollment and completion rates are lower for students from low-income backgrounds and for students belonging to certain racial/ethnic minority groups; over time, these gaps have increased (Bailey and Dynarski 2011; Cahalan et al. 2022). For example, students from low-income backgrounds are much less likely to earn a bachelor's degree. In 2020, bachelor's degree attainment rates by age 24 were about four times higher among students coming from households with the highest incomes compared to students coming from the households with the lowest (15 percent compared to 59 percent; Cahalan et al. 2022).[7] Similarly, there are large differences by race. In 2020, the shares of Asian and White non-Hispanic adults with bachelor's degrees were 61 percent and 41 percent, respectively, compared to 28 and 21 percent among Black and Hispanic adults (Cahalan et al. 2022).[8]

[7] The study considers income quartiles. That is, "households with the highest incomes" corresponds to households from the highest income quartile; "the lowest" corresponds to households from the lowest income quartile.

[8] The study considers adults ages 25 and older in this calculation.

These inequities are evident in Boston students' postsecondary completion patterns, too. Large percentages of Boston Public Schools (BPS) students are from groups who face substantial systemic barriers to postsecondary completion. Forty-three percent of BPS students are Hispanic, 32.2 percent are non-Hispanic Black, and 68.9 percent are from households with low incomes (BPS 2021).[9] Indeed, a recent Success Boston report found that gaps in Boston completion rates typically match national trends. Non-Hispanic White and Asian BPS graduates were more likely to enroll in and complete a credential or degree compared to their non-Hispanic Black and Hispanic peers; women of all races/ethnicities who graduated from BPS high schools were more likely to enroll in and complete a credential or degree than men (McLaughlin and Van Eaton 2018).

Recent enrollment trends suggest that students, particularly those from groups historically underrepresented in higher education, continue to face obstacles to staying enrolled in college and making progress toward their credentials. There were large drops in college enrollment in 2020 and 2021, largely associated with operational changes to postsecondary education, the labor market, and other personal preferences or challenges students faced associated with COVID-19. From the fall of 2019 to the fall of 2021, undergraduate enrollment dropped 7.8 percent (National Student Clearinghouse Research Center 2021). This drop in enrollment was even higher for students at public two-year colleges (14.8 percent drop), undergraduate students ages 25 to 29 (13.6 percent drop), and non-Hispanic Black students (12.0 percent drop) (National Student Clearinghouse Research Center 2021). Enrollment drops were higher at institutions that disproportionately serve students of color, including Historically Black Colleges and Universities and other minority-serving institutions (U.S. Department of Education 2021). Additionally, many students also reported delaying graduation, with the effects larger among students with low incomes (Aucejo et al. 2020).

2.2 Barriers to College Enrollment and Completion

There are a variety of reasons that students—especially students from households with low incomes or those who are the first in their family to attend college ("first-generation")—might not enroll in or complete college.

2.2.1 Barriers to Enrollment

First, students could lack information and support before they enroll in college. One relatively well studied concept known as "summer melt" occurs when students—as many as one in five—plan to enroll in college their senior year of high school but then do not enroll in the fall (Arnold et al. 2009; Castleman, Arnold, and Wartman 2012; Castleman, Page, and Schooley 2014; Castleman and Page 2020). During that summer, students can face complex administrative tasks, such as completing the Free Application for Federal Student Aid (FAFSA) or setting up a payment plan, registering for courses, or submitting health records, with limited professional support to help (Arnold et al. 2009; Castleman, Arnold, and Wartman, 2012; Castleman and Page 2015; Castleman, Page, and Schooley 2014).

2.2.2 Barriers to Completion

Once enrolled, students can face similar administrative barriers, such as registering for courses in subsequent semesters and completing the FAFSA annually, that could affect their ability to succeed in

[9] This BPS report defines "low income" as students who participated in any one of the following programs: Supplemental Nutrition Assistance Program; Massachusetts Transitional Aid to Families with Dependent Children; Massachusetts Department of Children & Families foster care; and MassHealth, which includes Medicaid and Children's Health Insurance Program for Massachusetts residents.

and ultimately complete college. First-generation college students can find these processes particularly challenging because their families are likely unfamiliar with them (Castleman and Page 2013; Stephens et al. 2015). Once students enroll, they also can face a range of academic challenges, such as being unprepared for college coursework, managing their time, and difficulty selecting coursework or meeting degree requirements (Engle and Tinto 2008). Navigating course and major selection can be a particular challenge, especially at community colleges, where students must select from a large array of courses, often with limited guidance (Bailey et al. 2015).

Many students struggle to afford college. Even if they qualify for financial aid, they might be unable to pay for other expenses such as housing, food, books, transportation, and childcare (Goldrick-Rab 2016; Urban Institute, n.d.; Mader 2021; Crespi, Bruecker, and Seldin 2021). Over time, changes in their financial circumstances or their financial aid package also can affect a student's decision to persist. Many students work part-time, making it difficult to juggle work and coursework.

2.2.3 Barriers Associated with COVID-19

The COVID-19 pandemic has exacerbated typical challenges students face and presented new ones, with larger impacts among community college students, students with low incomes, and students of color (U.S. Department of Education 2021; Lederer et al. 2021). These challenges affected students enrolled in college in 2020 and continue to affect students today.

First, COVID-19 has presented a new set of operational challenges that make it difficult for some students to succeed, including virtual learning and other operational protocols (such as regular COVID-19 testing and required quarantine periods). With the transition to virtual learning and campus closures, many students had less access or lost access entirely to certain university supports such as health services, their peers, faculty, and advising staff (U.S. Department of Education 2021; Hotez et al. 2022). As a result, some students fell behind academically, modified their graduation plans, considered dropping courses, or did not return (Rodriguez-Planas 2021; New England Secondary Schools Consortium 2021). For students who are parents or caregivers, childcare and school closures and the transition to virtual learning has strained their ability to care for their families and complete coursework (U.S. Department of Education 2021).

Since the start of the pandemic, many students have faced challenges with their mental health, including difficulty with motivation or focus, increased loneliness, and feelings of isolation, grief, or loss (U.S. Department of Education 2021; Hotez et al. 2022). Many students, especially low-income students, have experienced greater financial insecurity, stemming from a reduction in campus employment, family income, and financial aid, paired with an increase in other expenses such as home technology or in food/housing insecurity (Soria, Horgos, and Shenouda 2022). This is especially true for low-income students. One study estimates that the pandemic has reduced earnings for 35 percent of students at one university, with Pell recipients being 17 percent more likely to experience earnings losses (Rodriguez-Planas 2022).

2.3 Research on Impact of Transition Coaching

Coaching can support students as they face a variety of challenges in transitioning from high school into college (Avery and Kane 2004; Bettinger, Boatman, and Long 2013; Deming and Dynarski 2009; Roderick et al. 2008). Several studies have found that transition coaching programs increase student enrollment and persistence. These studies differ in several characteristics, including whether students receive a professional or peer coach; the timing, frequency, and duration of coaching; the population of

students served; the type of college at which the coaching takes place (for example, two-year or four-year); the amount of financial support provided; and the eligibility criteria.

Coaching programs that provide consistent and regular support to students once they enroll can positively effect student persistence, completion, and academic performance. Coaches can help students identify their goals, help them overcome administrative and academic barriers, and identify other sources of support at their institution (Avery et al. 2020; Bettinger and Baker 2014; Bettinger, Boatman, and Long 2013; Castleman and Page 2015; Dynarski et al. 2022; Johnson and Rochkind 2009; Karp 2011; Oreopoulos and Petronijevic 2016; Rossman et al. 2021; Swecker, Fifolt, and Searby 2013). For example:

- InsideTrack, a two-year coaching program aimed primarily at nontraditional students, where coaches meet with students and work with them to achieve their goals, increased college persistence the year students were coached and one year after. Universities that participated in a study of InsideTrack randomly assigned students to be coached. The study found that students who were coached were 15 percent more likely to have remained in college 18-24 months after their coaching period (Bettinger and Baker 2014).

- Bottom Line, which provides coaching to students beginning in high school or beginning in college, positively affects their enrollment and persistence.[10] One study of Bottom Line found that students who received coaching beginning in high school were 7 percentage points more likely to enroll in college and 10 percentage points more likely to enroll in a four-year college. Students who began coaching in their first year of college were 7 percentage points more likely to persist into their second year (Barr and Castleman 2018).

- Opening Doors, a coaching program implemented at two Ohio community colleges, improved student academic performance and credit accumulation in their second semester. A study of Opening Doors found that the program did not affect academic performance in subsequent semesters. The program expected students to meet with their assigned coach at least twice a week for at least two semesters. It also provided them a modest stipend (Scrivener and Weiss 2009).

- Monitoring Advising Analytics to Promote Success (MAAPS), which provides a dedicated academic advisor to students, increased students' course pass rate and first-year grade point averages (GPAs) at one of its sites (Georgia State University). A randomized control study found a statistically significant increase in persistence among Black students at Georgia State University, with MAAPS students persisting at a rate 12 percentage points higher than their peers. That said, overall, at all 11 sites at which the advising was offered, the effects of the program on primary outcomes such as completion were relatively small or nonexistent (Rossman et al. 2021).

Programs that support students as they face academic, social, and administrative challenges while also providing financial aid show positive outcomes for students (Azurdia and Galkin 2020; Clotfelter, Hemelt, and Ladd 2017; Erwin et al. 2021; Gupta 2017; Miller et al. 2020; Page et al. 2019; Ratledge et al. 2019; Rolston, Copson, and Gardiner 2017; Scrivener et al. 2015). For example:

- Vision Inspired Scholarship through Academic Achievement (VISTA) in New Mexico, a program that ties performance-based aid with enhanced academic advising, decreased the time it took students to complete their degrees. A randomized assignment study found that VISTA was

[10] Bottom Line is one of the nonprofit coaching organization partners that offers SBC.

especially effective for students with the lowest academic preparation and family income (Erwin et al. 2021).

- Accelerated Study in Associate Programs (ASAP), which provides financial and academic support to community college students provided they enroll full-time, results in a variety of positive college outcomes. One randomized control trial found that ASAP increased degree completion, decreased the time it took students to finish their degrees, and increased the amount of financial aid students received. For example, ASAP increased associate degree completion by about 18 percentage points after three years and 10 percentage points after six years (Azurdia and Galkin 2020). Another study at three Ohio community colleges found that a program modeled after ASAP doubled three-year graduation rates (Miller et al. 2020).
- The Dell Scholars Program, which provides up to $20,000 in scholarships to low-income students seeking a bachelor's degree while also providing ongoing support in academics and social aspects students face in college, improves college persistence and completion. A study found that Dell Scholars are 8-12 percentage points more likely to persist into their third year of college, 6-10 percentage points more likely to complete a bachelor's degree in four years, and 9-13 percentage points more likely to complete a bachelor's degree in six years (Page et al. 2019).

2.4 Research on Success Boston Coaching

Success Boston coaches provide students attending colleges in the Greater Boston area with help on academic, financial, career, and social and emotional topics, helping students overcome a lack of support or resources as they make the transition to college. Exhibit 2-1 summarizes past research on Success Boston coaching. Six previous studies—several of which are precursors to this report—compared coached students to noncoached students as measured across a range of outcomes, including year-to-year college persistence or completion.

Overall, five studies find that coached students have higher rates of college persistence at one or more time points (Sum et al. 2013; Sum, Khatiwada, and Palma 2014; Linkow, Gamse et al. 2017; Linkow et al. 2019; Linkow et al. 2021). Two studies looked at completion rates: One descriptive study observed that coached students had higher completion rates but did not detect statistically significant differences (McLaughlin et al. 2016); the second did not find statistically significant differences in completion rates (Linkow et al. 2021).

The current report adds to this research by following multiple cohorts of students for six years after college enrollment, a longer period compared to past studies. This is the final report in Abt Associates' evaluation series.

Exhibit 2-1. Summaries of past research on Success Boston

Study	Cohorts Included	Persistence Findings	Completion Findings
Sum et al. 2013	2007-2009 cohorts	• Coached students were more 20 and 24 percentage points more likely to persist into their first and second years of college, respectively	N/A

Study	Cohorts Included	Persistence Findings	Completion Findings
Sum, Khatiwada, and Palma 2014	2009 cohort	• Persistence rate of SBC students was 12-18 percentage points higher in any given year (from years 1 to 4)	• Coached students had a higher 4-year graduation rate (26 percent for coached students vs. 13 percent for uncoached students)
McLaughlin et al. 2016	2009 cohort	N/A	• Completion rates were higher among coached students who initially attended a 2-year institution (6-year completion rate 35% for coached students vs. 24% for uncoached students) • Difference in completion rates among Black students was relatively high (6-year completion rate: 53% for coached students vs. 41% for uncoached students)
Linkow, Gamse et al. 2017	2013 and 2014 cohorts	• Success Boston students were more likely to persist into their second and third year (with impacts of 8 and 13 percentage points, respectively)	N/A
Linkow et al. 2019	2015 and 2016 cohorts	• Coached students were 4 percentage points more likely to persist into their second year; but no significant difference on persistence into third year	N/A
Linkow et al. 2021	2013-2017 cohorts	• SBC students in some cohorts were 3-6 percentage points more likely to persist into their fourth, fifth, sixth, and seventh years, though results varied by cohort and impacts declined over time	• No statistically significant differences for postsecondary completion after the fourth, fifth, or sixth years

3. Evaluation Design

To examine whether Success Boston Coaching (SBC) is effective at improving students' postsecondary completion, this study uses a quasi-experimental design. The study looks at the completion outcomes of students who received SBC. It compares their outcomes to those of a group of matched noncoached students who are similar to the SBC students, and whose outcomes suggest how SBC students might have fared had they not received the coaching. By comparing the outcomes of SBC students with noncoached similar students, we can assess whether SBC had an effect on students' postsecondary completion.

This chapter summarizes our quasi-experimental study design. It details how we identified our study sample, including both coached students and noncoached students. It describes how we estimated program impacts across all students, and how we examined variation in program impacts according to student characteristics. It describes our data sources and the types of outcome and baseline student data we collected, and the characteristics of students in our sample. Finally, the chapter describes the limitations to our study design.

3.1 Study Design

This study examines the impacts of coaching for students who graduated from high schools within BPS and surrounding districts in 2013, 2014, 2015, 2016, or 2017, and who entered college in the fall immediately after their high school graduation. Throughout this study, we refer to students who graduated from high school in 2013 and enrolled in college in fall 2013 as the "2013 cohort," students who graduated from high school in 2014 and enrolled in college in fall 2014 as the "2014 cohort," and so on.

To look at SBC's effects on the 2013-2017 cohorts, we first identified students who received the coaching, as well as a group of comparison students who did not receive SBC but are as similar to the coached students as possible, as explained below.

3.1.1 How We Identified Students in the Sample

We identified students participating in the SBC program using the program's administrative database, which contains students who were recruited into SBC. For this evaluation, we consider all students who appear in the database to have received SBC.[11] A total of 3,922 students are identified as SBC students across the 2013, 2014, 2015, 2016, and 2017 cohorts. We identified a ***comparison group of students*** from among the 62,225 who graduated in the 2012-13, 2013-14, 2014-15, 2015-16, or 2016-17 academic years from BPS and surrounding district high schools.

To be eligible for the evaluation sample, SBC and comparison group students had to:

- enroll in college in the fall immediately 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

[11] We consider all students in the database to have received SBC, even though a small proportion of students had no recorded interactions with a coach. For example, in the 2016-17 academic year, 2 percent (37 students) of students in the program database in the 2015 and 2016 cohorts had no coaching interactions recorded in the database (Linkow et al. 2019).

- have no missing information on two key baseline characteristics used in the matching process: high school GPA and free/reduced-price lunch status.[12,13]

After applying the eligibility criteria, we could include 2,994 SBC students and 16,065 non-SBC (comparison group) students in the evaluation sample across the 2013-2017 cohorts. Eligible students for the comparison group attended public high schools in BPS and 21 surrounding districts, plus an additional 12 charter schools.[14]

We selected students for the evaluation sample through a *local and focal matching* process described in detail below.

We used a ***quasi-experimental*** design that compares SBC students with a comparison group of similar students. We used a *local and focal matching* process to construct the strongest comparison group possible.

3.1.2 How We Create a Matched Comparison Group to Assess Program Effects

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 to randomly assign sample members to a treatment group or a comparison group, give only the treatment group access to an intervention ("the treatment"), and then compare outcomes of the treatment group versus the comparison group. Because the two groups are formed randomly, they are expected to be similar at baseline (pre-intervention) on 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.

Because an experimental design was not possible for SBC, given partner organizations' capacity and the size of the potential participant population, we used a *quasi-experimental* design. This design allows us to

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12 The U.S. Department of Education's What Works Clearinghouse (WWC 2022) requires studies examining outcomes that cannot be measured pre-intervention (such as postsecondary completion) to establish baseline equivalence using pre-intervention measures of both student academic achievement and student socioeconomic status. For that reason, we consider high school GPA and free/reduced-price lunch status to be key characteristics.

13 A student's eligibility for free or reduced-price meals under the U.S. Department of Agriculture's school nutrition program is a commonly used measure of a student's low-income status. However, starting in the 2014-15 academic year, the Massachusetts Department of Elementary and Secondary Education (2015) adopted a new metric of "economic disadvantage" based on a student's participation in one or more of the following assistance programs: Supplemental Nutrition Assistance Program, Transitional Assistance for Families with Dependent Children, the Department of Children and Families foster care program, and MassHealth (the state's Medicaid program). Although this is now the department's preferred income measure, that data is not available for the 2013 cohort—unlike free and reduced-price lunch status, which is available for all cohorts. In our analysis, we use free and reduced-price lunch status as a proxy for students' low-income status across all cohorts for consistency.

14 ***Districts*** that provided comparison students include 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 include 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.

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. For example, one potential difference in background characteristics between program participants and noncoached 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. If they exist, 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 were 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.[15] It is "focal" because treatment and comparison students are carefully matched based on similar baseline characteristics (for example, 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.[16]

For this evaluation, we implemented local and focal matching by (1) defining "matching blocks"— based on the student's cohort (2013, 2014, 2015, 2016, or 2017) and the postsecondary institution in which the student initially enrolled; 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 summarize the matching process below, and provide additional information in Appendix A.

Estimation of the Propensity Scores

We use *propensity score matching* to match SBC students with similar noncoached students. 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). Propensity scores can range from 0 to 1, with numbers closer to 1 representing a greater likelihood that a student receives the treatment—in this case, the SBC program.

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15 The matching blocks include students from BPS and nearby districts with similar characteristics to BPS.

16 In addition, varied SBC recruitment strategies (referrals, organizations' pipelines, word-of-mouth) and staggered timing (end of high school, summer, or start of college) help create cohorts of SBC students with different levels of willingness to seek support, motivation, and attachments to the coaching organizations. This reduces the chance that unmeasured characteristics related to both participation in coaching and student outcomes cause any impacts that we observe.

For this study, we estimated a propensity score for each student, using student-level data from BPS and the Massachusetts Department of Elementary and Secondary Education (MA DESE) on a variety of baseline characteristics:

- **Student demographics**: age, race/ethnicity, gender, free/reduced-price lunch status, disability status, and English language learner 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 attendance and number of suspensions
- **Characteristics of high schools**: college-going rate, high school-level average MCAS math and English scores[17]
- **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)

We selected the characteristics above based on a comprehensive literature review and on information from coaching organizations about criteria they use when selecting or recruiting students for their programs (see Linkow, Gamse et al. 2017; Linkow et al. 2019; Linkow et al. 2021). Appendix A contains a complete list of student and high school characteristics used in the propensity score models.

Conducting Matching and Assessing Baseline Balance

After we estimated propensity scores, we used the propensity scores to match SBC students in each matching block (defined by the student's cohort and original postsecondary institution) with potential comparison group students in the same block. Appendix A describes the matching process in further detail.

