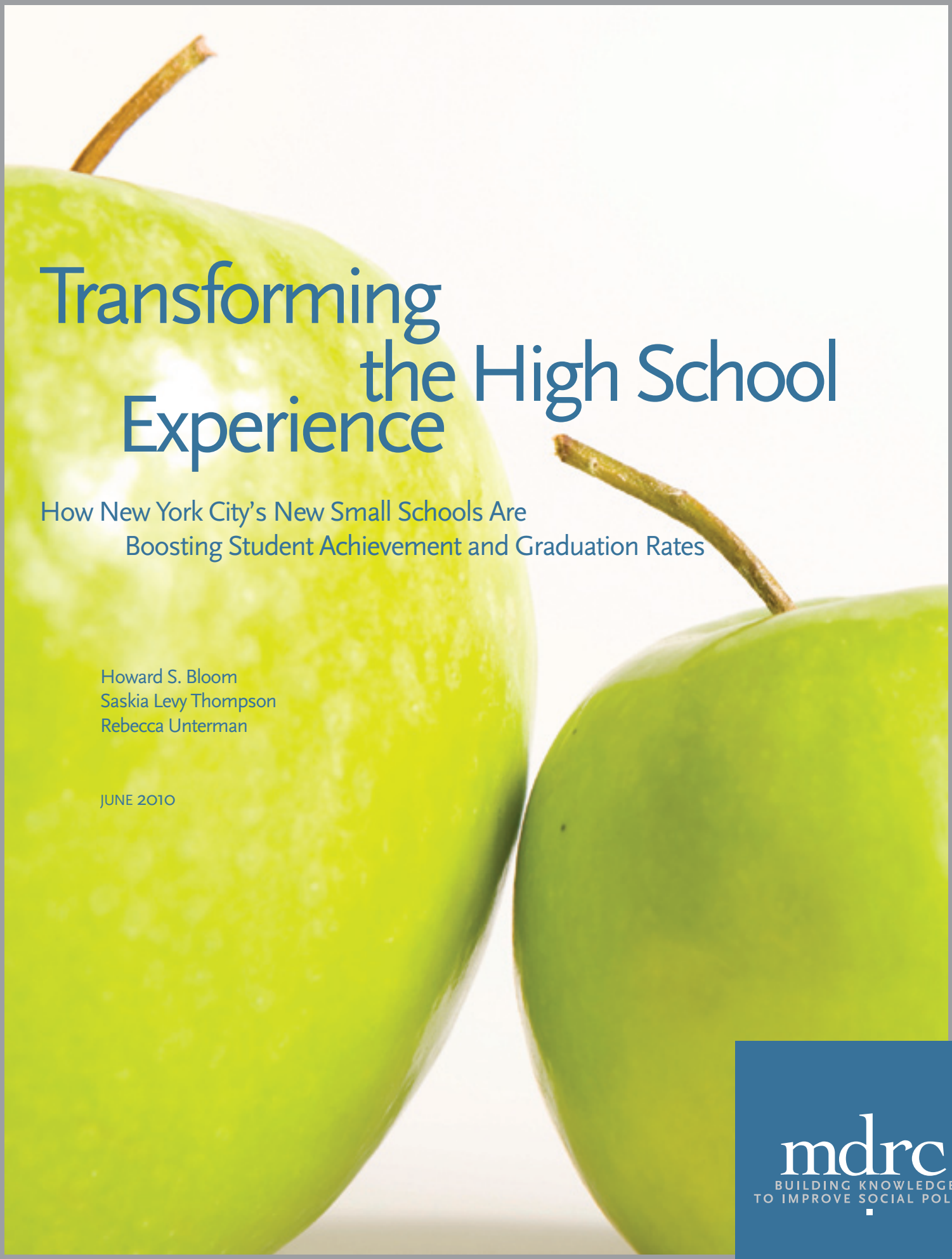

Transforming the High School Experience

How New York City's New Small Schools Are Boosting Student Achievement and Graduation Rates

Howard S. Bloom
Saskia Levy Thompson
Rebecca Unterman

JUNE 2010

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BUILDING KNOWLEDGE TO IMPROVE SOCIAL POLICY

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Overview

Since 2002, New York City has closed more than 20 underperforming public high schools, opened more than 200 new secondary schools, and introduced a centralized high school admissions process in which approximately 80,000 students a year indicate their school preferences from a wide-ranging choice of programs. At the heart of these reforms lie 123 new "small schools of choice" (SSCs) — small, academically nonselective, four-year public high schools for students in grades 9 through 12. Open to students at all levels of academic achievement and located in historically disadvantaged communities, SSCs were intended to be viable alternatives to the neighborhood high schools that were closing.

SSCs are more than just *small.* They were authorized through a demanding competitive proposal process designed to stimulate innovative ideas for new schools by a range of stakeholders and institutions, from educators to school reform intermediary organizations. The resulting schools emphasize strong, sustained relationships between students and faculty. Each SSC also received start-up funding as well as assistance and policy protections from the district and other key players to facilitate leadership development, hiring, and implementation.

The first step in New York City's high school admissions process is to require eighth-graders to select in rank order of priority up to 12 high schools that they want to attend; when an SSC has more applicants than spaces, the district uses a lottery-like process to randomly assign students to the SSC or to another school in the district. These lotteries provide the basis for an unusually large and rigorous study, supported by the Bill & Melinda Gates Foundation, of the effects of SSCs on students' academic achievement.

This report presents encouraging findings from that study, providing clear and reliable evidence that, in roughly six years, a large system of small public high schools can be created and can markedly improve graduation prospects for many disadvantaged students. Specifically:

- By the end of their first year of high school, 58.5 percent of SSC enrollees are on track to graduate in four years compared with 48.5 percent of their non-SSC counterparts, for a difference of 10.0 percentage points. These positive effects are sustained over the next two years.
- By the fourth year of high school, SSCs increase overall graduation rates by 6.8 percentage points, which is roughly *one-third the size of the gap in graduation rates* between white students and students of color in New York City.
- SSCs' positive effects are seen for a broad range of students, including male high school students of color, whose educational prospects have been historically difficult to improve.

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Preface

The traditional large high schools that typify so many school districts in this country — particularly our poor urban centers — are a relic of a former time, with too many of them characterized by shockingly high dropout rates and large numbers of young people who graduate unprepared for college-level studies. Despite much experimentation, little concrete evidence has emerged about how to turn around our lowest-performing public schools and equip America's high school students with the skills they'll need in today's rapidly changing world.

In New York City, however, a remarkable transformation now appears to be taking place. Since 2002, the city has closed more than 20 underperforming public high schools, opened more than 200 new secondary schools, and introduced a centralized high school admissions process in which approximately 80,000 students a year indicate their school preferences from a wide-ranging choice of programs. At the heart of these reforms lie 123 small, academically nonselective public high schools for students in grades 9 through 12. These "small schools of choice" (SSCs) — a name coined by the authors of this report to highlight the fact that students at any academic level could choose to attend them — are located in historically disadvantaged communities and were intended to be viable alternatives to the neighborhood high schools that were closing. This report presents the findings of the first large-scale, rigorous evaluation of that reform effort.

What was the exact nature of the reform? It was rooted in the small schools movement, but it went further. SSCs are more than just *small.* They were authorized through a demanding and competitive proposal process that was designed to encourage and enable a range of on-the-ground stakeholders with innovative ideas — from educators to school reform intermediary organizations — to start new schools. The result was an emphasis on features that offered support to disadvantaged and traditionally underserved students, such as reduced teacher load and common planning time as a way to ensure that all students were known well and to promote strong, sustained relationships between students and faculty. Each SSC also received start-up funding as well as assistance and policy support from the district and other key players to facilitate leadership development, hiring, and implementation. In short, these schools were the product of a bottom-up, not a top-down, process.

MDRC's unusually large and rigorous study takes advantage of a lottery-like system that New York City uses to assign students when the high schools they choose are oversubscribed. The findings show that it is possible, in a relatively short span of time, to replace a large number of underperforming public high schools in a poor urban community and, in the process, achieve significant gains in students' academic achievement and attainment. And those gains are seen among a large and diverse group of students — including students who entered the ninth grade far below grade level and male students of color, for whom such gains have been stubbornly elusive.

While debates continue over test score differences and whether they can accurately predict progression through high school and success later in life — despite little compelling evidence that scores alone can be relied upon to make such predictions — the reform effort that is the subject of this report has led to actual improvements in measures that point directly to increased attainment, graduation rates, and college-readiness: increases in attendance rates, in the number of credits earned from grade to grade over four years of high school, in high school graduation rates, in earning the New York State Regents diploma, and in achieving Regents scores in English that enable entry into the City University of New York. If the quality of the evidence presented here is rare, the results are rarer still. No comparable evidence has been produced to date for any other major educational reform effort.