We then checked to see whether the matched SBC students and matched comparison students were "balanced" (that is, whether the treatment group was similar to the comparison group on background characteristics). We iteratively matched and checked baseline balance, adjusting the propensity scores model as needed, until we achieved satisfactory balance.[18] Once we achieved satisfactory balance for all variables used in the matching process, we stopped matching and considered the resulting sample to be final.

The evaluation examines several different completion outcomes. For some outcomes, not enough time has elapsed for the outcome to be measured for all students. Specifically, enough time has elapsed to allow us to measure completion overall, and completion of specific degrees, within six years for the 2013 through

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

[18] For the 2015-2017 cohort propensity score models, we also imposed exact matching by gender (female or not) and by one race category (non-Hispanic Black or not) to help us achieve balance on key demographics.

2015 cohorts, but not for the 2016 or 2017 cohort. In addition, we have the data to measure five-year completion outcomes for the 2013 through 2016 cohorts, but not for the 2017 cohort. Because different outcomes were available for different cohorts, we conducted matching and assessed baseline balance separately for each outcome, and the outcome findings reported in Chapter 4 are based on those different analytic samples. By confirming that SBC students and matched comparison students were similar on observable characteristics for each outcome sample, we could rule out the possibility that these characteristics themselves accounted for any observed differences in outcomes between SBC and noncoached students. Appendix A contains additional information about the balance we achieved for each sample.

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

In this report, we examine the effects of SBC on postsecondary completion, answering our primary research question, *What are the effects of SBC on students' completion rates, and on students' completion of specific credentials?* In previous reports, we examined effects on persistence for the 2013-2014 cohorts (Linkow, Gamse et al. 2017; Linkow et al. 2021), persistence for the 2015-2016 cohorts (Linkow et al. 2019; Linkow et al. 2021), persistence for the 2017 cohort (Linkow et al. 2021), and completion for the 2013-2014 cohorts (Linkow et al. 2021). In this final report, we provide a summative view of SBC's impacts on completion across all five cohorts, using data that covers student outcomes through fall 2021. Pooling data across the 2013-2017 cohorts allows us to maximize statistical power"—our ability to detect any effects of SBC—which increases as the number of students in our analytic sample increases.

Linkow et al. (2021) reported SBC's effects on postsecondary completion rates only in the pre-scale-up cohorts (2013 and 2014 cohorts). Now that sufficient time has elapsed for data to become available for later cohorts, we can also examine how SBC affects completion (if at all) for the post-scale-up (2015-2017) cohorts. Therefore, in addition to examining results across all five cohorts, this report presents results separately for the 2015-2017 cohorts, allowing us to explore how the impacts of SBC changed (if at all) after the 2015 scale-up.[19]

We estimate SBC's effects across all students separately for each outcome measure, using the relevant analytic sample of matched treatment and comparison students. To do this, we use a linear regression model that includes matching block indicators and also, as covariates, all the matching characteristics used to construct the corresponding comparison group, thereby increasing the precision of the impact estimates. We conducted robustness checks with different covariate sets, which yielded similar results (see Appendix B for more information).

3.1.4 How We Estimate the Subgroup Differences in Impacts

To address the second research question, *How, if at all, do the SBC impacts vary by student characteristics?,* we conducted exploratory analyses to examine how SBC's effects differ (if at all) by student characteristics measured before SBC students started receiving coaching. These analyses allow us to understand whether, and if so, how, observed impacts of SBC vary as a function of particular student characteristics. We consider these analyses to be exploratory because they look at SBC's effects on subsets of the full sample for each outcome. The smaller size of these subsets relative to the full sample means the results have higher standard errors, which lessens our ability to detect statistically significant

[19] Previous reports (Linkow, Gamse et al. 2017; Linkow et al. 2019) have found larger effects for SBC on interim college outcomes (such as persistence) among students in the pre-scale-up cohorts (2013 and 2014 cohorts) than in some of the post-scale-up cohorts (2015 and 2016 cohorts).

impacts. In addition, the number of subgroups examined increases the number of impacts estimated, making it more likely that any statistically significant impacts detected could be due to chance variation and not represent actual effects.

For each characteristic, we divide students into two non-overlapping subgroups. This simplifies the analyses, make comparisons between subgroups easier to interpret, and increases our statistical power. Specifically, we looked at how (if at all) SBC effects differ by (1) **gender** (categorized as *women* or *men*); (2) **underrepresented minority** (categorized as *traditionally underrepresented in postsecondary education* or *not*);[20] (3) **high school student GPA** (categorized as *higher* for median >3.00 or *lower* for median ≤3.00);[21] and (4) **type of college** in which a student initially enrolls (categorized as *two-year* or *four-year*). We selected these characteristics based on research linking them to postsecondary completion, our outcome of interest. Specifically, previous studies have found higher postsecondary completion rates for women relative to men (Shapiro et al. 2019); for students who are not members of underrepresented minority groups relative to students who are members of these groups (Haskins 2008; Bailey and Dynarski 2011); for students with higher high school GPAs relative to students with lower GPAs (Belfield and Crosta 2012); and for students initially enrolling at four-year institutions relative to students initially enrolling at two-year institutions (Shapiro et al. 2019).

For our subgroup analyses, we first examine the difference *between* the impacts for any two subgroups (for example, women versus men). If the between-subgroup difference is not statistically significant, then we can conclude SBC similarly affects both subgroups (for example, no statistically significant difference between the impacts for students with higher versus lower high school GPAs would suggest SBC's impacts are similar for students with higher and lower GPAs). Alternatively, a statistically significant between-group difference could indicate SBC could have different effects for different subgroups. If we see such a significant *between*-subgroup difference, we look *within* the subgroups at the effects calculated separately for each subgroup (for example, examining SBC's effects on students with lower high school GPAs and SBC's effects on students with higher high school GPAs). Additional information about our subgroup analysis approach and our impact model can be found in Appendix B.

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 background data for students who graduated from BPS high schools in the spring of 2013 or 2014, including high school academic measures, behavior, and

[20] We defined *underrepresented minority* subgroups slightly differently for the two sets of cohorts, consistent with the decisions made in our previous impact reports (Linkow, Gamse et al. 2017; Linkow et al. 2019; Linkow et al. 2021). For the 2013 and 2014 cohorts, we defined *underrepresented minority* as being non-Hispanic Black, Hispanic, or Other/Multiracial. For the 2015-2017 cohorts, we defined it as non-Hispanic Black, Hispanic, non-Hispanic Native American, or Other/Multiracial.

[21] 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) in a given cohort, so that similar numbers of students would be in the two subgroups, and we could maximize our statistical power. This median GPA was 3.0 for the 2013-2016 cohorts. For the 2017 cohort, the median GPA was 2.95.

demographic information (for example, SAT, 10th-grade MCAS scores; coursework; attendance and suspensions; race/ethnicity, gender).[22]

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 (for example, SAT, 10th-grade MCAS scores; coursework; attendance 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 2021, the NSC included data covering 97.4 percent of student enrollments at U.S. colleges and 98.6 percent of enrollments at Massachusetts colleges (National Student Clearinghouse Research Center, 2022). Using NSC data allows us to access the records for all students, regardless of whether they transfer between colleges. MA DESE and BPS provided NSC data.[23] As of the time of this report, NSC data were available for enrollments through the fall of 2021.

Eleven colleges with more than 10 SBC students enrolled annually or strong partnerships with the Success Boston initiative also provided administrative data. Seventy-nine percent of eligible treatment group students across the 2013-2017 cohorts initially enrolled in those institutions immediately after graduating high school. We used student-level records from these colleges, which covered only through the spring of 2020, to supplement the NSC data in measuring overall postsecondary completion.[24]

3.3 Outcome Measures

In this section, we describe our completion outcomes. We then define the measures used in our exploratory analyses to test whether program impacts varied by student characteristics.

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22 BPS provided student data for 2013 and 2014 graduates because, prior to the scale-up, SBC served BPS graduates only. Thus, our 2013 and 2014 cohort sample consisted mainly of BPS graduates. (The only non-BPS students included in the 2013 and 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, we matched SBC students who attended University of Massachusetts Boston with comparison students who graduated from non-BPS high schools.)

After the scale-up, SBC began serving more students. To achieve a sufficiently large analytic sample for the post-scale-up cohorts, we expanded our analytic sample to include more non-BPS comparison students. As a result, we relied more on MA DESE data for the baseline characteristics for the 2015 through 2017 cohorts.

23 We use NSC data provided by MA DESE to measure credential-specific completion and overall completion through fall 2021. In addition to the NSC data from DESE, BPS provided NSC data through fall 2019, and we include those data in examining overall completion through fall 2019. However, we do not use BPS NSC data to examine credential-specific outcomes at any point or to measure overall completion after fall 2019.

24 Benjamin Franklin Institute of Technology, Bridgewater State University, Bunker Hill Community College, Massachusetts Bay Community College, Northeastern University, Roxbury Community College, Salem State University, Suffolk University, University of Massachusetts Boston provided data across all five cohorts (2013-2017). In addition, Framingham State University and Wentworth Institute of Technology provided data for students in the 2015-2017 cohorts only.

We use administrative data from colleges, collected for previous reports, to measure overall postsecondary completion through summer 2020. We relied solely on NSC data from MA DESE to measure completion outcomes after summer 2020, and to measure degree- and certificate-specific completion all time points.

3.3.1 Completion Measures

The ultimate goal of SBC is to increase the number of students who complete their degrees or certificates. This report examines a series of postsecondary completion outcomes. *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.[25]

Because we have multiple outcomes, we distinguish between primary and exploratory outcomes:

- **Primary outcomes** are those most closely related to the theory of change. SBC's theory of change hypothesizes that one-on-one coaching that addresses logistical, academic, financial, and emotional support topics can improve overall completion rates for traditionally underrepresented college students. For this study, completion of college with any degree or certificate within four years, within five years, and within six years are the primary outcomes, given SBC's ultimate objective of helping students complete college.

- **Exploratory outcomes** are also informed by the theory of change, though might not necessarily be the most important outcomes in that theory of change. Examining effects on exploratory outcomes can help explain why or why not a program has impacts on primary outcomes. Completion of a bachelor's degree within four years, five years, and six years; completion of an associate degree within four years, five years, and six years; and completion of an undergraduate certificate within four years, five years, and six years are this report's exploratory outcomes. These credential-specific outcomes can help explain our findings on overall completion; however, we consider these outcomes exploratory because whether a student earns a specific type of credential is secondary to whether a student completes college at all.

Exhibit 3-1 describes, for each outcome measure, the timing for measuring the outcome relative to students' high school graduation, the cohort(s) for which the outcome is measured and for which impacts are estimated, the post-matching sample size, and the data sources. We use NSC data through the fall of 2021 as our main data source for outcome data on overall postsecondary completion and degree- or credential-specific completion. We used administrative data collected from colleges for previous reports to supplement NSC data in measuring students' overall completion through spring 2020 (though not degree-specific completion). Appendix C shows the two-way correlations between these outcome measures across the 2013-2017 cohorts.[26]

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[25] 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.).

[26] Under WWC Group Design Standards, Version 5.0 (2022), in reviewing studies that examine the effects of a program on multiple outcomes within an outcome domain, WWC reviewers combine the findings across all outcomes in that domain and create a composite domain-level finding. The WWC uses this domain average effect size to rate the strength of evidence of the program's effectiveness on outcomes in this domain. We provide these correlations in Appendix C to facilitate creating this composite measure.

Exhibit 3-1. Outcomes measured in this report

Outcome	Primary or Exploratory	Cohorts	Sample Size	Data Source
Completion of any undergraduate degree or certificate…				
After 4 years	P	2013-2017	11,545	NSC, college administrative data
		2015-2017	9,054	
After 5 years	P	2013-2016	8,354	NSC, college administrative data
		2015-2016	5,863	
After 6 years	P	2013-2015	5,210	NSC, college administrative data
		2015	2,719	
Completion of a bachelor's degree…				
After 4 years	E	2013-2017	11,545	NSC
		2015-2017	9,054	
After 5 years	E	2013-2016	8,354	NSC
		2015-2016	5,863	
After 6 years	E	2013-2015	5,210	NSC
		2015	2,719	
Completion of an associate degree…				
After 4 years	E	2013-2017	11,545	NSC
		2015-2017	9,054	
After 5 years	E	2013-2016	8,354	NSC
		2015-2016	5,863	
After 6 years	E	2013-2015	5,210	NSC
		2015	2,719	
Completion of an undergraduate certificate…				
After four years	E	2013-2017	11,545	NSC
		2015-2017	9,054	
After five years	E	2013-2016	8,354	NSC
		2015-2016	5,863	
After six years	E	2013-2015	5,210	NSC
		2015	2,719	

NSC=National Student Clearinghouse. P=Primary Outcome. E=Exploratory Outcome.

3.3.2 Student Characteristics Measures

Exhibit 3-2 summarizes the means of key student characteristics for students in the 2013-2017 cohorts and for the students in the 2015-2017 cohorts.[27] It also includes the characteristics of 2013-2014 cohort students, to illustrate how characteristics of the students in the study compare before versus after the SBC scale-up. As shown in the table, across all cohorts, most students in the study are members of one or more groups traditionally underrepresented in higher education. Specifically, 85 percent of students in the pre-scale-up cohorts and 74 percent of students in the post-scale-up cohorts were eligible for free and reduced-price lunch in high school, substantially above the 33 percent of public school students eligible

[27] For the 2013-2017 and the 2015-2017 cohorts, Exhibit 3-2 includes each cohort set's largest analytic sample from Exhibit 3-1, specifically, the 11,545-student analytic sample for the 2013-2017 cohorts and the 9,054-student analytic sample for the 2015-2017 cohorts.

for free and reduced-price lunch across Massachusetts (National Center for Education Statistics 2021). About three-quarters of students are members of underrepresented minorities.

On average, students in the study earned a high school GPA equivalent to approximately a B- or C+, with students in the pre-scale-up cohorts having an average GPA of 2.81, compared with 2.47 for the post-scale-up cohorts. Across all cohorts, students scored below state averages on the English Language Arts section of the MCAS—with lower scores in the pre-scale-up cohorts than in the post-scale-up cohorts (-0.50 versus -0.28)—and comparable to state averages on the MCAS Math section.[28] Slightly more than half of sample students took at least one advanced course in high school, and on average took one advanced course.

Looking at the 2013-2017 cohorts combined, students initially enrolled in 53 different colleges in the fall after high school graduation; the expansion of SBC is reflected in the larger number of colleges in which students initially enrolled post-scale-up (51) relative to pre-scale-up (26). Finally, about one-third of all study students initially enrolled in a two-year college (38 percent in the pre-scale-up cohorts and 34 percent in the post-scale-up cohorts), with the remaining two-thirds enrolling in four-year colleges. The right-hand panels of Exhibits A-5a and A-5b provide the full set of descriptive characteristics for the analytic samples of students in the 2013-2017 cohorts and students in the 2015-2017 cohorts, respectively.

Exhibit 3-2. Student characteristics at baseline

Characteristic		2013-2014 Cohorts	2015-2017 Cohorts	2013-2017 Cohorts
Race and ethnicity				
	% Underrepresented minority students	79%	77%	77%
	% Black, non-Hispanic	41%	42%	42%
	% White, non-Hispanic	7%	7%	7%
	% Asian Pacific Islander, non-Hispanic	13%	16%	16%
	% Hispanic	37%	32%	34%
	% Native American, non-Hispanic	0%	0%	0%
	% Other/Multiracial	1%	<1%	<1%
Demographics				
	% Free/reduced-price lunch	85%	74%	77%
	% Women	60%	60%	60%
	% English language learners	15%	10%	12%
High school academic achievement				
	High school GPA (mean)	2.81	2.47	2.56
	MCAS English Language Arts score (z-score)[a]	-0.50	−0.28	−0.34
	MCAS Math score (z-score)[a]	-0.08	−0.03	−0.04

[28] We present students' MCAS scores for English Language Arts and Math as z-scores. For each student and subject area, we calculate the student's z-score by first identifying the mean and standard deviation for scores in that subject area across all students in Massachusetts. We then calculate the difference between the student's score in that subject area and the relevant statewide mean score, and finally divide that difference by the relevant statewide standard deviation. As a result, the mean English Language Arts score and the mean Math score across all students in Massachusetts would each be represented by a z-score of 0.

Characteristic		2013-2014 Cohorts	2015-2017 Cohorts	2013-2017 Cohorts
	SAT score (mean)[b]	1242	1201	1212
Behavioral measures				
	Took an advanced course in high school	55%	56%	56%
	Number of advanced courses taken in high school	1.01	1.10	1.08
	High school *average* college-going rate	60%	68%	66%
Initial college enrollment				
	Students who initially enrolled in two-year colleges	38%	34%	35%
	Number of colleges in which students initially enrolled	26	51	53

Notes: *N*=11,545 students in the 2013-2017 cohorts, 2,491 students in the 2013-2014 cohorts, and 9,054 students in the 2015-2017 cohorts. "Underrepresented minority students" denotes, for the 2013 and 2014 cohorts (within the 2013-2017 cohort sample), Black non-Hispanic, Hispanic, Mixed Race, and Other; for the 2015-2017 cohorts, Black non-Hispanic, Hispanic, Native American, Mixed Race, and Other.
[a] MCAS scores are presented as z-scores, which we computed by subtracting the student's score minus the mean score across all students, divided by the standard deviation of scores across all students.
[b] For the 2013-2016 cohorts, the SAT score is presented as the sum of the student's scores on the reading, math, and writing sections, for a maximum possible total score of 2400. For the 2017 cohort, the scoring of the SAT changed effective spring 2016 (Anderson 2014) to have a maximum possible total score of 1600, with just the reading and math section scores counting toward that total score. In spring 2016, 2017 cohort students were in their junior year of high school, which is a common time for students to take the SAT. As a result, for the 2017 cohort, the SAT score is presented as the sum of the student's scores on the reading and math sections, with a maximum possible total score of 1600.

3.4 Limitations

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

First, we matched students within a given college 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, we matched within colleges, accounting for high school characteristics. Even with this expanded pool of potential comparison students, in some cases it was not possible to find a similar comparison student to match to a coached student (see Appendix Exhibit A-3 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. The matching process addresses both differences in college experiences and high school characteristics to minimize historical and locational differences in students' previous educational experiences. Moreover, in addition to using student-level and high school-level baseline characteristics for matching, we 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).[29]

Second, because we were not able to use an experimental design for this study, it is possible that the local and focal matching approach did not sufficiently control for potentially confounding factors, as is true for

[29] Using the baseline characteristics both in the matching process and 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).

any quasi-experimental design. Coached and non-coached students could differ from each other with respect to characteristics that could be related to both their likelihood of participating in SBC and their outcomes, such as student academic achievement in high school, supports offered by their high schools, and parental involvement (see Appendix A). We account for many, but not necessarily all, of these characteristics in our design, both in our process for matching coached students with similar non-coached students and in our impact model, where we include these characteristics as covariates. Although we may not be able to observe all possible confounders, We were able to achieve baseline equivalence on observed characteristics for each outcome sample (see Appendix Exhibits A-5a and A-5b). To the extent that the distribution of all important confounders is similar across SBC students and the matched comparison group, our quasi-experimental design should produce impact estimates with minimal bias.

4. Impacts on Postsecondary Completion

This chapter presents the effects of Success Boston Coaching (SBC) on postsecondary completion, reflecting its ultimate objective: to provide students with supports and skills to help them earn their degrees or certificates. Using data available through the fall of 2021, the study follows the students in the 2013-2017 cohorts for four to six years, depending on when the cohort entered college.

We present results in four sections. First, we present the impacts on overall postsecondary completion, for all five cohorts ("**combined cohorts**") in Section 4.1 and for only the 2015-2017 cohorts ("**post-scale-up cohorts**") in Section 4.2.[30] We also show the results of our exploratory analyses for each of those two cohort sets. In Sections 4.3 and 4.4, we explore how SBC affected students' **completion of bachelor's and associate degrees**. We also examine how SBC's impacts differ, if at all, by key student characteristics, looking at **subgroups** by gender, underrepresented minority status, high school GPA, and the type of college at which the student initially enrolled.[31]

Key Findings

SBC has positive effects on completion within four and five years. In the combined (2013-2017) cohorts, compared to their noncoached peers, SBC students were:

- 4.6 percentage points (18 percent) more likely to complete college in four years
- 4.9 percentage points (12 percent) more likely to complete college in five years

Similarly, in the post-scale-up (2015-2017) cohorts, compared to their noncoached peers, SBC students were:

- 5.6 percentage points (21 percent) more likely to complete college in four years
- 6.0 percentage points (15 percent) more likely to complete college in five years

In both sets of cohorts, coached and non-coached students were similarly likely to complete college in six years.

4.1 SBC Impacts on Postsecondary Completion, Combined (2013-2017) Cohorts

Exhibit 4-1 shows the rates of postsecondary completion for SBC students and their noncoached peers in the 2013-2017 ("combined") cohorts four, five, and six years after entering college. It also shows the impacts of SBC on those completion rates at each of those time points. Completion rates increase after each year for both SBC students and noncoached students, as additional students graduate. Slightly more than one-quarter of all students (30.6 percent of SBC students and 26.0 percent of comparison students) graduated within four years; almost half of all students (48.6 percent of SBC students and 45.2 percent of comparison students) graduated within six years.

Overall, coached students were more likely than their uncoached peers to complete college after four and five years. After four years of college, SBC students were 4.6 percentage points (18 percent) more likely

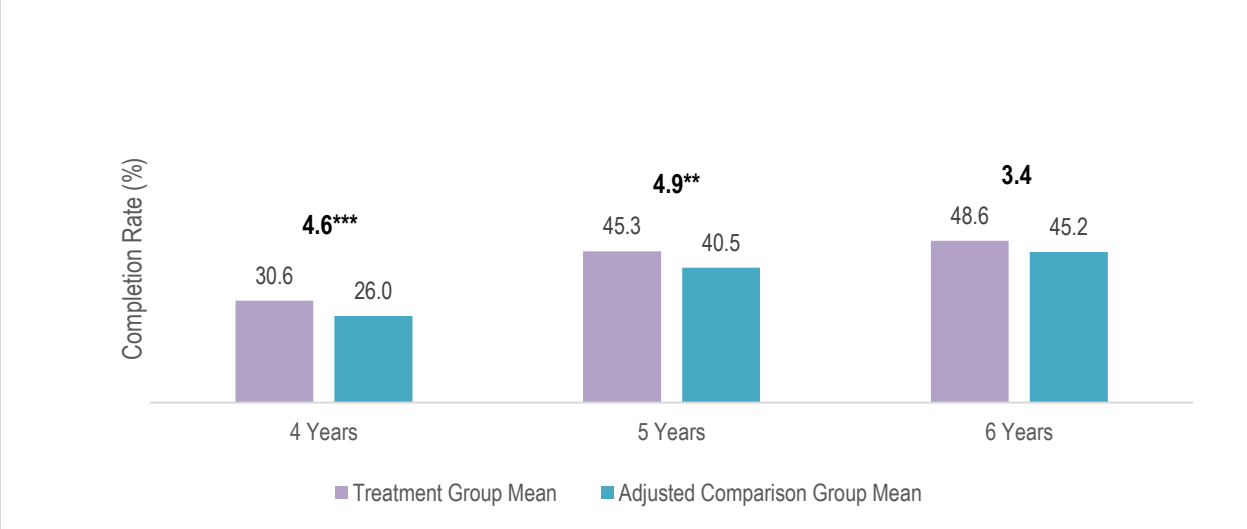
[30] We present results in these two sections for two reasons. First, because this is the final report, we wanted to show the impact of SBC for all cohorts across all years. Second, presenting results for the later cohorts (2015-2017) separately allows us to examine potential effects of the expanded ("scaled-up") coaching program, separate from the effects of SBC overall.

[31] The degree-type impacts presented in Sections 4.3 and 4.4 are exploratory because completion of any college degree was the intended goal of SBC, not a particular type of degree. The student subgroup impacts are exploratory because they use subsets of the full sample, whose smaller sample sizes limit the precision of the impact estimates and make it harder for us to detect statistically significant differences.

to have earned a degree or certificate, a *statistically significant* difference (meaning a difference unlikely to be due to chance alone). After five years of college, SBC students were 4.9 percentage points (12 percent) more likely to have earned a degree or certificate, a difference that is also statistically significant. After six years of college, this difference in completion rates between coached and uncoached students shrinks to 3.4 percentage points (7.5 percent) and no longer reaches statistical significance. However, we have the data needed to examine completion after six years only for the three earliest cohorts (2013-2015). The six-year impact's smaller total sample size and higher standard errors than for the other completion impacts make it more difficult to detect differences.

Putting these two findings together—that coached students are more likely to have completed college by years four and five, but not by year six—suggests that coaching might help some students graduate sooner (in four or five years after entering college, rather than in six years), but that noncoached students might have caught up after six years. Appendix Exhibit D-1 presents the details of these impacts.

Exhibit 4-1. Impact of SBC on postsecondary completion four, five, and six years after entering college, 2013-2017 cohorts



Source: National Student Clearinghouse data from Massachusetts Department of Elementary and Secondary Education and Boston Public Schools, and college administrative data.
Note: *N*=11,545 for overall sample (*n*=2,599 for treatment and *n*=8,946 for comparison) for completion in 4 years. *N*=8,354 for overall sample (*n*=1,908 for treatment and *n*=6,446 for comparison) for completion in 5 years. *N*=5,210 for overall sample (*n*=1,235 for treatment and *n*=3,975 for comparison) for completion in 6 years.
Data from the 2013-2017 cohorts are included in estimates for completion in 4 years. Data from the 2013-2016 cohorts are included in estimates for completion in 5 years. Data from the 2013-2015 cohorts are included in estimates for completion in 6 years.
Adjusted comparison group means, impacts (treatment mean minus adjusted comparison mean), and statistical significance are drawn from the study's regression model.
** Indicates statistical significance at the 1 percent level. *** Indicates statistical significance at the 0.1 percent level.
Exhibit Reads: SBC has significant positive effects on completion four and five years after entering college.

Results by Subgroup. Exhibit 4-2 shows the impacts of SBC on postsecondary completion in four, five, and six years after entry for men and women, and for students who are from an underrepresented racial or ethnic minority and those who are not.

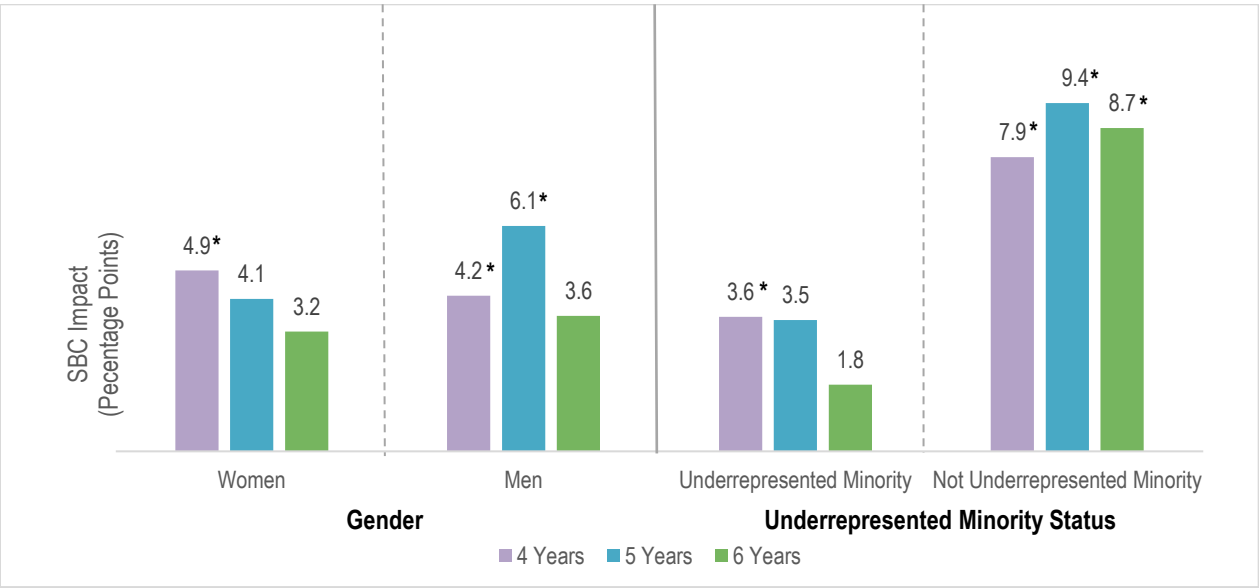
Coached men were more likely than noncoached men to complete their degree or credential in four and five years. In addition, coached women were more likely than noncoached women to complete their degree in four years (though not five years). However, across each time point (four, five, and six years), the *difference* between SBC's impact on men and SBC's impact on women was not statistically significant (Exhibit E-1)—that is, the difference in impacts was indistinguishable from zero. This means the results do not provide enough evidence to conclude that coaching is more effective at helping men or more effective at helping women complete postsecondary education.

Among students from underrepresented racial and ethnic minority backgrounds, coached students were more likely to complete their credential within four years than were their noncoached peers. Among students who do not come from underrepresented racial and ethnic minority backgrounds, coached students were more likely that noncoached students to complete their credential within four, five, and six years. However, here, too the difference between SBC's impacts on students from underrepresented minority backgrounds and SBC's impacts on students who are not from these backgrounds was not significant at any time point (Exhibit E-2).

Looking at the two other sets of subgroups, based on students' high school GPA and the college in which the student initially enrolled, similar patterns emerged. At each time point, there was no significant difference between SBC's impacts on completion for students with high versus low high school GPAs, and no significant difference between the impacts for students who initially enrolled at two-year versus four-year colleges.

Thus, across all sets of subgroups, SBC effects on postsecondary completion for the 2013-2017 cohorts did not differ by key student characteristics. Appendix Exhibits E-1 through E-4 provide detailed information about these subgroup impacts.

Exhibit 4-2. Impact of SBC on postsecondary completion four, five, and six years after entering college, by gender and underrepresented minority status, 2013-2017 cohorts



Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and colleges' administrative data.

Note: Sample sizes are as follows and include students in the treatment and comparison group. For women: N=6,217 for completion in 4 years, N=4,519 for completion in 5 years, and N=2,789 for completion in 6 years. For men: N=5,328 for completion in 4 years, N=3,835 for completion in 5 years, and N=2,421 for completion in 6 years. For students from underrepresented backgrounds: N=6,808 for completion in 4 years, N=4,858 for completion in 5 years, and N=3,148 for completion in 6 years. For students not from underrepresented minority backgrounds: N=4,737 for completion in 4 years, N=3,496 for completion in 5 years, and N=2,062 for completion in 6 years.
Impacts (treatment mean minus adjusted comparison mean) and statistical significance are drawn from the study's regression model.
* Indicates statistical significance at the 5 percent level.
Exhibit Reads: SBC has positive impacts on completion in four years for women, men, and students who are and are not members of underrepresented minorities. SBC also has positive impacts on completion in five years for men and for students who are not members of underrepresented minorities, and on completion in six years for students who are not members of underrepresented minorities. However, at each time point, there is no statistically significant variation detected in the impacts within gender or underrepresented minority status.

4.2 SBC Impacts on Postsecondary Completion, Post-Scale-up (2015-2017) Cohorts

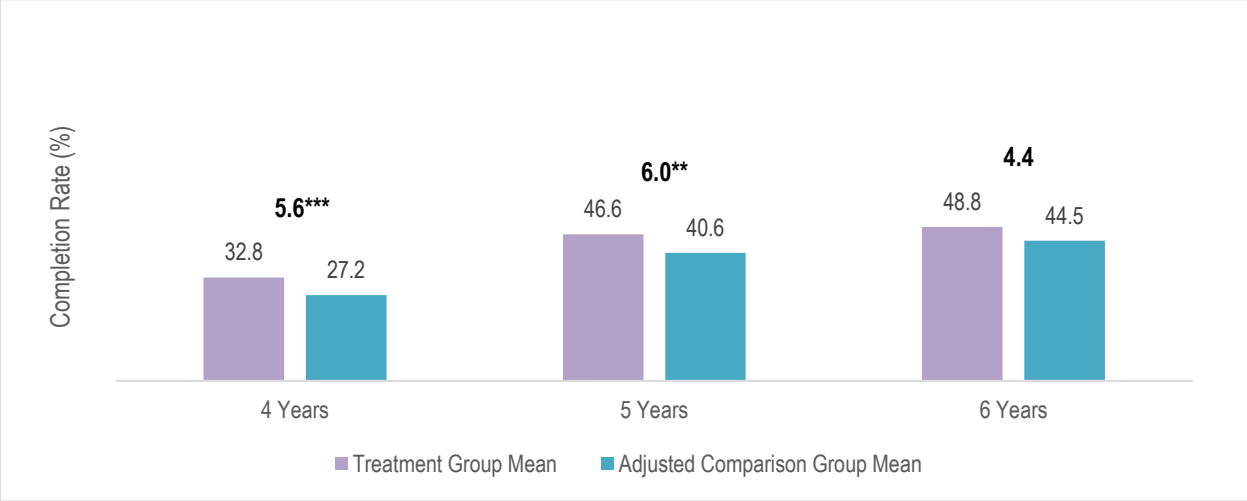
In this section, we present results specifically for the 2015-2017 ("post-scale-up") cohorts. These results complement the postsecondary completion results presented by Linkow et al. (2021), which focused on the pre–scale-up cohorts (2013-2014), given the data available at the time of that report.

Exhibit 4-3 shows completion rates for coached and noncoached students in the post-scale-up cohorts. As was true for the combined cohort results in Section 4.1, completion rates increase over time for both groups of students, with an especially large increase between years four and five. By the end of year six, almost half of coached and noncoached students have completed their degrees or certificates.

Comparing the outcomes between coached and noncoached students, we find statistically significant differences in completion rates by the end of years four and five: 5.6 (21 percent) percentage points and 6.0 percentage points (15 percent), respectively. After year six, the positive difference between coached and uncoached students is no longer statistically significant. Further detail about these impacts can be found in Appendix Exhibit D-2.

These effects are similar to the combined cohort results in Section 4-1. Combined with the previous report's finding that SBC did not have statistically significant effects on completion in the pre-scale-up cohorts (Linkow et al. 2021), this more recent finding suggests that the effects on completion in the post-scale-up cohorts in years four and five could be driving the overall positive completion results across all five cohorts in the same years.

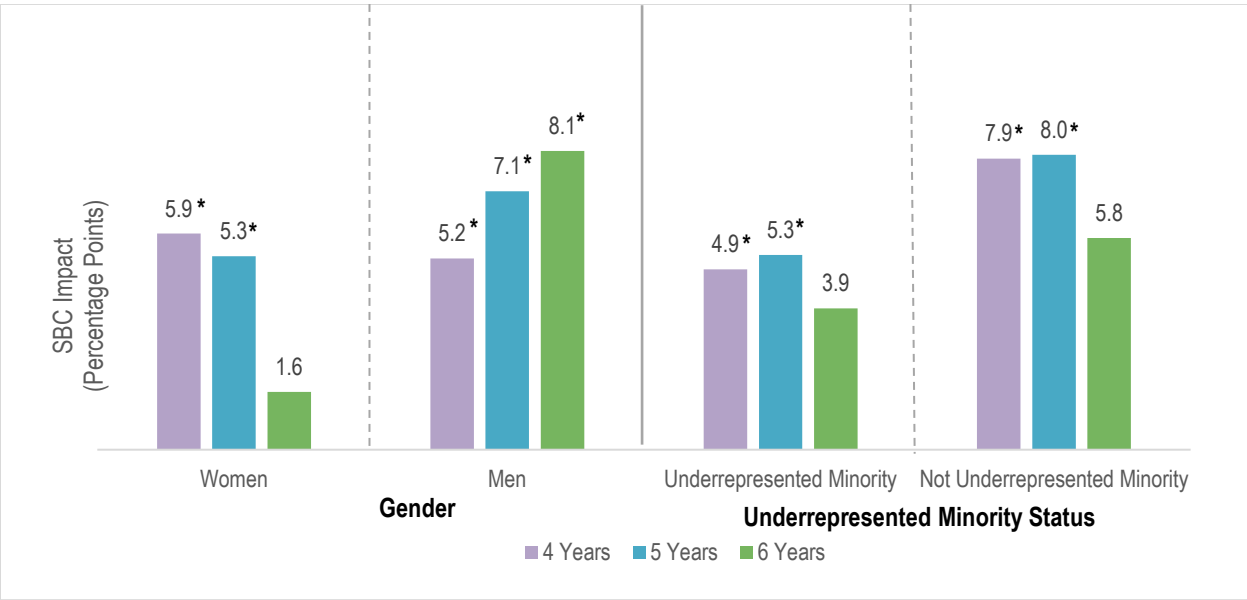
Exhibit 4-3. Impact of SBC on postsecondary completion four, five, and six years after entering college, 2015-2017 cohorts



Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and college' administrative data.
Note: *N*=9,054 for overall sample (*N*=1,925 for treatment and *n*=7,129 for comparison) for completion in 4 years. *N*=5,863 for overall sample (*N*=1,234 for treatment and *n*=4,629 for comparison) for completion in 5 years. *N*=2,719 for overall sample (*n*=561 for treatment and *n*=2,158 for comparison) for completion in 6 years.
Data from the 2015-2017 cohorts are included in estimates for completion in 4 years. Data from the 2015-2016 cohorts are included in estimates for completion in 5 years. Data from the 2015 cohort are included in estimates for completion in 6 years.
Adjusted comparison group means, impacts (treatment mean minus adjusted comparison mean), and statistical significance are drawn from the study's regression model.
** Indicates statistical significance at the 1 percent level. *** Indicates statistical significance at the 0.1 percent level.
Exhibit Reads: SBC has significant positive effects on completion four and five years after entering college.

Results by Subgroup. As with the combined cohorts, SBC's effects on completion for these cohorts are similar across different subgroups based on gender, underrepresented minority status, high school GPA, and level of initial college. Exhibit 4-4 shows the impacts of SBC on completion for women and men, and for students who are members of underrepresented minorities and students who are not. Within each of these four groups, coached students are between five and eight percentage points more likely to complete postsecondary education in four and five years than their noncoached peers. In addition, coached men are more likely than noncoached men to graduate in six years. However, at each time point, the difference between the impacts of SBC on men versus women is not statistically significant, and the difference between SBC's impacts on students who are members of underrepresented minorities versus students who are not members of underrepresented minorities also is not significant. Therefore, we conclude that coaching had similar-sized effects on students of different genders and racial/ethnicity minority statuses. Appendix Exhibits E-5 through E-8 provide more detail about the results for each set of subgroups.

Exhibit 4-4. Impact of SBC on postsecondary completion four, five, and six years after entering college, by gender and underrepresented minority status, 2015-2017 cohorts



Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and college administrative data.
Note: Sample sizes are as follows and include students in the treatment and comparison group. For women: N=4,854 for completion in 4 years, N=3,156 for completion in 5 years, and N=1,426 for completion in 6 years. For men: N=4,200 for completion in 4 years, N=2,707 for completion in 5 years, and N=1,293 for completion in 6 years. For students from underrepresented minority backgrounds: N=5,170 for completion in 4 years, N=3,220 for completion in 5 years, and N=1,510 for completion in 6 years. For students not from underrepresented minority backgrounds: N=3,884 for completion in 4 years, N=2,643 for completion in 5 years, and N=1,209 for completion in 6 years.
Impacts (treatment mean minus adjusted comparison mean) and statistical significance are drawn from the study's regression model.
* Indicates statistical significance at the 5 percent level.
Exhibit Reads: SBC has positive impacts on completion in four and five years for women, men, and students who are and are not members of underrepresented minorities. SBC also has positive impacts on completion in six years for men. However, at each time point, there is no statistically significant variation detected in the impacts within gender or underrepresented minority status.