Notably, New York City's reform effort represented a partnership among a diverse group of people and agencies: Mayor Michael Bloomberg, Schools Chancellor Joel Klein, the NYC Department of Education, a consortium of philanthropies, the teachers and principals unions, nonprofit intermediaries, and community groups. It took enormous courage and conviction, and years of unrelenting toil, for this group of people with diverging perspectives to tackle the problem of failing high schools. The logistics alone of simultaneously closing and opening schools at this scale are daunting to contemplate, making the results all the more impressive.

With the nation's attention focused squarely on turning around failing urban high schools, this study demonstrates that it is possible to achieve meaningful changes at scale within a large, urban public school system. We look forward to following the story of the students in New York City's small schools of choice to learn whether these gains grow as additional cohorts of students progress through their final year of high school, and whether the gains translate into success in postsecondary education and the labor market.

Gordon Berlin
President
MDRC

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This study would not have been possible without the support of the New York City Department of Education (DOE), which over the course of this project has demonstrated a tremendous commitment to learning about the effects of its reform agenda. We especially want to recognize DOE Chancellor Joel Klein; Michele Cahill, in her former role as Senior Counselor to the Chancellor for Education Policy; and Garth Harries, in his former role as Chief Executive of Portfolio Development, for providing early guidance and support for this study, as well as providing the access and information that seeded the past three years of research. We thank Jennifer Bell-Ellwanger for coordinating the DOE's involvement. We owe a debt to the former and current staff of the Office of Student Enrollment, including Elizabeth Sciabarra, Evaristo Jimenez, Jesse Margolis, and Hussham Khan, who helped build our understanding of the district's high school choice process for the purposes of rigorous study. Additionally, we are grateful to the many staff who provided data, input, and suggestions at different stages of the project, including Eric Nadelstern, Shael Polakow-Suransky, John White, Thomas Gold, Douglas Jaffe, Brianna Moore, and Dominique West.

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The Authors

Executive Summary

Over the last decade, New York City has been the site of a systemwide high school reform effort that is unprecedented in its scope and pace. Since 2002, the school district has closed more than 20 failing high schools, opened more than 200 new secondary schools, and implemented a centralized high school admission process in which approximately 80,000 students a year indicate their school preferences from a wide-ranging choice of programs.

At the heart of these reforms lie the new schools that in this report are called "small schools of choice" (SSCs) — small, academically nonselective, public high schools that were opened between 2002 and 2008. Serving approximately 100 students per grade in grades 9 through 12 and open to students at all levels of academic achievement, the SSCs in this study were created to serve the district's most disadvantaged and historically underserved students. Prior to the 2002-2003 school year, these students would have had little option but to enroll in one of the city's large, zoned high schools when they made the transition from eighth to ninth grade. Many of the large schools were low-performing, with graduation rates below 50 percent.

This report presents encouraging findings from an unusually large and rigorous study, supported by the Bill & Melinda Gates Foundation, of the effects of SSCs on students' academic achievement in high school. It emerges at a moment when policymakers, practitioners, and researchers have identified the high school years as the point of greatest weakness within the education pipeline. The rationale for this collective focus is clear: far too many students drop out of high school, and the consequences of entering adult life without a high school diploma are increasingly grave. Amid a national call for change and a dearth of effective responses, the findings presented in this report provide clear and reliable evidence that:

- In roughly six years, it is possible to create a large system of small public high schools that markedly improve graduation prospects for many of the disadvantaged students who choose to attend these schools.
- In the schools being evaluated, positive effects on students' progress toward high school graduation become apparent as early as the ninth grade and are sustained during the next two years; by the end of four years of high school, these effects culminate in higher rates of graduation.
- These positive effects are experienced by a broad range of students who differ in terms of their demographic characteristics, economic circumstances, and academic preparation. It is particularly noteworthy that the benefits of small schools extend to male high school students of color, whose educational prospects have been historically difficult to improve.

This executive summary describes these findings and identifies their key implications for policy, practice, and knowledge-building.

What Are Small Schools of Choice?

The New York City public school system is the largest in the United States, with over 1.1 million students enrolled in more than 1,600 schools. Over the past decade, it has been the site of an ambitious effort to reform the high school system, of which the creation of SSCs was a central part. Beginning in 2002, the New York City Department of Education (DOE) accelerated and expanded efforts that had been under way since the mid-1990s to close large, low-performing schools and open new small schools in their stead. These reform efforts were supported by a consortium of funders led by the Bill & Melinda Gates Foundation — which ultimately invested over $150 million in New York City[1] — and were implemented in partnership with the teachers and principals unions.[2] The resulting changes in the high school landscape transpired with unprecedented scale and rapidity. By 2008, 23 high schools with graduation rates below 45 percent had been targeted for closure, and 216 new small schools, of which 123 were SSCs, had been opened.