4.3 SBC Impacts on Postsecondary Completion, Combined (2013-2017) Cohorts, by Degree Type

The next two sections explore how SBC affected students' completion of different types of degrees.[32] Exhibit 4-5 shows SBC students' and noncoached students' rates of completing college with a bachelor's degree or an associate degree, and SBC's impacts on completion of those degrees, in the combined cohorts. Most of the students included in this study who finished college completed bachelor's degrees. At all three time points (four years, five years, and six years after entering college), higher shares of both coached and noncoached students completed bachelor's degrees than completed associate degrees. This is likely related to the fact that only approximately one-third of students in both groups initially enrolled at two-year colleges (see Exhibit 3-2). As with overall completion, the percentage of students who complete each type of degree grows over time, with a large jump in bachelor's degree completion between years four and five, and more gradual increases over time in associate degree completion.

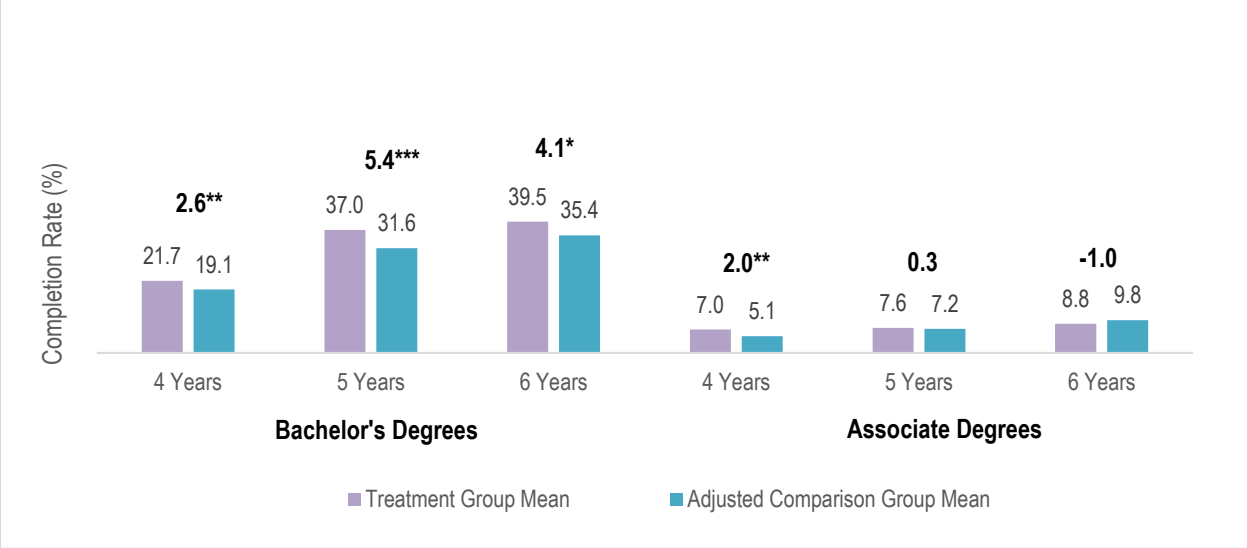
[32] We focus on associate's and bachelor's degree completion. We show data on certificate completions in Appendix D, but typically certificate completion rates are around 1 to 2 percent for both coached and noncoached students at years four, five, and six. These differences are not significant at any time point.

SBC has consistent impacts on students' bachelor's degree completion rates. After four years, SBC students are 2.6 percentage points (14 percent) more likely to earn a bachelor's degree than are their noncoached peers, a statistically significant difference. In years five and six, the differences between coached and noncoached bachelor's degree completion rates are even larger, and still significantly significant: 5.4 and 4.1 percentage points, respectively.

By contrast, SBC did not have consistent effects on associate degree completion in the combined cohorts. After year four, coached students were statistically significantly more likely than noncoached students to have earned an associate degree, by 2 percentage points. However, in year five or six, there were no significant differences in associate degree completion. More detail about these impacts, as well as about impacts on certificate completion, can be found in Appendix Exhibit D-1.

There are a few possible reasons for these differences between the impacts on associate's and bachelor's degree completion rates. First, associate degrees are intended to be completed in two years, although for many students, it takes longer to finish. For some associate degree-seeking students, the effects of coaching may diminish after five or six years. Some students in the 2013-2017 cohorts who were initially pursuing associate degrees but remain enrolled after five or six years may become discouraged and consequently drop out or stop out if they have not earned their degree by that time. Moreover, although coached students were more likely than noncoached students to earn associate degrees after four years, five or six years could allow time for more noncoached students to catch up in earning associate degrees.

Exhibit 4-5. Impact of SBC on completion of a bachelor's or associate degree four, five, and six years after entering college, 2013-2017 cohorts



Source: National Student Clearinghouse data from Massachusetts Department of Elementary and Secondary Education.
Note: *N*=11,545 for overall sample (*n*=2,599 for treatment and *n*=8,946 for comparison) for completion in 4 years. *N*=8,354 for overall sample (n=1,908 for treatment and *n*=6,446 for comparison) for completion in 5 years. *N*=5,210 for overall sample (*n*=1,235 for treatment and *n*=3,975 for comparison) for completion in 6 years.
Adjusted comparison group means, impacts (treatment mean minus adjusted comparison mean), and statistical significance are drawn from the study's regression model.
The bachelor's and associate degrees completion rates shown in Exhibit 4-5 do not sum to the overall completion rates in Exhibit 4-1 for several reasons. First, some students completed college by earning a certificate. These students are counted in the overall completion rate but not in the bachelor's degree or associate degree completion rate. We do not include certificate completion in the graph because less than 2 percent of coached and noncoached students earn a certificate at each time point. Second, for some students, degree title is missing in the source data. These students are counted in overall completion, as the data indicates they completed a credential, but not in the credential-specific completion rates, as it is not possible to determine what type of credential they completed. Finally, students are able to earn multiple

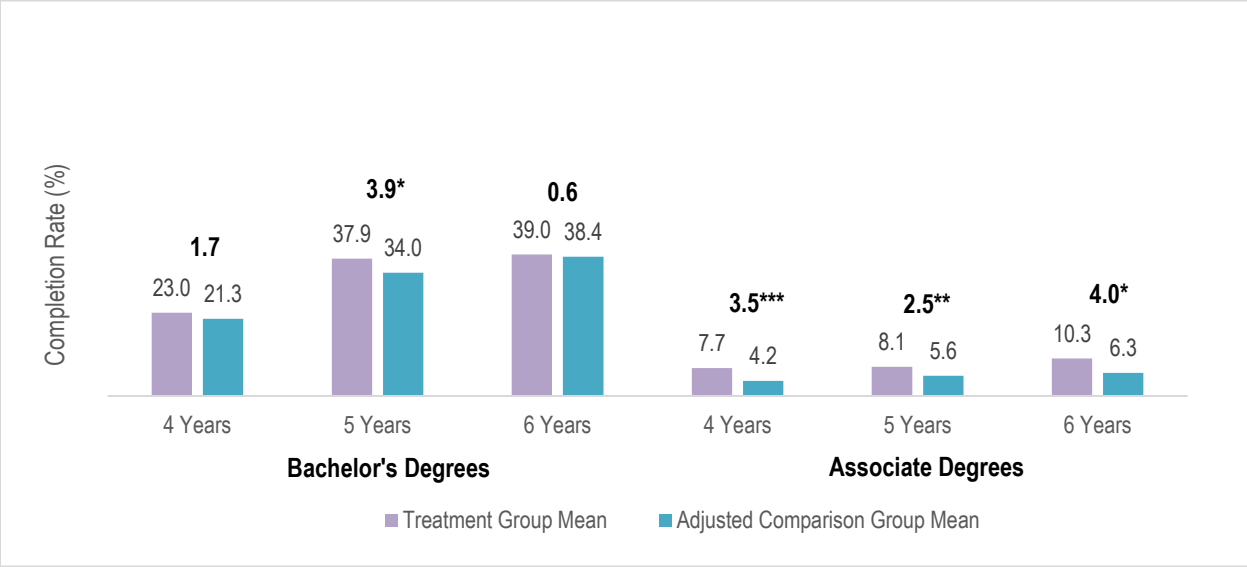
types of credentials. For example, a student could earn an associate degree and then later also earn a bachelor's degree. Such a student would be counted in both the associate degree and the bachelor's degree completion rates; thus, adding those completion rates would count this student twice.
* Indicates statistical significance at the 5 percent level. ** Indicates statistical significance at the 1 percent level. *** Indicates statistical significance at the 0.1 percent level.
Exhibit Reads: SBC has significant positive effects on completion of a bachelor's degree four, five, and six years after entering college, and significant positive effects on completion of an associate degree four years after entering college.

Results by Subgroup. SBC's effects on four-year and five-year bachelor's degree completion were significantly larger for students who initially enrolled in four-year institutions than for students who initially enrolled in two-year colleges. Conversely, for completion of associate degrees, the positive impact of SBC after years four and five was larger for students who initially enrolled in two-year colleges than for students who initially enrolled in four-year colleges. SBC impacts on bachelor's degree or associate degree completion did not vary systematically by gender, underrepresented minority status, or high school GPA at any time point. Appendix Exhibits E-1 through E-4 provide further information about the subgroup-specific results.

4.4 SBC Impacts on Postsecondary Completion, Post-Scale-up (2015-2017) Cohorts, by Degree Type

Exhibit 4-6 shows the completion rates for bachelor's and associate degrees for coached and noncoached students in the post-scale up cohorts. Overall, coached students in the post-scale up cohorts are significantly more likely to earn associate degrees compared to their noncoached counterparts, unlike in the combined cohorts, where we detect consistent significant effects among bachelor's degree completion rates. For the post-scale-up cohorts, this positive effect on associate degree completion is consistent across years four, five, and six, perhaps reflecting the increased attention paid to coaching students in two-year colleges after the scale-up. There is a significant impact on bachelor's degree completion only in year five. Appendix Exhibit D-2 contains more detail about these impacts, as well as about impacts on certificate completion.

Exhibit 4-6. Impact of SBC on completion of a bachelor's or associate degree four, five, and six years after entering college, 2015-2017 cohorts



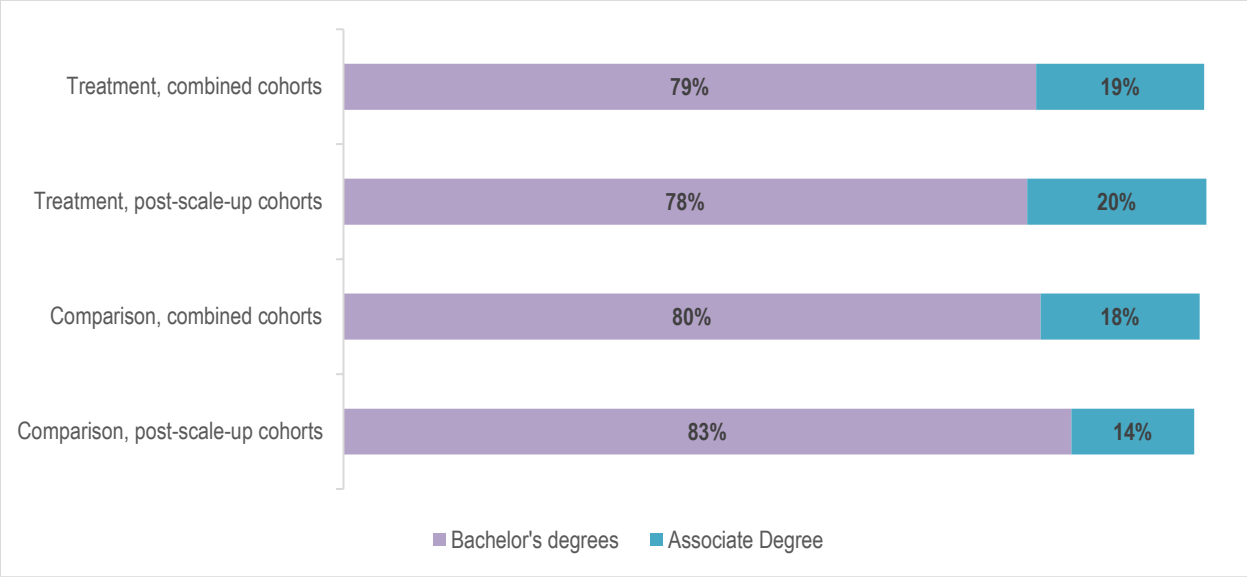
Source: National Student Clearinghouse data from Massachusetts Department of Elementary and Secondary Education.

Note: *N*=9,054 for overall sample (*n*=1,925 for treatment and *n*=7,129 for comparison) for completion in 4 years. *N*=5,863 for overall sample (*n*=1,234 for treatment and *n*=4,629 for comparison) for completion in 5 years. *N*=2,719 for overall sample (*n*=561 for treatment and *n*=2,158 for comparison) for completion in 6 years.
Adjusted comparison group means, impacts (treatment mean minus adjusted comparison mean), and statistical significance are drawn from the study's regression model.
The bachelor's and associate degrees completion rates shown in Exhibit 4-6 do not sum to the overall completion rates in Exhibit 4-3 for several reasons. First, some students completed college by earning a certificate. These students are counted in the overall completion rate but not in the bachelor's degree or associate degree completion rate. We do not include certificate completion in the graph because less than 2 percent of coached and noncoached students earn a certificate at each time point. Second, for some students, degree title is missing in the source data. These students are counted in overall completion, as the data indicates they completed a credential, but not in the credential-specific completion rates, as it is not possible to determine what type of credential they completed. Finally, students are able to earn multiple types of credentials. For example, a student could earn an associate degree and then later also earn a bachelor's degree. Such a student would be counted in both the associate degree and the bachelor's degree completion rates; thus, adding those completion rates would count this student twice.
* Indicates statistical significance at the 5 percent level. ** Indicates statistical significance at the 1 percent level. *** Indicates statistical significance at the 0.1 percent level.
Exhibit Reads: SBC increases completion of an associate degree four, five, and six years after entering college, and increases completion of a bachelor's degree five years after entering college.

Interestingly, patterns of effect for the post-scale-up cohorts differ from patterns for the combined cohorts. Section 4-3 showed that for the combined cohorts, coaching increases bachelor's degree completion after four, five, and six years, but increases associate degree completion only after year four. For the post-scale-up cohorts, coaching increases bachelor's degree completion only after year five, but increases associate degree completion after four, five, and six years.

The different patterns could be related to differences in the types of degrees earned by students who completed college in the two sets of cohorts, and to differences among comparison students in particular. Specifically, if we look only at SBC students who earn any credential, similar shares of SBC students in the post–scale up cohorts (20 percent) and in SBC students in the combined cohorts (19 percent) earn an associate degree (Exhibit 4-7). But looking only at noncoached students who earn any credential, a lower share of comparison students in the post-scale-up cohorts (14 percent) earn an associate degree than in the combined cohorts (18 percent). That is, the consistent impacts on associate degree completion seen in the post-scale-up cohorts, but not in the combined cohorts, simply could reflect this difference in *comparison* group students' associate degree completion across the two sets of cohorts. It is also possible that Success Boston's increased attention on coaching at two-year colleges after the scale-up can help explain the consistent impacts on associate degree completion in the post-scale up years, in contrast to the impacts on bachelor's degree completion when looking at the combined cohorts.

Exhibit 4-7. Percentages of bachelor's and associate degrees earned among students completing postsecondary education



Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and colleges' administrative data.
Note: *N*=11,545 for overall sample (*n*=2,599 for treatment and *n*=8,946 for comparison) for the combined (2013-2017) cohorts, and *N*=9,054 for overall sample (*n*=1,925 for treatment and *n*=7,129 for comparison) for the post–scale-up (2015-2017) cohorts.
Comparison group percentages reflect the adjusted comparison group means drawn from the study's regression model.
The percentage of degrees earned by students in a given group (treatment or comparison) in a given set of cohorts (2013-2017 or 2015-2017) that were bachelor's degrees reflects the percentage of students who earned bachelor's degrees divided by the percentage of students who completed college with any credential in that group and set of cohorts. Similarly, the percentage of degrees earned by students in a given group (treatment or comparison) in a given set of cohorts (2013-2017 or 2015-2017) that were associate degrees reflects the percentage of students who earned associate degrees divided by the percentage of students who completed college with any credential in that group and set of cohorts.
The percentages of bachelor's and percentages of associate degrees shown in Exhibit 4-7 do not sum to 100 percent for several reasons. First, some students completed college by earning a certificate. These students are counted in the overall completion rate but not in the bachelor's degree or associate degree completion rates. We do not include certificate completion in the graph because less than 2 percent of coached and noncoached students earn a certificate at each time point. Second, for some students, degree title is missing in the source data. These students are counted in overall completion, as the data indicates they completed a credential, but not in the credential-specific completion rates, as it is not possible to determine what type of credential they completed. Finally, students are able to earn multiple types of credentials. For example, a student could earn an associate degree and then later also earn a bachelor's degree. Such a student would be counted in both the associate degree and the bachelor's degree completion rates; thus, adding those completion rates would count this student twice.

Results by Subgroup. SBC effects on associate degree completion by years four and five, though not in year six, were significantly larger for students who initially enrolled in two-year colleges. The level of the student's initial college had no effect on bachelor's degree completion at any time point. In addition, SBC effects on associate degree completion or bachelor's degree completion did not differ in any year for women versus men, students from underrepresented minority groups or not, or students with high versus low high school GPAs. Appendix Exhibits E-5 through E-8 provide detailed information about these subgroup impacts.

4.5 Summary

Coaching helps more students complete their degrees in the four and five years after entering college, but after six years, SBC no longer has a statistically significant impact on students' postsecondary completion. This is true for both the combined cohorts and for the post-scale-up cohorts only, with similar findings across different student subgroups. These results suggest that SBC might boost postsecondary

completion in the years closer to the time students receive coaching (usually their first two years in college). However, as more time elapses since coaching finishes, comparison students have more opportunity to catch up, and six years after entering college, SBC students no longer complete college at higher rates.

Looking at how SBC affected completion of specific types of degrees, coached students in the combined cohorts (2013-2017) consistently earned bachelor's degrees at higher rates than did noncoached students, whereas coached students in the post-scale-up cohorts (2015-2017) consistently earned associate degrees at higher rates than did noncoached students. These patterns could be driven by SBC's increased focus on coaching on two-year colleges after the scale-up, or by differences in the types of degrees that comparison students earned in the different cohorts.

The next chapter considers the implications of our findings for SBC and the citywide completion initiative in general.

5. Discussion

Success Boston's one-on-one college transition coaching increased rates of postsecondary completion for students with the most opportunity to improve—those identifying as members of racial/ethnic groups underrepresented in postsecondary education and those from low-income households. Coached students were more likely than their noncoached peers to obtain a credential or degree within four and five years of entering college. SBC students who complete in this time frame thus can benefit from the rewards of a college credential, such as entering the labor force sooner as a more competitive and higher-earning worker. In addition, there may be other financial benefits to earning a degree in four or five years rather than six, such as lower student debt burden. After six years, however, noncoached students catch up with SBC students and both groups complete at similar rates.[33]

The findings of the last report, using data through the fall of 2019, found no effect of SBC on the completion rates of students in the pre-scale-up cohorts (2013-2014) and suggested that SBC's effects on helping students persist faded as more time elapsed since the end of coaching in students' second year of college (Linkow et al. 2021). In this report, the impacts on completion in the post-scale-up cohorts (2015-2017) at some time points could relate to the larger size of those cohorts, improving our ability to detect differences. Greater familiarity with campus resources, aided by increased professional development, the introduction of higher education liaisons at five colleges, more regular communications within the Success Boston network overall, and greater experience acquired over time, also might have helped coaches, in the post-scale-up years, to provide students with the services, tools and skills they need to graduate.

Moreover, starting in the spring of 2020, the COVID-19 pandemic disrupted the enrollment and progress of students across the nation, including SBC and comparison students who were enrolled in college during the 2019-20 and later academic years.[34] In March of 2020, many campuses across the country closed or abruptly transitioned to remote learning. A survey of 3,000 colleges showed that by fall of 2020, 44 percent of colleges were operating entirely or primarily remotely (Chronicle of Higher Education 2020)—forcing instructors to shift to a new mode of teaching and some campuses to close residential halls and send students home (U.S. Department of Education 2021). The pandemic also prompted some college students to change their enrollment plans, perhaps to enroll instead in colleges less expensive or closer to home (Kim et al. 2020; Quilantan 2020), and other students already enrolled in college to not return (National Student Clearinghouse Research Center 2021).

Although SBC is designed to serve students during their first two years of college, coaches sometimes still offer ad hoc support to students after the first two years, connecting students with resources to help them overcome challenges they face later in their college careers as needed. It is not unlikely that some coaches might have continued to offer ad hoc support to students still enrolled in college during the pandemic, even after their first two years of college, helping them to navigate virtual learning and

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[33] The six-year results exclude the 2016 and 2017 cohorts because of data availability and therefore are based on a smaller group of students than are the four- and five-year findings. Finding no effect of SBC after six years could be due to the small sample size and the study's inability to detect statistically significant effects.

[34] About two-thirds of SBC students and their noncoached peers were enrolled in four-year colleges, and students in the study who complete their degrees typically take about 4½ years to do so (Linkow et al. 2021). Thus, many students, especially those from the 2015 to 2017 cohorts, were likely still enrolled in their third, fourth, or fifth year of college during the years most disrupted by COVID.

connecting them with resources such as emergency food or cash sources and mental health services. The extra scaffolding could have helped some students navigate the pandemic-related challenges and cross the finish line in four or five years, at a time when their peers might have experienced these same disruptions without such support. Even for coached students who might not have received direct support from SBC coaches during the pandemic, SBC's effects on completion in four years and five years, though not six years, suggest the recency of the coaching supports could have helped. Students who recently received coaching could have been able to use the skills and knowledge about campus resources they learned to better adapt and identify campus supports during COVID-19-related closures and transitions, potentially allowing them to stay on track or lowering their risk of dropping out.

5.1 SBC in the Context of the Larger Success Boston Initiative

Success Boston Coaching is an important but not the sole component of the Success Boston citywide postsecondary completion initiative. Success Boston brought together The Boston Foundation, Boston Public Schools, the City of Boston, local colleges and universities, and community nonprofit organizations to provide support to students while still in high school to get them into college. Once in college, in addition to the coaching, Success Boston offers students workplace connections to help them see the value of a credential for a stable and fulfilling career. The college partners also engage in complementary efforts to increase college success for all their students, ranging from college success courses to on-campus food pantries to peer mentors (Bunker Hill Community College, n.d.; University of Massachusetts Boston, n.d.).

The confluence of changes in Boston's higher education system, some of which the Success Boston initiative itself might have spurred, is likely related to the rises in the city's postsecondary completion rate since Success Boston began (Boston Opportunity Agenda 2022). This rate has hovered in just above 50 percent in recent years and currently sits at 52 percent of all Boston high school graduates (Boston Opportunity Agenda 2022), which is slightly higher than the approximately 49 percent of coached students—who primarily come from historically marginalized groups—followed in this study (see Exhibit 4-1).

The goal of the citywide initiative is to almost double the share of Boston students who complete college, relative to the 35 percent completion rate for BPS graduates in the Class of 2000 (The Boston Foundation 2022). The initiative renewed this goal in 2022, emphasizing a commitment to reaching a 70 percent postsecondary completion rate for all students, including setting the same target rate for students from all racial and ethnic backgrounds. The results in this report show that there remains work to be done to achieve this goal. Both unforeseen influences, including the COVID-19 pandemic, and ongoing trends, such as rising college costs (Ma and Pender 2022), could still be moving the college finish line further out of reach for some students.

5.2 Value of Collaboration

One of the distinguishing features of Success Boston—its network of partnerships and history of collaboration—positions the initiative to help students address these challenges and others that might arise. Continued coordinated efforts across partners and stakeholders could be the key to expanding the previous decade of success and reaching the initiative's postsecondary completion goal.

As a citywide initiative, SBC is grounded in cross-sector collaboration. BPS high schools collaborate with nonprofits to identify and recruit students into coaching (Linkow, Didriksen et al. 2017). This engagement with BPS can take the form of coaches visiting high schools, coordinating with guidance counselors to

identify students eligible for SBC, or participating at college fairs. Recruitment occurs not only in students' senior year of high school but also in college, where partner colleges often coordinate recruitment efforts with Success Boston staff as well as with coaches. Colleges collaborate with nonprofit organizations' coaches by providing them space for coaching; sharing data with coaches and Success Boston staff to support students; leading joint workshops with coaches for students; hosting meetings between coaches and college staff to support coordination and provide professional development; and communicating with coaches on resources available within the college. As the ongoing funder, The Boston Foundation has sought to foster collaboration not only through providing funding for the coaching program but also by organizing the Success Boston Coaches' Network. This network convenes monthly meetings and provides both initial and ongoing training to coaches, serving as a forum for coaches to share their knowledge, best practices, and resources with one another more fluidly across organizations.

Although the collaboration has proven successful in many ways, examining some of the challenges encountered and variations of collaboration could help enhance the effectiveness of future coaching efforts. Coaches and college staff, for example, reported that increased collaboration through enhanced communication helped coaches understand campus support services, allowing them to more easily connect students to the appropriate service (Linkow, Didriksen et al. 2017). Five partner SBC colleges had higher education liaisons, who served as a point of contact to the Success Boston network and helped coordinate coaching activities on campus, connect coaches to network resources, and trained coaches about available campus services. Peer-to-peer information sharing among coaches, both within the same organization and across different organizations, also could be especially important for programs operating across multiple campuses. Less regular collaboration between coaches and colleges occurred at partner colleges enrolling fewer SBC students or colleges newer to participation in SBC. In addition, not all coaches had access to student data or participated regularly in the Success Boston Coaches' Network monthly meetings. And in some cases, when SBC coaches collaborated more closely with colleges, challenges arose, such as different cultural norms and expectations between the colleges and the nonprofit organizations or over colleges' concerns about coaching staff turnover within some organizations.

Researchers have noted that collaboration can take a variety of forms, ranging from transactional relationships to sharing of resources and co-creation of programming (Neuhoff et al. 2014). The different types of collaboration currently taking place within SBC offer some lessons that could help partners articulate what successful collaboration might look like, how different partners benefit, and how to promote that collaboration. For example, if in-depth knowledge of campus services and access to student data allows coaches to refer students more effectively to campus resources, thereby helping students succeed in and complete college, colleges and nonprofit coaching organizations could consider what structures might need to be in place to facilitate that type of collaboration. These structures might include a toolkit with straightforward guidance on data sharing agreements and student consent procedures for data sharing or inclusion of coaches on college listservs that provide updates on resources. In addition, designating staff to serve as higher education liaisons for SBC at all partner institutions—or at least institutions that serve a minimum number of SBC students—could further help coaches who serve students at those institutions and the students themselves.

Successful collaboration requires a process for decision making that takes into account different perspectives (Information Change and College Futures Foundation 2017), ensures enough time and resources are invested, and develops the necessary relationships to sustain that collaboration (Trebil-Smith and Shields 2019). For example, within SBC, some partner colleges have held monthly or biweekly meetings for SBC coaches to discuss how to best help specific students, coordinate services, and offer

professional development, thereby integrating coaches into the campus support service structure (Linkow, Didriksen et al. 2017). This coordination could only work with time and staff commitments from both colleges and coaches and an openness to work together to better support students. Institutionalizing practices that allow regular communication and emphasize the importance of building relationships could help pave the way for a sustained and effective collaboration.

5.3 Looking Ahead

After six years, both noncoached and SBC students complete college at rates that are similar and only slightly below those of all BPS students who enter college. To achieve Success Boston's ambitious goal of 70 percent postsecondary completion for all—a target higher than the 62 percent national six-year completion rate among all students who enter college (Sedmak 2022)—BPS students will continue to need a sustained system of support. SBC brings the advantage of an existing network of partnerships to the challenge and could expand its benefits through enhancing collaboration among existing partners and signing up new partners; for example, by sharing information about institutional resources or data about students across coaches, colleges, and other partners. Finally, given the myriad barriers to completion that students can face throughout their time in college, extending the coaching support offered to students beyond their first two years potentially could increase the effectiveness of SBC and help move the city closer to that 70 percent completion goal.

Appendix A. Propensity Score Matching Process

A simple comparison of the postsecondary outcomes of Massachusetts students who receive Success Boston Coaching (SBC) services 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 noncoached 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 SBC and to their postsecondary outcomes. We refer to characteristics that affect both selection into SBC and postsecondary outcomes such as completion as *confounding factors*, and these specific types of characteristics as *individual self-selection factors*.

A second type of confounding factor, which we call *historical and locational factors,* can arise when coached and noncoached 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.

Another complication for comparing SBC and non-SBC students is that they could enroll in different colleges, and thus could been exposed to different 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 differences are observed *after* selection into coaching and could not have determined whether a student participates in SBC or not, and so are not confounders by definition. However, 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.*

Ideally, we would like to randomly assign students to receive SBC or not. Because whether someone receives SBC or not would be decided at random and thus would not be related to any characteristic, SBC and non-SBC students would be expected to have similar distributions of confounding characteristics, both those we can observe and those we cannot observe.

Unfortunately, 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. In the absence of random assignment, we aim to adjust for as many possible confounders as we can, and hope either

- that any confounders we cannot observe have small correlations with selection into SBC, and with any outcomes, and thus are unlikely to bias our impact estimates; or
- that any unobserved confounders are highly correlated with observed confounders, such that adjusting for these observed confounders can substantially decrease bias due to the unobserved confounders.

Instead of an experimental design, we use a quasi-experimental design that (1) compares SBC students with a comparison group of similar students and (2) accounts 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 noncoached comparison students such that the matches were both:

- *local* matches: the comparison cases drawn from the same settings as the treatment cases to the extent possible; and
- *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, where *cohort* was defined by the combination of the year the student initially enrolled in college and the college in which the student initially enrolled. Each set of matched students 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, which were estimated using the student's background characteristics, represent the conditional probability of students getting SBC coaching (given these characteristics). In estimating the propensity score, we are thereby incorporating all the relevant influence of the confounders on selection into SBC in one variable.[35] The assumption is that there could be factors that affect receipt of SBC conditional on these observed characteristics, but we need not observe those factors. For example, some students might, through happenstance, hear about SBC and become more open to participating, and these students could be more likely to participate, even conditional on all the observed characteristics or the propensity score that captures the influence of these characteristics.

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. 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 in this evaluation directly depend 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, we would ideally implement "local matching" 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—in other words, our "matching blocks" would represent 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

[35] One way to conduct matching is to form matched pairs that have the same baseline characteristics (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.*

sources of bias—that is, college-related factors that are independent of the SBC program, differ across colleges, and potentially affect student outcomes of interest. 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 some high school/college combinations, there are no potential comparison students with whom we can match treatment students; 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 initially enrolled (in the fall after their high school graduation), rather than students' high schools, to use in our 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 some 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 such as school-level averages of 10th grade math and English language arts scores on the Massachusetts Comprehensive Assessment System (MCAS), grade point averages (GPAs), and college-going rate as a proxy for exact matching on high schools. By 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.

SBC focuses on serving students who graduated from Boston Public Schools (BPS) and, in later cohorts, from other surrounding districts, starting in the first fall after students' high school graduation. As a result, we selected comparison students from high schools in 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 2015-2017 cohorts, related in part to the size of the SBC cohorts before and after the program scale-up in 2015.

- 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 initially enrolled at University of Massachusetts Boston (UMB). For SBC students who initially enrolled at UMB, we drew comparison students from districts surrounding BPS instead of from BPS.[36]

- 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 2015-2017 cohorts,

[36] All BPS students attending UMB 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 for the 2013 and 2014 cohorts from among other UMB students from districts with similar characteristics to BPS. To identify potential comparison districts, we identified districts both that were within the top 20 sending districts to UMB (that is, districts that had the most graduating students enroll in UMB) in either 2011 or 2012 and that contained at least one high school that consistently sent at least 10 students in any year and at least 15 students a year, on average, to UMB between 2009 and 2013. We then compared the median incomes of the districts that met those criteria versus Boston's median income, to select the comparison districts.

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 might not be as balanced as would be using a more limited 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, which we summarized in Appendix A of previous Abt Associates reports (Linkow, Gamse et al. 2017; Linkow et al. 2019; and Linkow et al. 2021). We also asked coaching organizations about criteria they use when selecting and/or targeting students for their programs, though most organizations reported they do not follow a strict selection process based on observable student characteristics when recruiting students.[37] To avoid missing some important confounders, we decided to use all of the relevant variables yielded by the literature review and available in the administrative datasets to estimate propensity scores. Exhibit A-1 lists these variables.[38]

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

[38] 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 initially 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 through 2017 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 through 2017 cohorts.

Exhibit A-1. Matching characteristics

Variable	Domain	Data Sources for 2013-2014 Cohorts	Data Sources for 2015-2017 Cohorts
Age	Demographics	BPS and MA DESE	MA DESE
Gender			
Disability status			
Race/ethnicity			
Socioeconomic status			
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)[a]	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; N/A=not applicable; SES=socioeconomic status.

[a] 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 2015-2017 cohorts, for whom the MA DESE data rather than BPS data were our data source for matching variables.

We required that no students in our sample have missing values for free/reduced-price lunch status—a proxy for socioeconomic status—or for high school GPA, as noted in Chapter 3. For all other baseline characteristics, in the propensity score estimation models, we addressed missing values[39] using the "dummy variable method"—that is, replacing the missing values with the sample means and including a dummy variable indicating such values (Rosenbaum and Rubin 1984; Stuart 2010).[40]

[39] Across all students eligible for matching, missing data rates ranged between 0 and 3 percent for the 2013-2017 cohorts and for the 2015-2017 cohorts, for all baseline characteristics except SAT scores. SAT score missing data rates (16 percent for both sets of cohorts) were higher than the missingness rates for other characteristics, perhaps because SATs are not typically required for students enrolling in open-access two-year institutions.

[40] As Stuart (2010) points out, propensity scores calculated using this "dummy variable method" would match both on observed covariate values and on missing data patterns.

A.2 Estimation of Propensity Scores

We estimated propensity scores via seven logistic regression models across the 2013 and 2014 cohorts, 2015 and 2016 cohorts, and 2017 cohort, as described in Exhibit A-2.

Exhibit A-2. Logistic regression models by cohort

Cohort	Logistic Regression Model
2013 and 2013 cohorts[a,b]	Logistic model that includes all covariates in Exhibit A-1 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-1 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-1 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-1 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, 2016, and 2017 cohorts[c]	Logistic model that includes all covariates listed in Exhibit A-1 except those from BPS Exit Surveys, 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 in Exhibit A-1 except those from BPS Exit Surveys, 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)
	Logistic model that includes all covariates listed in Exhibit A-1 except those from BPS Exit Surveys, plus high school-level averages of GPA, 10th-grade MCAS scores, and college-going rate, estimated with all SBC students from the 2017 cohort (treatment students) and non-SBC students from the 2017 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 (for example, 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, 2016, and 2017 cohorts to capture potential changes in the selection processes employed by the coaching organizations over the years.

A.3 Conducting Matching and Assessing Quality of the Matches

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 used *radius matching*, which entails matching each treatment student with all potential comparison students whose propensity scores are within the pre-specified caliper of their score (± 0.4 of the standard deviation [SD] of the propensity scores) in their block. For the 2015-2017 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 samples reported in Chapter 3 and below and the impact results reported in Chapter 4 are obtained with the matched groups yielded by this method.

We used the methods described above to create matched samples for the 2013-2014 cohorts, for the 2015-2016 cohorts, and for the 2017 cohort. For each outcome, to create a dataset containing the matched sample across the 2013-2017 ("combined") cohorts, we appended those cohort-specific matched samples. We used the resulting pooled 2013-2017 cohort dataset, containing the matched samples across all five cohorts, to assess the number of treatment and comparison students who did and did not match, as well as baseline balance across the treatment and comparison groups. Similarly, for the 2015-2017 ("post-scale-up") cohorts, we appended the cohort-specific matched samples and used the resulting dataset, which contained the matched samples for the 2015-2017 cohorts, to assess matching rates and balance.[41]

Exhibit A-3 shows the sizes of the matched treatment and comparison groups for each outcome measure for each set of cohorts: the 2013-2017 cohorts and the 2015-2017 cohorts. As noted in Chapter 3, outcome data are not available across all cohorts at each time point. The exhibit indicates the cohorts for which outcome data are available for each outcome measure at each time point. For example, within the 2013-2017 cohorts, all five cohorts have data available for overall completion in four years, but only the 2013-2016 cohorts have data available for completion in five years, and only the 2013-2015 cohorts have data available for completion in six years. In addition, the degree-specific completion measures use the same sample as the overall completion measure for a given time point and given set of cohorts. For example, the measures for bachelor's degree, associate degree, and certificate completion in four years for the 2013-2017 cohorts use the same sample as the measure for overall completion in four years for the 2013-2017 cohorts.

Across all measures, between 11 and 17 percent of the SBC students were not able to be matched due to their not having a sufficiently similar comparison student. Coached students are more likely to be from groups traditionally underrepresented in college, which 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 in the analysis only the SBC students for whom we could identify statistically similar comparison students.

[41] The pooled dataset for the 2015-2017 cohorts contains the matched samples for the 2015-2016 cohorts and the matched sample for the 2017 cohort. The pooled dataset for the 2013-2017 cohorts contains the same sample as in the 2015-2017 cohort dataset, plus the matched sample for the 2013-2014 cohorts that we used for previous reports focusing on the 2013-2014 cohorts, such as Linkow, Gamse et al. (2017) and Linkow et al. (2021).

Exhibit A-3. Matching rates and sample sizes for each outcome

	2013-2017 cohorts			2015-2017 cohorts		
	Completion by 4th Year	Completion by 5th Year (2013-2016 cohorts only)	Completion by 6th Year (2013-2015 cohorts only)	Completion by 4th Year	Completion by 5th Year (2015-2016 cohorts only)	Completion by 6th Year (2015 cohort only)
Matched treatment students (*n*)	2,599	1,908	1,235	1,925	1,234	561
Matched treatment students (%)	87%	87%	89%	85%	83%	83%
Non-matched treatment students (*n*)	389	283	150	352	246	113
Non-matched treatment students (%)	13%	13%	11%	15%	17%	17%
Matched comparison students (*n*)	8,946	6,446	3,975	7,129	4,629	2,158
Matched comparison students (%)	56%	58%	61%	52%	52%	50%
Non-matched comparison students (*n*)	7,064	4,658	2,573	6,676	4,270	2,185
Non-matched comparison students (%)	44%	42%	39%	48%	48%	50%

Note: The degree-specific completion measures use the same sample as the overall completion measure for a given time point and set of cohorts.

A.4 Matching Diagnostics

The most important step in matching is to examine to what extent matching resulted in treatment and comparison groups that were statistically similar. As explained in more detail below, we assessed the balance of the matched treatment and comparison groups by examining the distribution of the propensity scores in the two groups, and by assessing 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 to estimate effects. We conducted this process separately for each outcome measure and for each set of cohorts.

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

- For the 2013 and 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 2015-2017 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.