While the district established a variety of small school models (shown in Box ES.1), ranging from transfer schools designed to serve students who had struggled in conventional high schools to specialized schools intended to serve the district's highest-performing students, the predominant model was the small school of choice,[3] which, notably among the other school types, was academically nonselective and small not only in size but also in function. That is, structures such as reduced teacher load and common planning time (in which teachers meet together to discuss their students' progress and problems) were recommended to ensure that all students were known well and to promote strong, sustained relationships between students and teachers. SSCs also had four other essential features:

- SSCs were predominantly located in disadvantaged communities whose neighborhood high schools were closing.

[1]The Gates Foundation supported the DOE's new school creation efforts in partnership with the Carnegie Corporation of New York and the Open Society Institute, and other systemwide initiatives benefited from at least $230 million worth of funding from philanthropies including the Wallace Foundation, the Michael & Susan Dell Foundation, and the Eli and Edythe Broad Foundation. Quint, Smith, Unterman, and Moedano (2010) provides a history of small schools in New York City, including the efforts undertaken by New Visions for Public Schools — which launched the New Century High Schools Initiative — that immediately preceded and served as the model for the school creation efforts under the Bloomberg/Klein administration.

[2]New Visions for Public Schools (2005).

[3]"Choice" in "small schools of choice," a term coined by the researchers, is meant to emphasize the fact that these nonselective schools are accessible to students of all academic levels.

New York City Small Schools of Choice

Box ES.1

Types of New Small Schools Opened Between 2002 and 2008

General high schools offer a standard core curriculum in addition to elective courses and serve students at various levels of academic ability in grades 9-12.

- **Small schools of choice (SSCs)** are both small and academically nonselective (123 opened by the 2008-2009 school year).
- **Other general high schools** are small and academically selective (38 opened by the 2008-2009 school year).

Transfer schools are small, personalized, full-time schools designed to help overage and undercredited students overcome obstacles to graduation (21 opened by the 2008-2009 school year).

Middle/high schools, typically serving grades 6-12 or 7-12, are intended to support students' transition from middle to high school by enabling them to maintain relationships with familiar staff members and stay within familiar surroundings (33 opened by the 2008-2009 school year).

Specialized high schools serve students who are high-performing academically and/or artistically. Admission usually depends on the student's score on the Specialized High Schools Admissions Test, taken during eighth grade (1 opened by the 2008-2009 school year).

SOURCE: MDRC calculations use High School Application Processing System data from 2004-2005 to 2007-2008 and school-level administrative records provided by the DOE for the 2002-2003 to 2008-2009 school years.

- SSCs were established via a demanding and competitive proposal process that emphasized the common design principles of *academic rigor, personalization,* and *community partnerships*. This process required a prospective school leadership team to articulate an educational philosophy and demonstrate how it would motivate teachers, community members, and partner organizations around it. Additionally, the new school leadership had to develop a viable improvement strategy from the ground up.
- SSCs benefited from an infusion of outside resources: new principals and teachers, partnerships with intermediary organizations that had expertise in starting new schools, and start-up funding from the district and its philanthropic partners.

- SSCs received policy protections during their start-up period, including opening with only one founding grade of students (ninth grade) and having access to supports to facilitate procurement and hiring — such as special training for school principals and teachers; an amendment to the collective bargaining agreement, which gave principals more hiring discretion; and the conversion from a management system of regional offices to one in which schools had greater control over their budgets and educational programs.

How Was the Study Conducted?

In the spring of 2004, the city introduced the High School Application Processing System (HSAPS), a centralized choice process that was to govern the placement of all entering ninth-grade students. HSAPS uses an objective, computer-based process to assign about 72,500 entering ninth-graders annually to about 400 public high schools.[4] When they are in the eighth grade, students who participate in HSAPS indicate, in order of preference, up to 12 high schools they would like to attend. Each year, some schools have more applicants than seats available. When this occurs at an SSC, a lottery is created within HSAPS that randomly determines which students are assigned to that school.

The analysis presented in this report uses data from the high school admissions process to identify a sample of students who chose SSCs, but who — because their chosen SSC had more applicants than seats available — were assigned via lottery either to that school or to a subsequent choice on their list. The analysis includes four annual cohorts of students who entered high school in the fall of 2005, 2006, 2007, and 2008, respectively — a total of 21,085 students who applied to the 105 SSCs that were oversubscribed, and for which lotteries were held, during the study period.