Exhibits A-4a, A-4b, and A-4c show the propensity score distributions for students in the 2013-2017 cohorts for the samples associated with the outcome measures *completion in four years, completion in five years,* and *completion in six years,* respectively. These exhibits provide evidence for the balance of the final matched groups in those samples. Exhibits A4-d, A4-e, and A4-f illustrate the balance of the final matched groups for students in the 2015-2017 cohorts for the samples for *completion in four years, completion* in *five years,* and *completion in six years,* respectively. Within each set of cohorts, the

credential-specific completion outcomes at each time point use the same sample, and thus their propensity scores have the same distributions.

In each of Exhibits A-4a through A-4f, the left-hand panel shows that before matching, treatment students and potential comparison students had different distributions of propensity scores, with the comparison group's propensity scores being more skewed to the right than the treatment group's. The right-hand panel in each exhibit shows that matching yields matched treatment and comparison groups with overlapping propensity score distributions.

Exhibit A-4a. Distributions of propensity scores for completion in four years, 2013-2017 cohorts

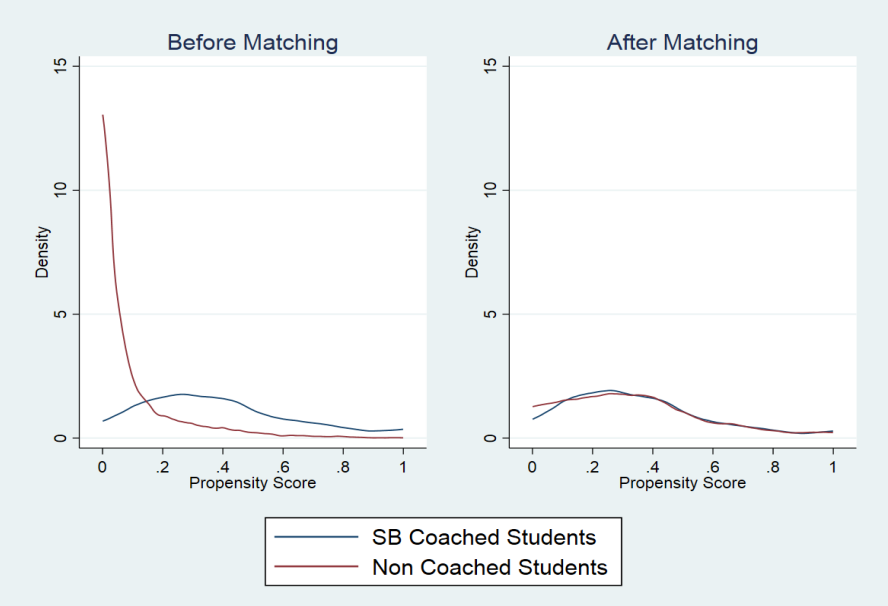


Exhibit A-4b. Distributions of propensity scores for completion in five years, 2013-2017 cohorts

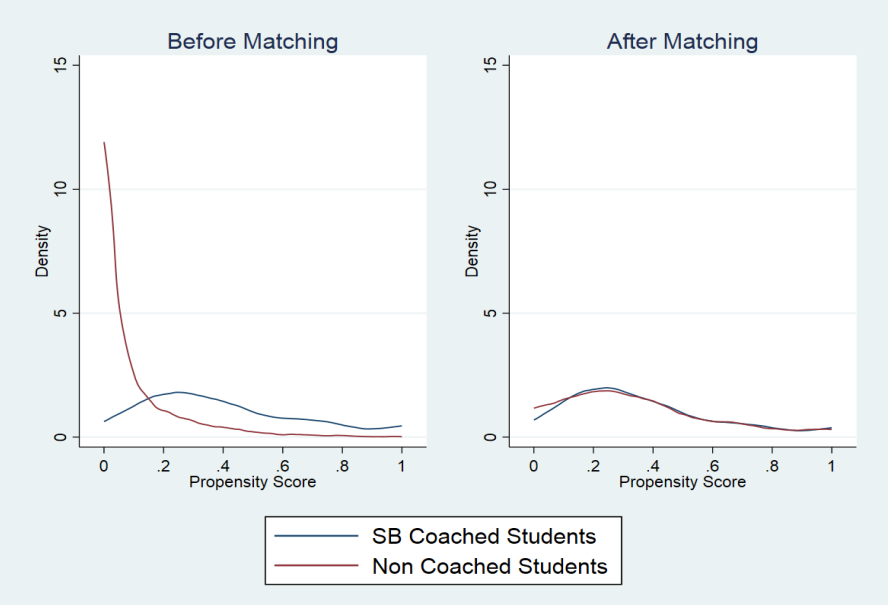


Exhibit A-4c. Distributions of propensity scores for completion in six years, 2013-2017 cohorts

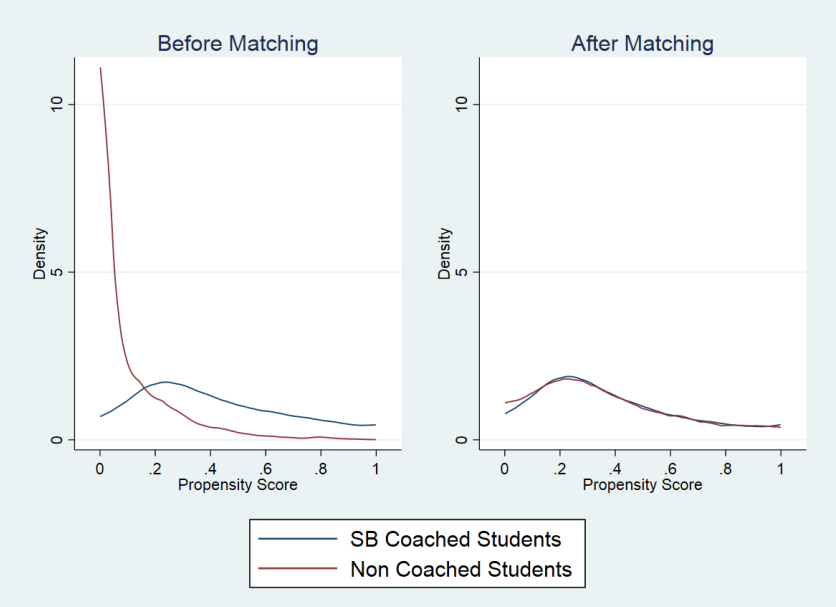


Exhibit A-4d. Distributions of propensity scores for completion in four years, 2015-2017 cohorts

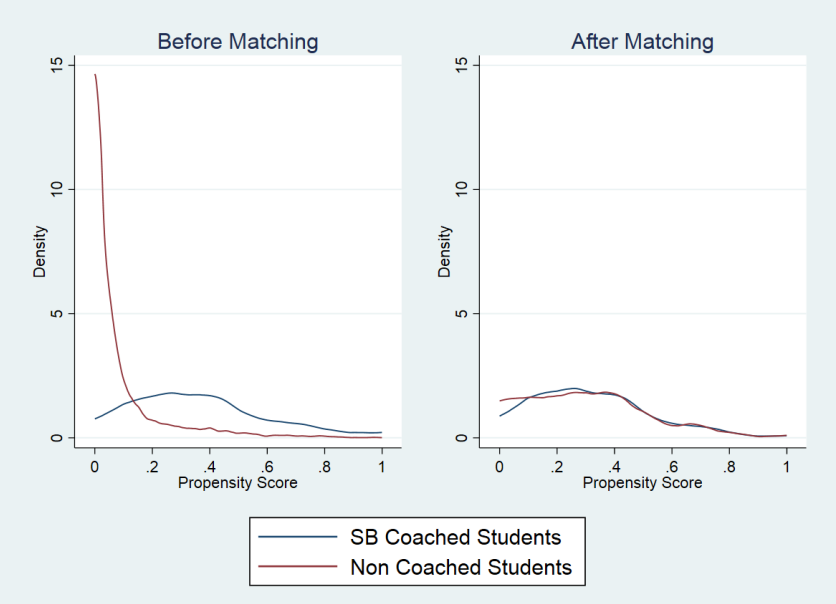


Exhibit A-4e. Distributions of propensity scores for completion in five years, 2015-2017 cohorts

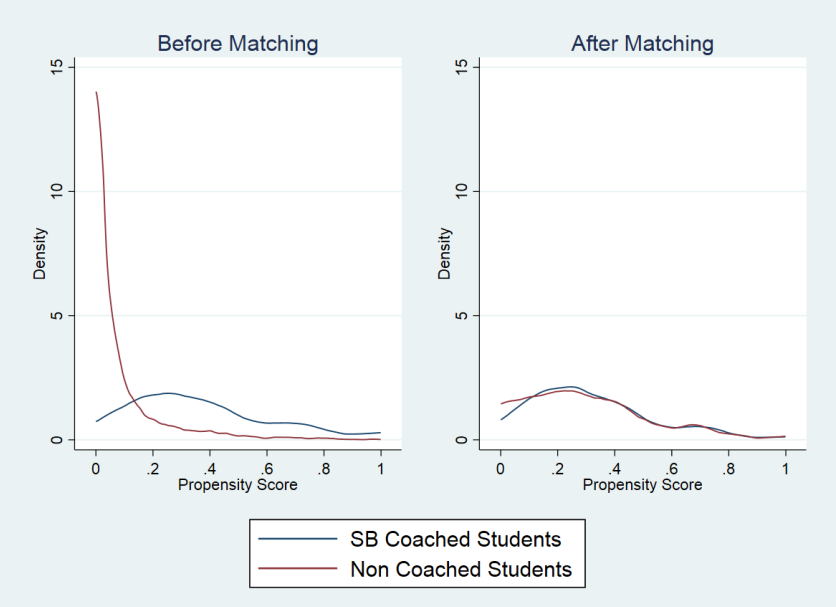
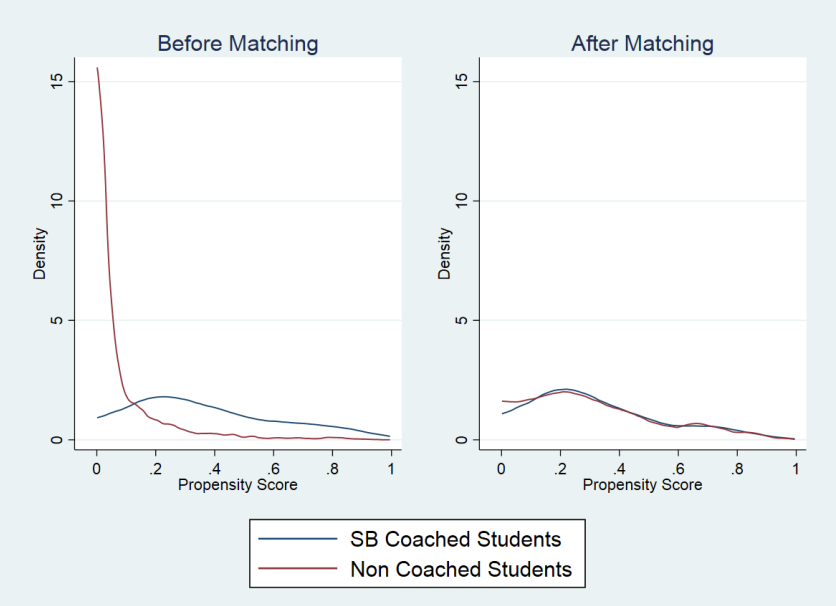


Exhibit A-4f. Distributions of propensity scores for completion in six years, 2015-2017 cohorts



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 (2022), 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[42] for all matching variables.

Exhibit A-5a shows the standardized baseline differences before and after matching for the analytic sample for each outcome measure for the 2013-2017 cohorts with radius matching.

As an example, let's examine the differences in Exhibit A-5a for the sample for overall completion in four years, bachelor's degree completion in four years, associate degree completion in four years, and certificate completion in four years for the 2013-2017 cohorts (all the same sample). In the left-hand "Before Matching" panel, the "Standardized Difference" column shows that the pre-matching differences for some variables are notably large: 0.341 SD for *Free/reduced-price lunch eligible*, 0.343 SD for *Black*, -0.506 SD for *White*, and -0.907 SD for *High school average GPA*. By contrast, in the "After Matching" panel on the right, the "Standardized Difference" column shows that matching reduced the pre-matching differences across the baseline variables, such that all post-matching differences are now below the 0.15 SD threshold we established.

Exhibit A-5b presents the standardized baseline differences before and after matching for the analytic sample for each outcome measure for the 2015-2017 cohorts with radius matching.

As shown in Exhibits A-5a and A-5b, the balance estimates across all cohort sets and all outcomes were all below 0.15 SD. Based on these results, we deemed the matched treatment and comparison groups balanced and used them in the estimation of SBC effects.

[42] Note that this 0.15 criterion is more stringent than what is used by the What Works Clearinghouse (2022), which requires that the baseline differences between quasi-experimental treatment and comparison groups be less than 0.25 SD to meet WWC evidence standards.

Exhibit A-5a. Standardized baseline differences by outcome, 2013-2017 cohorts

	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: Overall Completion in Four Years, Bachelor's Degree Completion in Four Years, Associate Degree Completion in Four Years, and Certificate Completion in Four Years														
Student, Demographics														
Age	2,988	16,010	18.22	18.07	0.74	0.66	0.143	2,599	8,946	18.22	18.24	0.74	0.78	-0.019
Women	2,988	16,010	0.60	0.54	0.49	0.50	0.170	2,599	8,946	0.60	0.60	0.49	0.49	-0.006
English language learner	2,988	16,010	0.12	0.06	0.33	0.23	0.184	2,599	8,946	0.12	0.12	0.32	0.32	<0.001
Free/reduced-price lunch eligible	2,988	16,010	0.78	0.57	0.41	0.49	0.341	2,599	8,946	0.77	0.77	0.42	0.42	0.016
Student has a high-incidence disability	2,988	16,010	0.08	0.06	0.27	0.23	0.051	2,599	8,946	0.08	0.07	0.27	0.26	0.017
Student has a low-incidence disability	2,988	16,010	0.03	0.03	0.17	0.17	-0.039	2,599	8,946	0.03	0.03	0.17	0.18	-0.022
Black	2,988	16,010	0.43	0.27	0.50	0.44	0.343	2,599	8,946	0.42	0.42	0.49	0.49	-0.011
White	2,988	16,010	0.06	0.32	0.24	0.47	-0.506	2,599	8,946	0.07	0.07	0.25	0.26	-0.012
Asian/Pacific Islander	2,988	16,010	0.15	0.18	0.36	0.38	-0.050	2,599	8,946	0.16	0.15	0.37	0.36	0.014
Hispanic	2,988	16,010	0.34	0.22	0.47	0.41	0.211	2,599	8,946	0.34	0.33	0.47	0.47	0.009
Native American	2,988	16,010	<0.01	<0.01	0.06	0.05	0.015	2,599	8,946	<0.01	<0.01	0.06	0.06	-0.005
Other/Multiracial	2,988	16,010	0.01	0.02	0.11	0.13	-0.032	2,599	8,946	0.01	0.01	0.11	0.11	-0.006
Student, Achievement in High School														
SAT score (2400)[a]	2,637	13,406	1208.93	1324.32	285.92	322.11	-0.214	2,272	7,515	1213.82	1210.66	282.97	281.83	0.027
10th grade English MCAS scaled score[b]	2,885	15,532	-0.33	0.02	0.92	0.90	-0.234	2,508	8,650	-0.33	-0.35	0.91	0.95	0.017
10th grade math MCAS scaled score[b]	2,892	15,573	-0.04	0.15	0.90	0.88	-0.095	2,515	8,665	-0.04	-0.04	0.90	0.88	-0.003
GPA	2,988	16,010	2.51	2.87	0.87	0.74	-0.373	2,599	8,946	2.56	2.56	0.82	0.83	0.007
Student took an advanced course	2,984	16,000	0.57	0.54	0.49	0.50	0.181	2,595	8,936	0.57	0.55	0.50	0.50	0.029
Number of advanced courses taken	2,984	16,000	1.10	1.24	1.33	1.58	0.046	2,595	8,936	1.09	1.06	1.33	1.35	0.021
Student, Behavioral														
Percentage of school days on which student was present	2,965	15,941	89.81	91.88	17.62	13.98	-0.010	2,578	8,891	89.31	89.25	18.71	18.87	0.003
Number of suspensions	2,988	16,010	0.16	0.29	0.70	1.42	-0.059	2,599	8,946	0.16	0.17	0.72	0.69	-0.010

	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
High School Characteristics														
Average English MCAS score[b]	2,923	15,880	7.17	4.67	14.69	12.81	-0.035	2,537	8,843	7.91	8.13	15.22	15.34	-0.004
Average math MCAS score[b]	2,923	15,882	10.44	6.54	20.12	17.15	-0.023	2,537	8,843	11.43	11.74	20.77	21.04	-0.005
High school average GPA	2,988	16,010	2.25	2.69	0.55	0.40	-0.907	2,599	8,946	2.30	2.34	0.48	0.49	-0.064
College-going rate	2,988	16,010	0.66	0.67	0.21	0.16	0.058	2,599	8,946	0.66	0.66	0.22	0.20	-0.005
Outcomes: Completion in Five Years, Bachelor's Degree Completion in Five Years, Associate Degree Completion in Five Years, and Certificate Completion in Five Years														
Student, Demographics														
Age	2,191	11,104	18.23	18.07	0.76	0.67	0.136	1,908	6,446	18.22	18.25	0.75	0.80	-0.035
Women	2,191	11,104	0.60	0.54	0.49	0.50	0.175	1,908	6,446	0.60	0.60	0.49	0.49	-0.008
English language learner	2,191	11,104	0.12	0.06	0.32	0.23	0.164	1,908	6,446	0.12	0.12	0.32	0.32	0.002
Free/reduced-price lunch eligible	2,191	11,104	0.79	0.59	0.41	0.49	0.328	1,908	6,446	0.78	0.78	0.41	0.42	0.017
Student has a high-incidence disability	2,191	11,104	0.07	0.06	0.26	0.23	0.036	1,908	6,446	0.07	0.07	0.26	0.26	0.013
Student has a low-incidence disability	2,191	11,104	0.03	0.03	0.18	0.16	-0.004	1,908	6,446	0.03	0.04	0.18	0.19	-0.014
Black	2,191	11,104	0.43	0.27	0.50	0.44	0.328	1,908	6,446	0.41	0.42	0.49	0.49	-0.014
White	2,191	11,104	0.07	0.32	0.25	0.47	-0.483	1,908	6,446	0.07	0.08	0.26	0.27	-0.018
Asian/Pacific Islander	2,191	11,104	0.15	0.18	0.36	0.39	-0.053	1,908	6,446	0.16	0.15	0.37	0.36	0.022
Hispanic	2,191	11,104	0.34	0.22	0.47	0.41	0.202	1,908	6,446	0.34	0.34	0.47	0.47	0.010
Native American	2,191	11,104	<0.01	<0.01	0.06	0.05	0.018	1,908	6,446	<0.01	<0.01	0.06	0.06	-0.006
Other/Multiracial	2,191	11,104	0.01	0.01	0.11	0.12	-0.024	1,908	6,446	0.01	0.01	0.10	0.10	-0.004
Student, Achievement in High School														
SAT score (2400)[a]	2,004	9,962	1281.11	1422.41	277.13	302.98	-0.254	1,732	5,735	1284.74	1276.52	273.57	275.46	0.036
10th grade English MCAS scaled score[b]	2,116	10,746	-0.37	0.01	0.93	0.92	-0.238	1,838	6,226	-0.37	-0.38	0.93	0.97	0.014
10th grade math MCAS scaled score[b]	2,123	10,780	-0.06	0.16	0.91	0.89	-0.094	1,846	6,241	-0.06	-0.05	0.91	0.89	-0.011
GPA	2,191	11,104	2.58	2.88	0.83	0.71	-0.321	1,908	6,446	2.62	2.63	0.79	0.79	-0.011
Student took an advanced course	2,187	11,094	0.57	0.54	0.50	0.50	0.176	1,904	6,436	0.56	0.56	0.50	0.50	0.007
Number of advanced courses taken	2,187	11,094	1.05	1.23	1.24	1.56	0.033	1,904	6,436	1.05	1.07	1.25	1.33	-0.015