The existence of these lotteries provides an unprecedented opportunity to launch a rigorous study of the effects of this group of schools on student academic achievement, because the lotteries create two randomized groups among students who chose a given SSC — those who won its lottery and were assigned to the SSC and those who lost its lottery and were assigned elsewhere. Future outcomes for these two groups can be compared to obtain valid estimates of the effects of SSCs on student achievement. The lotteries created by HSAPS together with the unusually large size of the randomized sample they produced allow for a high degree of validity and precision in the present analyses. Thus, one can have considerable

[4]Although approximately 80,000 students participate in HSAPS each year, a small percentage of those students do not receive a match and advance to high school through a borough enrollment office instead of through HSAPS. Thus, an average of 72,500 students are *assigned* through HSAPS.

confidence in them. Using these lotteries as the basis for its analysis, this report presents the estimated effects of *enrolling in* a small school of choice versus enrolling in one of the other high schools that are available to the average incoming ninth-grader.[5]

Most of the schools attended by students who did not enroll in an SSC were *older* and *larger* than the SSCs: all SSCs were created since 2002 while two-thirds of the schools attended by the non-SSC enrollees were established before then, and the ninth-grade classes averaged 129 students in SSCs and 635 students in the non-SSC schools.[6] However, it is important to remember that the SSCs are *not* being compared with the large, failing schools they replaced but rather with a wide range of schools that were also operating in a reform-rich atmosphere.

What Are the Effects of Small Schools of Choice?

Making a successful transition *into* high school is a critical step toward graduation. For example, the Consortium on Chicago School Research found that high school students who are on track to graduate by the end of their first year — meaning that they have earned at least 10 credits and are failing no more than one core subject — are three and a half times more likely to graduate in four years than are other students.

The First Three Years of High School

SSCs have a substantial positive impact on the transition into high school during ninth grade, according to data using all four cohorts (see Table ES.1):

- SSC enrollees were 10.8 percentage points more likely than the students who enrolled in other schools to earn 10 or more credits during their first year — 73.1 percent compared with 62.3 percent.
- SSC enrollees were 7.8 percentage points less likely to fail more than one core subject (39 percent compared with 46.8 percent).
- Combining these two indicators, 58.5 percent of SSC enrollees were on track to graduate in four years compared with 48.5 percent of their counterparts who attended a different type of school — a 10 percentage point difference.

[5] As explained in Appendix A, to estimate the effects of enrolling in an SSC, the estimated effects of winning an SSC lottery (see Appendix B) are adjusted to account for the proportion of SSC lottery winners who do not enroll in an SSC and the proportion of control group members who do enroll in an SSC, using a well-known statistical approach called instrumental variables analysis.

[6] While the schools attended by non-SSC enrollees were significantly larger, some of those larger schools (for approximately one-eighth of those students) had structures such as small learning communities in place to increase the level of personalization.

New York City Small Schools of Choice

Table ES.1

Estimated Effects of SSC Enrollment in Years 1 to 4 of High School

Outcome	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Year 1 of high school (cohorts 1 to 4)					
9th-grade on-track indicator[a] (%)	58.5	48.5	10.0 **		0.000
Earned 10 or more credits	73.1	62.3	10.8 **		0.000
Failed more than 1 semester of a core subject	39.0	46.8	-7.8 **		0.000
Total credits earned toward graduation[b]	11.3	10.4	0.9 **	0.21 **	0.000
Total number of student observations = 29,811					
Year 2 of high school (cohorts 1 to 3)					
Earned 20 or more credits (%)	69.4	58.3	11.1 **		0.000
Total credits earned toward graduation[b]	22.3	19.8	2.6 **	0.31 **	0.000
Total number of student observations = 21,822					
Year 3 of high school (cohorts 1 and 2)					
Earned 30 or more credits (%)	69.5	62.4	7.1 **		0.000
Total credits earned toward graduation[b]	32.2	29.7	2.4 **	0.23 **	0.000
Total number of student observations = 13,297					
Year 4 of high school (cohort 1)					
Graduated from high school	68.7	61.9	6.8 *		0.013
Local diploma granted	24.6	21.9	2.8		0.261
Regents diploma granted	39.5	34.6	4.9		0.074
Advanced Regents diploma granted	4.4	5.5	-1.1		0.366
Total number of student observations = 5,363					

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2007-2008, as well as data from New York City Department of Education attendance, course credits, Regents exam, transactional, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]The on-track composite measure indicates whether students earned at least 10 credits in their first year of high school and had no more than one semester of failure in a core subject in that school year (English, math, science, and social studies).