	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
Student, Behavioral														
Percentage of school days on which student was present	2,169	11,035	88.85	91.31	20.10	16.19	<0.001	1,887	6,391	88.21	88.16	21.36	21.45	0.002
Number of suspensions	2,191	11,104	0.13	0.28	0.60	1.36	-0.076	1,908	6,446	0.14	0.13	0.62	0.57	0.005
High School Characteristics														
Average English MCAS score[b]	2,126	10,975	9.98	6.82	16.35	14.91	-0.039	1,846	6,343	10.99	11.28	16.83	16.92	-0.005
Average math MCAS score[b]	2,126	10,976	14.40	9.49	22.34	19.93	-0.027	1,846	6,343	15.75	16.14	22.90	23.14	-0.006
Average GPA	2,191	11,104	2.31	2.69	0.50	0.37	-0.858	1,908	6,446	2.36	2.39	0.44	0.44	-0.070
College-going rate	2,191	11,104	0.65	0.66	0.22	0.16	0.025	1,908	6,446	0.65	0.65	0.23	0.21	-0.003
Outcomes: Completion in Six Years, Bachelor's Degree Completion in Six Years, Associate Degree Completion in Five Years, and Certificate Completion in Six Years														
Student, Demographics														
Age	1,385	6,548	18.26	18.09	0.77	0.70	0.137	1,235	3,975	18.25	18.29	0.77	0.83	-0.041
Women	1,385	6,548	0.60	0.53	0.49	0.50	0.177	1,235	3,975	0.59	0.59	0.49	0.49	-0.013
English language learner	1,385	6,548	0.13	0.06	0.34	0.24	0.186	1,235	3,975	0.13	0.13	0.33	0.34	-0.018
Free/reduced-price lunch eligible	1,385	6,548	0.79	0.61	0.41	0.49	0.279	1,235	3,975	0.79	0.77	0.41	0.42	0.054
Student has a high-incidence disability	1,385	6,548	0.07	0.06	0.25	0.24	-0.010	1,235	3,975	0.07	0.07	0.25	0.25	-0.003
Student has a low-incidence disability	1,385	6,548	0.04	0.03	0.20	0.17	0.020	1,235	3,975	0.04	0.04	0.20	0.20	0.004
Black	1,385	6,548	0.43	0.27	0.50	0.45	0.294	1,235	3,975	0.41	0.42	0.49	0.49	-0.022
White	1,385	6,548	0.07	0.30	0.25	0.46	-0.438	1,235	3,975	0.07	0.08	0.26	0.28	-0.034
Asian/Pacific Islander	1,385	6,548	0.16	0.19	0.36	0.39	-0.029	1,235	3,975	0.16	0.15	0.37	0.35	0.043
Hispanic	1,385	6,548	0.33	0.23	0.47	0.42	0.158	1,235	3,975	0.34	0.33	0.47	0.47	0.018
Native American	1,385	6,548	<0.01	<0.01	0.06	0.06	-0.002	1,235	3,975	<0.01	<0.01	0.05	0.07	-0.035
Other/Multiracial	1,385	6,548	0.01	0.01	0.10	0.11	-0.030	1,235	3,975	0.01	0.01	0.09	0.09	-0.017
Student, Achievement in High School														
SAT score (2400)[a]	1,254	5,874	1267.51	1416.18	270.06	305.81	-0.248	1,113	3,496	1273.70	1266.57	264.98	272.04	0.032
10th grade English MCAS scaled score[b]	1,340	6,309	-0.44	-0.02	0.94	0.94	-0.252	1,193	3,831	-0.43	-0.43	0.94	1.01	0.002
10th grade math MCAS scaled score[b]	1,338	6,330	-0.12	0.12	0.91	0.89	-0.106	1,192	3,836	-0.10	-0.07	0.90	0.90	-0.025

	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
GPA	1,385	6,548	2.61	2.85	0.78	0.69	-0.263	1,235	3,975	2.64	2.66	0.77	0.74	-0.016
Student took an advanced course	1,381	6,538	0.56	0.53	0.50	0.50	0.221	1,231	3,965	0.55	0.55	0.50	0.50	-0.003
Number of advanced courses taken	1,381	6,538	1.00	1.16	1.18	1.51	0.075	1,231	3,965	1.00	1.04	1.20	1.26	-0.026
Student, Behavioral														
Percentage of school days on which student was present	1,363	6,486	86.34	89.54	24.48	20.23	0.011	1,214	3,920	85.59	85.74	25.75	25.73	-0.006
Number of suspensions	1,385	6,548	0.11	0.22	0.48	1.14	-0.081	1,235	3,975	0.11	0.10	0.49	0.44	0.029
High School Characteristics														
Average English MCAS score[b]	1,320	6,419	16.32	11.78	18.01	17.90	-0.047	1,173	3,872	17.53	17.89	18.12	18.10	-0.007
Average math MCAS score[b]	1,320	6,420	23.26	16.25	24.42	23.86	-0.037	1,173	3,872	24.86	25.36	24.44	24.58	-0.008
Average GPA	1,385	6,548	2.31	2.66	0.42	0.37	-0.782	1,235	3,975	2.35	2.37	0.41	0.40	-0.042
College-going rate	1,385	6,548	0.63	0.66	0.24	0.18	-0.038	1,235	3,975	0.64	0.64	0.24	0.23	0.004

[a] For the 2015 and 2016 cohorts, the SAT score is presented as the sum of the student's scores on the reading, math, and writing sections, for a maximum possible total score of 2400. For the 2017 cohort, the SAT score is presented as the sum of the student's scores on the reading and math sections, with a maximum possible total score of 1600, due to a change in the scoring of the SAT effective in spring 2016 (Anderson 2014).

[b] MCAS scores are presented as z-scores, which we computed by subtracting the student's score minus the mean score across all students, divided by the standard deviation of scores across all students.

Exhibit A-5b. Standardized baseline differences by outcome, 2015-2017 cohorts

	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: Overall Completion in Four Years, Bachelor's Degree Completion in Four Years, Associate Degree Completion in Four Years, and Certificate Completion in Four Years														
Student, Demographics														
Age	2,277	13,805	18.21	18.04	0.72	0.63	0.164	1,925	7,129	18.20	18.21	0.71	0.73	-0.005
Women	2,277	13,805	0.60	0.54	0.49	0.50	0.169	1,925	7,129	0.60	0.60	0.49	0.49	<0.001
English language learner	2,277	13,805	0.11	0.05	0.31	0.22	0.194	1,925	7,129	0.10	0.11	0.30	0.31	-0.006
Free/reduced-price lunch eligible	2,277	13,805	0.76	0.55	0.43	0.50	0.343	1,925	7,129	0.74	0.74	0.44	0.44	-0.002
Student has a high-incidence disability	2,277	13,805	0.08	0.05	0.28	0.22	0.085	1,925	7,129	0.08	0.08	0.28	0.27	0.015
Student has a low-incidence disability	2,277	13,805	0.02	0.03	0.13	0.16	-0.089	1,925	7,129	0.02	0.03	0.14	0.16	-0.052
Black	2,277	13,805	0.44	0.25	0.50	0.43	0.402	1,925	7,129	0.42	0.42	0.49	0.49	<0.001
White	2,277	13,805	0.06	0.34	0.23	0.47	-0.545	1,925	7,129	0.07	0.07	0.25	0.25	0.001
Asian/Pacific Islander	2,277	13,805	0.15	0.18	0.35	0.38	-0.058	1,925	7,129	0.16	0.17	0.37	0.37	-0.021
Hispanic	2,277	13,805	0.34	0.21	0.47	0.41	0.218	1,925	7,129	0.33	0.32	0.47	0.47	0.020
Native American	2,277	13,805	<0.01	<0.01	0.06	0.05	0.011	1,925	7,129	<0.01	<0.01	0.06	0.07	-0.008
Other/Multiracial	2,277	13,805	0.01	0.02	0.12	0.13	-0.032	1,925	7,129	0.01	0.01	0.12	0.12	-0.010
Student, Achievement in High School														
SAT score (2400)[a]	1,993	11,475	1201.26	1317.46	295.84	324.24	-0.197	1,664	5,944	1204.35	1198.23	294.34	290.35	0.040
10th grade English MCAS scaled score[b]	2,179	13,345	-0.27	0.06	0.90	0.88	-0.228	1,839	6,849	-0.26	-0.30	0.89	0.93	0.044
10th grade math MCAS scaled score[b]	2,187	13,385	-0.03	0.17	0.91	0.87	-0.111	1,847	6,865	-0.03	-0.02	0.91	0.88	-0.005
GPA	2,277	13,805	2.41	2.87	0.89	0.74	-0.474	1,925	7,129	2.48	2.47	0.84	0.86	0.005
Student took an advanced course	2,277	13,805	0.57	0.55	0.49	0.50	0.171	1,925	7,129	0.57	0.55	0.49	0.50	0.040
Number of advanced courses taken	2,277	13,805	1.12	1.29	1.37	1.62	0.023	1,925	7,129	1.12	1.08	1.37	1.39	0.032

	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
Student, Behavioral														
Percentage of school days on which student was present	2,275	13,787	92.84	93.63	6.67	6.39	-0.065	1,924	7,124	92.81	92.76	6.78	7.51	0.007
Number of suspensions	2,277	13,805	0.20	0.33	0.79	1.51	-0.064	1,925	7,129	0.20	0.21	0.82	0.78	-0.012
High School Characteristics														
Average English MCAS score[b]	2,277	13,803	-0.39	-0.15	0.62	0.43	-0.422	1,925	7,129	-0.38	-0.36	0.62	0.56	-0.028
Average math MCAS score[b]	2,277	13,805	-0.16	-0.05	0.62	0.44	-0.173	1,925	7,129	-0.16	-0.14	0.62	0.55	-0.030
Average GPA	2,277	13,805	2.20	2.71	0.58	0.39	-1.086	1,925	7,129	2.26	2.31	0.50	0.53	-0.084
College-going rate	2,277	13,805	0.68	0.67	0.18	0.13	0.144	1,925	7,129	0.68	0.69	0.19	0.16	-0.010
Outcomes: Completion in Five Years, Bachelor's Degree Completion in Five Years, Associate Degree Completion in Five Years, and Certificate Completion in Five Years														
Student, 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
Women	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	<0.001
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	<0.001
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	<0.01	<0.01	0.06	0.05	0.014	1,234	4,629	<0.01	<0.01	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

	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
Student, Achievement in High School														
SAT score (2400)[a]	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[b]	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[b]	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
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
Student, Behavioral														
Percentage of school days on which 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														
Average English MCAS score[b]	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
Average math MCAS score[b]	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
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
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
Outcomes: Completion in Six Years, Bachelor's Degree Completion in Six Years, Associate Degree Completion in Six Years, and Certificate Completion in Six Years														
Student, 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
Women	674	4,343	0.59	0.54	0.49	0.50	0.179	561	2,158	0.58	0.58	0.49	0.49	<0.001
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

	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
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	<0.001
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	<0.01	<0.01	0.05	0.06	-0.027	561	2,158	<0.01	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
Student, Achievement in High School														
SAT score (2400)[a]	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[b]	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[b]	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
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
Student, Behavioral														
Percentage of school days on which 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														
Average English MCAS score[b]	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
Average math MCAS score[b]	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
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
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

[a] For the 2015 and 2016 cohorts, the SAT score is presented as the sum of the student's scores on the reading, math, and writing sections, for a maximum possible total score of 2400. For the 2017 cohort, the SAT score is presented as the sum of the student's scores on the reading and math sections, with a maximum possible total score of 1600, due to a change in the scoring of the SAT effective in spring 2016 (Anderson 2014).

[b] MCAS scores are presented as z-scores, which we computed by subtracting the student's score minus the mean score across all students, divided by the standard deviation of scores across all students.

Appendix B. Details About the Estimation of Effects and Robustness Checks

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 used the model shown in Equation 1 with the full analytic sample (all SBC students and matched comparison students) for each outcome for each set of cohorts.

(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.

X_{ij}^{n} = nth 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.[43]

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. To estimate impacts for a given outcome across the 2013-2017 cohorts, we used the combined 2013-2017 data file described in Appendix A, which contained the cohort-specific analytic samples, and associated matching weights, across all five cohorts. Similarly, we used the combined 2015-2017 data file described in Appendix A for impacts for a given outcome across the 2015-2017 cohorts. Across all analysis samples, 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.

Two aspects of the model in Equation 1 warrant 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 (that is, the dependence of outcomes of students from the same college) will be fully explained by the matching block indicators already included in the

[43] Free/reduced-price lunch and GPA baseline covariates are identified as primary by the What Works Clearinghouse, and therefore we did not impute them using the dummy variable method. We dropped from the analysis any students missing values on either of these two covariates.

model.[44] Similarly, the model does not include a separate indicator for students in any cohort, because the block indicators are cohort-specific.

Second, the independent variables of the model included the matching characteristics that were available for all students (with missing values imputed using the missing value method as described in Appendix A) and used in the matching process. As noted in Chapter 3, 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). Section B.3 presents results from alternative specifications that did not control for the matching covariates or matching blocks.

B.2 Analytic Approach for Exploratory Subgroup Analyses

As described in Chapter 3, we examined pre-treatment student characteristics not related to program participation or effects (that is, that were exogenous) and were available for both the treatment students and the comparison students, specifically gender, race/ethnicity, high school GPA, and type of college (two- or four-year). We examined the extent to which program effects were related to these student characteristics using a slightly modified version of the impact model in Equation 1, which included the interaction of the treatment indicator T_{ij} and the characteristic that is being tested. To simplify the analyses and make results easier to interpret, 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 non-Hispanic Black, Hispanic, non-Hispanic Native American, and Other/Multiracial students, and 0 for the remaining students.[45] 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,[46] 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, if that M_{ij} is an indicator for being a woman (set to 1 if student i is a woman and to 0 if student i is a man), then the estimate of π_1 captures the effect estimate for men, and the estimate of π_2 captures the difference in the estimated effects between women and men. We calculate the effect estimate by adding the two coefficients.

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[44] 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.

[45] As noted in Chapter 3, we defined the *underrepresented minority* category slightly differently for different cohorts. Specifically, non-Hispanic Native American students were included in the underrepresented minority category for the 2015 through 2017 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.

[46] 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 4.0 corresponds with an average grade of an "A."

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

B.3 Robustness Checks

The results presented in Chapter 4 reflect estimates using the impact model in Equation 1 and our preferred impact model specification, in which we control for all matching covariates and for the matching blocks. We conducted additional analyses testing the robustness of our results to including or excluding matching covariates and matching blocks. Specifically, we estimated two alternative versions of this model: one version that estimates impacts but without including matching covariates or matching blocks, and another version that includes matching blocks but no matching covariates.

Exhibit B-1 presents the results of our robustness checks for each set of cohorts for our primary outcomes, overall completion within four, five, and six years. Within each set of cohorts, the first panel in this exhibit repeats the results from our preferred specification (from Chapter 4, Exhibit 4-1), 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. Including additional covariates and matching blocks increases the precision of effect estimates—standard errors of the preferred specification were 2 to 13 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
2013-2017 Cohorts						
Matching Blocks and All Matching Covariates (Preferred Specification)						
Completion after…						
4 Years	30.59	26.00	**4.59*** **	0.10	1.21	11,545
5 Years	45.34	40.46	**4.88** **	0.10	1.60	8,354
6 Years	48.58	45.19	**3.39**	0.07	2.18	5,210
No Covariates (Alternative Specification 1)						
Completion after…						
4 Years	30.59	25.79	**4.80*** **	0.11	1.32	11,545
5 Years	45.34	40.33	**5.01** **	0.10	1.80	8,354
6 Years	48.58	45.15	**3.43**	0.07	2.40	5,210
No Covariates, Controlling for Matching Blocks (Alternative Specification 2)						
Completion after…						
4 Years	30.59	25.79	**4.80*** **	0.11	1.23	11,545
5 Years	45.34	40.33	**5.01** **	0.10	1.64	8,354
6 Years	48.58	45.15	**3.43**	0.07	2.23	5,210

Outcome	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Effect Size	Standard Error	Sample Size
2015 through 2017 Cohorts						
Matching Blocks and All Matching Covariates (Preferred Specification)						
Completion after…						
4 Years	32.83	27.21	**5.62*** **	0.13	1.34	9,054
5 Years	46.60	40.61	**5.98*** **	0.12	1.80	5,863
6 Years	48.84	44.47	**4.37**	0.09	2.99	2,719
No Covariates (Alternative Specification 1)						
Completion after…						
4 Years	32.83	26.84	**5.99*** **	0.13	1.50	9,054
5 Years	46.60	40.27	**6.32** **	0.13	2.07	5,863
6 Years	48.84	44.71	**4.14**	0.08	3.35	2,719
No Covariates, Controlling for Matching Blocks (Alternative Specification 2)						
Completion after…						
4 Years	32.83	26.84	**5.99*** **	0.13	1.38	9,054
5 Years	46.60	40.27	**6.32*** **	0.13	1.88	5,863
6 Years	48.84	44.71	**4.14**	0.08	3.07	2,719

Notes: 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, race/ethnicity (non-Hispanic Black, non-Hispanic White, Hispanic, non-Hispanic Native American, non-Hispanic Asian/Pacific Islander, Other/Multiracial), age, whether the student took advanced courses in high school, and number of advanced courses taken.

** Indicates statistical significance at the 1 percent level. *** Indicates statistical significance at the 0.1 percent level.

Appendix C. Correlations Between Outcomes, 2013-2017 Cohorts

Exhibit C-1. Correlations between outcomes, 2013-2017 cohorts

		Overall completion by…			Bachelor's degree completion by …			Associate degree completion by …			Certificate completion by …		
		Year 4	Year 5	Year 6	Year 4	Year 5	Year 6	Year 4	Year 5	Year 6	Year 4	Year 5	Year 6
Overall completion by….	Year 4	1.00											
	Year 5	0.71	1.00										
	Year 6	0.61	0.88	1.00									
Bachelor's degree completion by …	Year 4	0.85	0.60	0.52	1.00								
	Year 5	0.59	0.85	0.74	0.71	1.00							
	Year 6	0.52	0.76	0.84	0.61	0.88	1.00						
Associate degree completion by …	Year 4	0.33	0.23	0.21	−0.12	−0.10	−0.04	1.00					
	Year 5	0.25	0.27	0.26	−0.14	−0.13	−0.08	0.86	1.00				
	Year 6	0.21	0.24	0.28	−0.15	−0.16	−0.11	0.75	0.91	1.00			
Certificate completion by …	Year 4	0.18	0.13	0.10	0.04	0.003	−0.04	0.02	0.01	0.02	1.00		
	Year 5	0.15	0.14	0.12	0.03	−0.001	−0.04	0.01	0.01	0.02	0.89	1.00	
	Year 6	0.12	0.11	0.13	−0.02	−0.05	−0.05	0.02	0.02	0.03	0.81	0.89	1.00

Source: National Student Clearinghouse data from the Massachusetts Department of Elementary and Secondary Education.
Sample: *N*=11,545 students for all two-way correlations between two four-year completion outcomes. *N*= 8,354 students for all two-way correlations between two five-year outcomes. *N*= 5,210 students for all two-way correlations between two six-year outcomes. *N*= 8,354 students for all two-way correlations between one four-year completion outcome and one five-year outcome. *N*= 5,210 students for all two-way correlations between one four-year completion outcomes and one six-year outcome. *N*= 5,210 students for all two-way correlations between one five-year completion outcomes and one six-year outcome. All samples include students in the 2013-2017 cohorts.

Appendix D. Impacts Across all Students

Exhibit D-1. Impacts of SBC on postsecondary completion, 2013-2017 cohorts

Outcome	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Effect Size	Standard Error	p-value	Degrees of Freedom	Sample Size
Completion by End of 4th Year	**30.59**	**26.00**	**4.59*** **	**0.10**	**1.21**	**<0.001**	**11,383**	**11,545**
Bachelor's degree	21.74	19.09	**2.65****	0.07	0.96	0.006	11,383	11,545
Associate degree	7.04	5.05	**1.99****	0.09	0.72	0.006	11,383	11,545
Certificate	0.85	1.30	**-0.46**	−0.04	0.29	0.113	11,383	11,545
Completion by End of 5th Year	**45.34**	**40.46**	**4.88****	**0.10**	**1.60**	**0.002**	**8,221**	**8,354**
Bachelor's degree	37.00	31.59	**5.41*****	0.12	1.42	<0.001	8,221	8,354
Associate degree	7.55	7.24	**0.30**	0.01	0.97	0.755	8,221	8,354
Certificate	1.15	1.57	**-0.42**	−0.03	0.38	0.268	8,221	8,354
Completion by End of 6th Year	**48.58**	**45.19**	**3.39**	**0.07**	**2.18**	**0.120**	**5,115**	**5,210**
Bachelor's degree	39.51	35.44	**4.07***	0.08	1.99	0.040	5,115	5,210
Associate degree	8.83	9.81	**-0.98**	−0.03	1.44	0.496	5,115	5,210
Certificate	1.05	1.75	**-0.69**	−0.06	0.50	0.164	5,115	5,210

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and college administrative data.
* Indicates statistical significance at the 5 percent level. ** Indicates statistical significance at the 1 percent level. *** Indicates statistical significance at the 0.1 percent level.

Exhibit D-2. Impacts of SBC on postsecondary completion, 2015-2017 cohorts

Outcome	Treatment Group Mean	Adjusted Comparison Group Mean	Program Impact	Effect Size	Standard Error	p-value	Degrees of Freedom	Sample Size
Completion by End of 4th Year	**32.83**	**27.21**	**5.62*** **	**0.13**	**1.34**	**<0.001**	**8,932**	**9,054**
Bachelor's degree	22.96	21.27	**1.69**	0.04	1.13	0.135	8,932	9,054
Associate degree	7.69	4.16	**3.53*** **	0.17	0.68	<0.001	8,932	9,054
Certificate	1.04	1.35	**-0.31**	-0.03	0.37	0.402	8,932	9,054
Completion by End of 5th Year	**46.60**	**40.61**	**5.98*** **	**0.12**	**1.80**	**0.001**	**5,770**	**5,863**
Bachelor's degree	37.93	34.00	**3.93***	0.08	1.58	0.013	5,770	5,863
Associate degree	8.10	5.62	**2.48****	0.10	0.94	0.008	5,770	5,863
Certificate	1.46	1.61	**-0.15**	-0.01	0.53	0.777	5,770	5,863
Completion by End of 6th Year	**48.84**	**44.47**	**4.37**	**0.09**	**2.99**	**0.143**	**2,664**	**2,719**
Bachelor's degree	39.04	38.44	**0.59**	0.01	2.65	0.823	2,664	2,719
Associate degree	10.34	6.34	**4.00***	0.16	1.62	0.014	2,664	2,719
Certificate	1.25	1.90	**-0.65**	-0.05	0.89	0.464	2,664	2,719

Source: National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and college administrative data.
* Indicates statistical significance at the 5 percent level. ** Indicates statistical significance at the 1 percent level. *** Indicates statistical significance at the 0.1 percent level.

Appendix E. Variation in Impacts by Student Characteristics

Exhibit E-1. Impacts of SBC on postsecondary completion by gender, 2013-2017 cohorts

Outcome	Women					Men					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 by End of 4th Year	**34.25**	**29.39**	**4.86***	**1.68**	**6,217**	**25.10**	**20.92**	**4.18***	**1.65**	**5,328**	**0.68**
Bachelor's degree	25.02	22.29	**2.72***	1.33	6,217	16.83	14.29	**2.54**	1.35	5,328	0.19
Associate degree	6.80	4.91	**1.89**	1.03	6,217	7.40	5.28	**2.13***	0.94	5,328	−0.24
Certificate	1.03	1.64	**−0.61**	0.44	6,217	0.58	0.80	**−0.23**	0.29	5,328	−0.38
Completion by End of 5th Year	**49.91**	**45.82**	**4.10**	**2.20**	**4,519**	**38.48**	**32.42**	**6.06***	**2.20**	**3,835**	**−1.97**
Bachelor's degree	41.26	35.95	**5.31***	1.98	4,519	30.63	25.06	**5.56***	1.91	3,835	−0.25
Associate degree	7.17	7.55	**−0.38**	1.40	4,519	8.12	6.78	**1.33**	1.21	3,835	−1.71
Certificate	1.31	2.10	**−0.79**	0.57	4,519	0.92	0.78	**0.13**	0.40	3,835	−0.92
Completion by End of 6th Year	**54.20**	**50.97**	**3.22**	**3.01**	**2,789**	**40.55**	**36.91**	**3.64**	**3.01**	**2,421**	**−0.42**
Bachelor's degree	45.25	40.44	**4.82**	2.80	2,789	31.30	28.29	**3.01**	2.63	2,421	1.81
Associate degree	8.12	11.49	**−3.38**	2.13	2,789	9.84	7.39	**2.45**	1.70	2,421	−5.83*
Certificate	1.51	2.03	**−0.52**	0.75	2,789	0.39	1.34	**−0.95**	0.54	2,421	0.43

Source: Student background data and National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and college administrative data.

* Indicates statistical significance at the 5 percent level.

Exhibit E-2. Impacts of SBC on postsecondary completion by underrepresented minority status, 2013-2017 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 by End of 4th Year	**26.48**	**22.87**	**3.62***	**1.39**	**6,808**	**44.44**	**36.53**	**7.91***	**2.37**	**4,737**	**−4.29**
Bachelor's degree	16.36	14.86	**1.50**	1.06	6,808	39.90	33.32	**6.58***	2.24	4,737	−5.08*
Associate degree	8.18	5.67	**2.51***	0.89	6,808	3.20	3.00	**0.20**	0.86	4,737	2.31
Certificate	1.00	1.46	**−0.46**	0.35	6,808	0.34	0.78	**−0.44**	0.29	4,737	−0.02
Completion by End of 5th Year	**39.86**	**36.33**	**3.53**	**1.88**	**4,858**	**63.17**	**53.8**	**9.36***	**2.91**	**3,496**	**−5.84**
Bachelor's degree	30.48	26.42	**4.06***	1.65	4,858	58.26	48.37	**9.89***	2.77	3,496	−5.83
Associate degree	8.56	8.00	**0.56**	1.19	4,858	4.24	4.79	**−0.55**	1.20	3,496	1.11
Certificate	1.30	1.78	**−0.48**	0.47	4,858	0.67	0.89	**−0.23**	0.44	34,96	−0.25
Completion by End of 6th Year	**43.60**	**41.81**	**1.79**	**2.57**	**3,148**	**64.31**	**55.62**	**8.69***	**4.02**	**2,062**	**−6.90**
Bachelor's degree	32.62	30.35	**2.27**	2.29	3,148	61.28	51.29	**9.99***	3.94	2,062	−7.71
Associate degree	10.34	11.32	**−0.98**	1.80	3,148	4.04	5.06	**−1.02**	1.60	2,062	0.04
Certificate	1.39	2.10	**−0.71**	0.63	3,148	<0.01	0.63	**−0.63***	0.29	2,062	−0.09

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

Exhibit E-3. Impacts SBC on postsecondary completion by high school GPA, 2013-2017 cohorts

Outcome	High					Low					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 by End of 4th Year	**42.87**	**38.66**	**4.21**	**2.27**	**5,016**	**24.26**	**19.55**	**4.71***	**1.42**	**6,529**	**−0.49**
Bachelor's degree	34.05	30.13	**3.92***	1.90	5,016	15.39	13.45	**1.94**	1.08	6,529	1.98
Associate degree	7.24	6.67	**0.57**	1.36	5,016	6.94	4.24	**2.70***	0.88	6,529	−2.13
Certificate	0.90	1.66	**−0.76**	0.44	5,016	0.82	1.13	**−0.31**	0.37	6,529	−0.44
Completion by End of 5th Year	**62.46**	**57.40**	**5.06**	**2.78**	**3,646**	**35.98**	**31.3**	**4.68***	**1.96**	**4,708**	**0.38**
Bachelor's degree	54.90	46.99	**7.91***	2.62	3,646	27.23	23.27	**3.96***	1.68	4,708	3.95
Associate degree	8.01	8.64	**−0.63**	1.70	3,646	7.29	6.50	**0.79**	1.23	4,708	−1.42
Certificate	1.04	1.68	**−0.65**	0.52	3,646	1.22	1.52	**−0.31**	0.51	4,708	−0.34
Completion by End of 6th Year	**65.99**	**63.63**	**2.36**	**3.58**	**2,187**	**38.81**	**35.04**	**3.77**	**2.72**	**3,023**	**−1.41**
Bachelor's degree	58.78	52.46	**6.32**	3.51	2,187	28.70	26.02	**2.67**	2.39	3,023	3.65
Associate degree	7.66	10.96	**−3.31**	2.38	2,187	9.48	9.20	**0.28**	1.83	3,023	−3.59
Certificate	0.90	1.90	**−0.99**	0.69	2,187	1.14	1.69	**−0.55**	0.69	3,023	−0.44

Source: Student background data and National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and college administrative data.
Notes: For the 2013-2016 cohorts, high GPA was defined as cumulative high school GPA of above 3.00, and low GPA was defined as 3.00 or below. For the 2017 cohorts, high GPA was defined as cumulative high school GPA of above 2.95, and low GPA was defined as 2.95 or below.
* Indicates statistical significance at the 5 percent level.

Exhibit E-4. Impacts of SBC on postsecondary completion by college type, 2013-2017 cohorts

Outcome	2-Year					4-Year					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 by End of 4th Year	**20.59**	**15.48**	**5.11***	**1.70**	**3,686**	**36.00**	**31.69**	**4.31***	**1.62**	**7,859**	**0.80**
Bachelor's degree	1.20	1.10	**0.11**	0.55	3,686	32.86	28.84	**4.02***	1.45	7,859	−3.91*
Associate degree	17.42	10.94	**6.48***	1.49	3,686	1.42	1.87	**−0.44**	0.78	7,859	6.92*
Certificate	1.64	2.72	**−1.08**	0.73	3,686	0.42	0.54	**−0.12**	0.20	7,859	−0.96
Completion by End of 5th Year	**22.55**	**20.86**	**1.69**	**2.19**	**2,717**	**57.78**	**51.16**	**6.62***	**2.18**	**5,637**	**−4.93**
Bachelor's degree	5.64	3.76	**1.88**	1.12	2,717	54.13	46.79	**7.34***	2.12	5,637	−5.46*
Associate degree	18.10	14.74	**3.37**	1.89	2,717	1.78	3.16	**−1.37**	1.12	5,637	4.74*
Certificate	1.78	3.49	**−1.71**	0.94	2,717	0.81	0.53	**0.28**	0.29	5,637	−1.99*
Completion by End of 6th Year	**26.70**	**25.14**	**1.55**	**3.07**	**1,820**	**61.44**	**56.96**	**4.48**	**2.97**	**3,390**	**−2.93**
Bachelor's degree	9.41	7.10	**2.31**	1.90	1,820	57.20	52.08	**5.12**	2.96	3,390	−2.81
Associate degree	19.04	17.48	**1.56**	2.50	1,820	2.83	5.32	**−2.49**	1.78	3,390	4.04
Certificate	1.97	3.88	**−1.91**	1.23	1,820	0.51	0.49	**0.02**	0.31	3,390	−1.93

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

Exhibit E-5. Impacts of SBC on postsecondary completion by gender, 2015-2017 cohorts

Outcome	Women					Men					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 by End of 4th Year	**36.56**	**30.67**	**5.90***	**1.84**	**4,854**	**27.21**	**21.99**	**5.22***	**1.92**	**4,200**	**0.68**
Bachelor's degree	25.76	25.00	0.76	1.56	4,854	18.75	15.66	3.09*	1.57	4,200	−2.33
Associate degree	7.95	3.65	4.30*	0.89	4,854	7.29	4.93	2.36*	1.09	4,200	1.94
Certificate	1.30	1.76	−0.47	0.57	4,854	0.65	0.72	−0.07	0.35	4,200	−0.40
Completion by End of 5th Year	**50.81**	**45.53**	**5.28***	**2.47**	**3,156**	**40.24**	**33.19**	**7.05***	**2.57**	**2,707**	**−1.77**
Bachelor's degree	41.11	38.41	2.70	2.19	3,156	33.13	27.34	5.79*	2.21	2,707	−3.09
Associate degree	8.49	5.66	2.83*	1.23	3,156	7.52	5.57	1.95	1.46	2,707	0.88
Certificate	1.62	2.25	−0.63	0.81	3,156	1.22	0.65	0.57	0.55	2,707	−1.20
Completion by End of 6th Year	**52.92**	**51.35**	**1.58**	**4.24**	**1,426**	**43.22**	**35.07**	**8.15***	**4.08**	**1,293**	**−6.57**
Bachelor's degree	42.77	44.92	−2.16	3.84	1,426	33.90	29.59	4.30	3.49	1,293	−6.46
Associate degree	10.15	8.13	2.03	2.21	1,426	10.59	3.93	6.67*	2.42	1,293	−4.64
Certificate	1.85	2.11	−0.26	1.34	1,426	0.42	1.61	−1.19	0.98	1,293	0.92

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

Exhibit E-6. Impacts of SBC on postsecondary completion by underrepresented minority status, 2015-2017 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 by End of 4th Year	**28.82**	**23.90**	**4.92***	**1.55**	**5,170**	**46.36**	**38.42**	**7.94***	**2.72**	**3,884**	**−3.02**
Bachelor's degree	17.64	17.01	0.63	1.26	5,170	40.91	35.72	5.19*	2.55	3,884	−4.56
Associate degree	8.82	4.62	4.20*	0.84	5,170	3.86	2.55	1.31	1.02	3,884	2.89*
Certificate	1.21	1.45	−0.24	0.45	5,170	0.45	0.98	−0.53	0.38	3,884	0.29
Completion by End of 5th Year	**41.38**	**36.07**	**5.32***	**2.16**	**3,220**	**63.27**	**55.22**	**8.04***	**3.30**	**2,643**	**−2.73**
Bachelor's degree	31.81	28.62	3.19	1.85	3,220	57.48	51.26	6.22*	3.16	2,643	−3.04
Associate degree	9.04	6.18	2.87*	1.16	3,220	5.10	3.82	1.28	1.42	2,643	1.58
Certificate	1.60	1.72	−0.12	0.65	3,220	1.02	1.26	−0.24	0.63	2,643	0.12
Completion by End of 6th Year	**44.50**	**40.63**	**3.86**	**3.67**	**1,510**	**61.54**	**55.76**	**5.78**	**5.27**	**1,209**	**−1.91**
Bachelor's degree	32.78	33.60	−0.83	3.14	1,510	57.34	52.83	4.51	5.29	1,209	−5.34
Associate degree	11.96	7.36	4.60*	2.07	1,510	5.59	3.24	2.35	2.33	1,209	2.25
Certificate	1.67	2.26	−0.59	1.17	1,510	<0.01	0.84	−0.84	0.46	1,209	0.25

Source: Student background data and National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and college administrative data.

* Indicates statistical significance at the 5 percent level.

Exhibit E-7. Impacts of SBC on postsecondary completion by high school GPA, 2015-2017 cohorts

Outcome	High					Low					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 by End of 4th Year	**46.02**	**40.95**	**5.07**	**2.60**	**3,883**	**26.99**	**21.11**	**5.88***	**1.56**	**5,171**	**−0.81**
Bachelor's degree	35.70	33.97	1.73	2.34	3,883	17.32	15.64	1.67	1.26	5,171	0.06
Associate degree	8.29	5.52	2.77*	1.21	3,883	7.42	3.56	3.86*	0.84	5,171	−1.09
Certificate	1.18	1.78	−0.60	0.58	3,883	0.97	1.15	−0.18	0.45	5,171	−0.42
Completion by End of 5th Year	**62.99**	**57.23**	**5.76**	**3.20**	**2,513**	**39.27**	**33.12**	**6.16***	**2.20**	**3,350**	**−0.40**
Bachelor's degree	54.07	49.98	4.09	2.97	2,513	30.72	26.80	3.92*	1.88	3,350	0.17
Associate degree	9.45	6.80	2.65	1.63	2,513	7.50	5.09	2.41*	1.16	3,350	0.24
Certificate	1.57	1.50	0.07	0.75	2,513	1.41	1.65	−0.25	0.68	3,350	0.32
Completion by End of 6th Year	**63.58**	**64.59**	**−1.01**	**5.66**	**1,054**	**43.41**	**36.79**	**6.62**	**3.50**	**1,665**	**−7.64**
Bachelor's degree	53.64	59.78	−6.14	5.43	1,054	33.66	30.29	3.37	3.01	1,665	−9.51
Associate degree	9.27	6.97	2.30	2.63	1,054	10.73	6.07	4.66*	2.01	1,665	−2.36
Certificate	1.32	1.31	0.02	1.16	1,054	1.22	2.09	−0.87	1.19	1,665	0.89

Source: Student background data and National Student Clearinghouse data from Boston Public Schools and Massachusetts Department of Elementary and Secondary Education, and college administrative data.

Notes: For the 2015 and 2016 cohorts, high GPA was defined as cumulative high school GPA of above 3.00, and low GPA was defined as 3.00 or below. For the 2017 cohorts, high GPA was defined as cumulative high school GPA of above 2.95, and low GPA was defined as 2.95 or below.* Indicates statistical significance at the 5 percent level.

Exhibit E-8. Impacts of SBC on postsecondary completion by college type, 2015-2017 cohorts

Outcome	2-Year					4-Year					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 by End of 4th Year	**23.18**	**14.81**	**8.37***	**2.10**	**2,722**	**37.87**	**33.67**	**4.20***	**1.73**	**6,332**	**4.17**
Bachelor's degree	1.36	1.49	−0.12	0.69	2,722	34.23	31.60	2.63	1.68	6,332	−2.75
Associate degree	19.39	10.19	9.20*	1.81	2,722	1.58	1.00	0.58	0.43	6,332	8.63*
Certificate	1.97	2.59	−0.62	0.94	2,722	0.55	0.69	−0.14	0.27	6,332	−0.48
Completion by End of 5th Year	**24.70**	**19.40**	**5.30**	**2.92**	**1,753**	**57.93**	**51.60**	**6.33***	**2.30**	**4,110**	**−1.03**
Bachelor's degree	6.18	4.95	1.23	1.52	1,753	54.37	49.05	5.32*	2.28	4,110	−4.09
Associate degree	20.19	13.51	6.68*	2.47	1,753	1.85	1.53	0.31	0.61	4,110	6.37*
Certificate	1.90	3.31	−1.41	1.34	1,753	1.23	0.73	0.50	0.44	4,110	−1.91
Completion by End of 6th Year	**30.88**	**23.40**	**7.49**	**5.16**	**856**	**59.10**	**56.51**	**2.59**	**3.69**	**1,863**	**4.89**
Bachelor's degree	12.75	11.46	1.28	3.61	856	54.06	53.86	0.20	3.68	1,863	1.08
Associate degree	22.55	14.19	8.35*	3.93	856	3.36	1.85	1.51	1.18	1,863	6.84
Certificate	1.96	3.88	−1.92	2.19	856	0.84	0.77	0.07	0.53	1,863	−1.99

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

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