[b]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

- During the first year of high school, SSC enrollees earn almost one full credit more (0.9 credit) toward graduation than do their control group counterparts.

These positive effects on the transition into high school during ninth grade were seen among nearly all subgroups as defined by students' academic proficiency, socioeconomic status, race/ethnicity, and gender. The effects of SSCs for the second year of high school (using data from the first three cohorts) are also positive:

- Among second-year SSC enrollees, 69.4 percent had earned 20 or more credits toward graduation as opposed to 58.3 percent of their counterparts in non-SSC schools — an 11.1 percentage point difference.

- Second-year SSC enrollees had accumulated an average of 22.3 credits toward graduation as opposed to 19.8 credits for their non-SSC counterparts, for a difference of 2.6 credits.

- SSCs continue to increase students' engagement during their second year of high school, as evidenced by the increase in the percentage of students who attend school regularly — that is, at least 90 percent of the time — by 6.2 percentage points (49.0 percent for the non-SSC group compared with 55.2 percent for SSC enrollees).

In the third year of high school, positive effects continue to accumulate (according to data from the first two cohorts):

- SSCs increase the percentage of students earning 30 or more credits by 7.1 percentage points (69.5 percent for SSC enrollees compared with 62.4 percent for the non-SSC group).

- SSCs increase the average number of credits earned toward graduation by 2.4 credits (32.2 credits compared with 29.7 credits).

- SSCs increase average attendance during students' third year of high school by 3.0 percentage points and increase the percentage of students who attend regularly by 8.1 percentage points.

In summary, SSCs consistently improve student academic outcomes during the first three years of high school. The next logical question is: To what extent do these academic gains translate into increased rates of high school graduation?

Effects on Graduation Rates

For the first cohort of students (the only cohort for whom there are four years of follow-up data), the evidence indicates that SSC improvements in students' academic progress and school engagement during the early years of high school translate into higher rates of on-time graduation after four years:

- SSCs increase overall graduation rates by 6.8 percentage points, from 61.9 percent for students who attend schools other than SSCs to 68.7 percent for SSC enrollees.
- A majority of the SSC effect on graduation rates reflects an increase in receipt of New York State Regents diplomas.[7] For this type of diploma, students must pass a series of Regents examinations with a score of 65 points or above and pass all of their required courses.
- SSCs increase the proportion of students (by 5.3 percentage points) who passed the English Regents with a score of 75 points or higher, the threshold for exempting incoming students at the City University of New York from remedial courses. They did not have an effect on math Regents exams.

What Are the Implications of These Findings?

These findings speak to the nation's current focus on high school reform. Much of the national discussion focuses on three areas where the education community has struggled to demonstrate success: (1) improving the academic outcomes of the most disadvantaged students, particularly with respect to high school graduation and college readiness; (2) identifying turnaround strategies for historically underperforming schools; and (3) implementing effective interventions at scale. This study sits at the nexus of all three themes, and its findings demonstrate that, in a relatively short period of time, an effective model can be implemented at scale and can improve the academic trajectories of large numbers of traditionally underserved students.

[7] Although the estimated effect of SSCs on the overall high school graduation rate is statistically significant, estimates of SSC effects on graduation rates by type of diploma ($p = 0.07$) miss the standard of statistical significance established for this study ($p = 0.05$). Thus, comparisons of effects across diploma types are suggestive only. Regents exams are administered to all public high school students in New York State. Students must pass at least five tests in specified subject areas in order to graduate with a diploma that is recognized by the New York State Board of Regents, which sets standards and regulations for all public schools.

The effects of small high schools of choice described in this report should be understood through three important lenses: their scale, the particular package of reforms they represent, and the group of highly disadvantaged students for whom they occurred.

Effecting Change at Scale. At capacity, the 105 SSCs in the study sample will serve over 45,000 students. That is roughly equivalent to the entire high school population of Houston, which is the seventh largest school district in the country. Readers should understand the magnitude of the present report's findings in that context — imagine, *for a school district the size of Houston*, increasing the percentage of ninth-graders who are eligible for on-time promotion by 10.8 percentage points, the percentage of black males in ninth grade who are on track to graduate by 8.5 percentage points, or the percentage of high school graduates by 6.8 percentage points. Given the scale of the SSC initiative, even seemingly minor gains can be understood as affecting thousands of high school students. In fact, the 6.8 percentage point increase in four-year graduation rates is roughly equivalent in size to one-third of New York City's gap in graduation rates between white students and students of color. Additionally, because the reported effects of SSCs are not the product of a small, targeted intervention but rather of a large system of small schools, the effects can be understood as reflecting the mean performance of a model implemented at scale. Reported effects are not the product of the best or most popular of the SSCs, but of 105 schools on average. In other words, the findings represent a *real-world test* of an intervention launched at the scale of a large-sized urban school district.

The SSC Package of Reforms. Students enrolled in SSCs did not just attend schools that were *small*. SSC enrollees attended schools that were purposefully organized around smaller, personalized units of adults and students, where students had a better chance of being known and noticed, and where teachers knew enough about their charges to provide appropriate academic and socioemotional supports. SSCs were not only *new* but were mission-driven. Their recent establishment via a demanding authorization process, which rejected more school proposals than it approved, required that a prospective school leadership team articulate an educational philosophy and demonstrate how it would motivate teachers, community members, and partner organizations around it. And the district's commitment to acting as a steward for new schools throughout the start-up period generated a set of supports and protections as these schools got up and running. Finally, SSCs benefited from an influx of external ideas, talent, and resources.

Serving Disadvantaged Students. SSCs were intended to be a viable and accessible option for the district's most disadvantaged students, and over the course of the study period, they served a population that almost exclusively comprised low-income students of color. The fact that SSCs targeted and served this population gives the reported findings even greater policy significance, as it is precisely economically disadvantaged students of color who find themselves at the bottom end of the nation's persistent achievement gap, and who are least

likely to graduate from high school on time, if at all. Furthermore, the robust positive SSC effects for many different types of students, including young men of color, hold out great hope for educational policymakers, practitioners, and researchers who wish to effect change, by demonstrating that it is possible to transform a large number of high schools in ways that benefit many disadvantaged students.

Interpreting and Using the Findings

The reforms implemented in New York City should be considered as a package of integrated, reinforcing strategies. The effects are not simply the result of closing low-performing schools or of creating SSCs, but rather a purposeful marriage of the two strategies supported by the implementation of several enabling reforms. Decision-makers interested in replicating the district's strategy should devote as much attention to *how* these reforms were operationalized as they do to *what* was conceptualized. Closing the failing schools would likely not have been singularly effective without the intentional creation of a range of viable alternative options to educate the displaced students. Similarly, the creation of new schools would likely not have gained the traction it did without the introduction of a districtwide choice process that motivated previously underserved students and their families to explore their high school options and exercise choice. Thus, while this study provides compelling evidence in support of a particular small school model, that model cannot be understood as existing in isolation but rather as one integral component of a comprehensive and coordinated set of district reforms.

While these results are uniformly encouraging, they are still early. Only one of the cohorts has been followed through four years of high school up to graduation. The full effects of the high school reform initiative in New York City will not begin to be revealed until the remaining three cohorts of students graduate from high school and venture into postsecondary education and the labor market.

Chapter 1

Introduction

Over the last decade, New York City has been the site of a systemwide high school reform effort that is unprecedented in its scope and pace. Since 2002, the school district has closed more than 20 failing high schools, opened hundreds of new secondary schools, and implemented a centralized high school admissions process that serves approximately 80,000 students per year.

At the heart of these reforms lie the new schools that in this report are called "small schools of choice" (SSCs) — small, nonselective, public high schools serving students in grades 9 through 12 that were opened between 2002 and 2008. Serving approximately 100 students per grade and open to students at all levels of academic achievement, the SSCs in this study were created to serve the district's most disadvantaged students. Prior to the 2002-2003 school year, New York City's most disadvantaged public school students had little option but to enroll in one of the city's large, zoned high schools when they made the transition from eighth to ninth grade. Many of those schools were low-performing, with graduation rates below 50 percent.

Supported by the Bill & Melinda Gates Foundation, this report presents very encouraging findings from an unusually large and rigorous study of the effects of SSCs on students' academic achievement in high school. The study benefits from two aspects of the district's systemwide strategy: (1) the unprecedented scale at which SSCs were created, with 123 opening in the six-year period noted above; and (2) the district's simultaneous introduction of a universal high school choice process, which created lotteries for each SSC that was oversubscribed — that is, for schools that did not have enough spaces for all the students who wished to attend them.

The analysis presented in this report uses data from the high school admissions process to identify a sample of students who chose SSCs, but who — because their chosen SSC had more applicants than seats available — were assigned via lottery either to that school or to a subsequent choice on their list.[1] The analysis includes four annual cohorts of students who entered high school in the fall of 2005, 2006, 2007, and 2008 — a total of 21,085 students who applied to 105 oversubscribed SSCs.

The report presents estimates of the effects on students' academic progress of enrolling in a small school of choice relative to what their progress would have been if they had enrolled

[1] In rare instances, students are not assigned to any of the choices they list.

in one of the wide range of other available public high schools in New York City.[2] For the students who constitute the study sample, those other schools were, on average, older and larger.[3] To obtain these estimates, school records data are used to compare the academic progress of students who enroll in SSCs with that of their control-group counterparts who enroll elsewhere. This analysis reveals robust positive effects on students' academic transition into high school, their subsequent progress toward graduation, and their attainment of a high school diploma within four years.

The remainder of this chapter positions these findings by:

- Describing the unique set of implementation conditions that gave rise to SSCs
- Discussing the ways in which this report's analysis of SSCs contributes to the evidence base around the efficacy of small schools
- Presenting a research framework that outlines what was studied, what comparisons were drawn, and how broadly the findings can be generalized

Only in New York

The New York City public school system is the largest in the United States, with over 1.1 million students enrolled in more than 1,600 schools.[4] Over the past decade, it has been the site of an ambitious effort to reform the high school system, of which the creation of SSCs was a central part.

In 2002, newly elected Mayor Michael Bloomberg identified school reform as a priority of his administration, successfully petitioning the New York State legislature to establish mayoral control of the school district,[5] and appointing Joel Klein — a nationally recognized antitrust lawyer — as its chancellor. Beginning in 2002, the New York City Department of Education (DOE) rapidly introduced an ambitious set of reforms organized around the principles of "Leadership, Empowerment, and Accountability," including:

[2]As explained in Appendix A, to estimate the effects of enrolling in an SSC, the estimated effects of winning an SSC lottery are adjusted to account for the proportion of SSC lottery winners who do not enroll in an SSC and the proportion of control group members who do enroll in an SSC, using a well-known statistical approach called instrumental variables analysis.

[3]It is important to remember that the SSCs are *not* being compared with the large, failing schools they replaced.

[4]NYC Department of Education (2010a).

[5]Prior to 2003, district governance responsibilities were divided among the mayor, an appointed Board of Education, and 32 locally elected school boards.

- The founding of a training institute for school principals, known as the NYC Leadership Academy, and the expansion of an analogous program for teachers, known as the NYC Teaching Fellows, intended to both attract and train nontraditional educators to serve in DOE schools[6]

- An amendment to the collective bargaining agreement, which eliminated the prevailing hiring policy that compelled principals to hire teachers with seniority in favor of a policy that gave them more discretion[7]

- The conversion from a management system of regional offices responsible for school governance, curricular mandates, and budget allocation to one in which schools had greater control over their budgets and educational programs, and were responsible for contracting with their choice of "School Support Organization" to purchase core services[8]

Together, these systemwide changes, which provide the policy backdrop for the high school reforms described below, signaled a shift in responsibility for decisions about budget, staffing, and instruction away from district offices to the schools themselves.

In an effort to address its persistently low four-year graduation rate, which had hovered around 50 percent for more than a decade,[9] the district implemented a particularly ambitious set of changes at the high school level. The impetus for and scope of those reforms are detailed at length in a companion report that identifies two key dimensions of the district's efforts: (1) an overhaul of the stock of existing high schools through the closure of some high schools and the creation of others, and (2) the implementation of a centralized high school choice process for all rising ninth-graders.[10]

While the changes had systemwide implications, they were specifically intended to benefit the district's most academically and socioeconomically disadvantaged students, who, as noted earlier, had historically been served by a limited and often low-performing set of high schools.

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[6]By the 2008-2009 school year, graduates of the NYC Leadership Academy represented 13 percent of New York City public school principals, and graduates of the NYC Teaching Fellows represented 11 percent of teachers. See NYC Leadership Academy (n.d.) and NYC Teaching Fellows (n.d.).

[7]Daly, Keeling, Grainger, and Grundies (2008).

[8]Beginning in 2007-2008, principals were able to choose their school's School Support Organizations. These organizations provide many of the same services and supports that were historically provided by the New York City Department of Education through its regional offices.

[9]Between 1992 and 2002, New York City Department of Education graduation rates ranged from 48-51 percent. See NYC Department of Education (2010b).

[10]Quint, Smith, Unterman, and Moedano (2010).

A Changed Set of High School Options

Beginning in 2002, the DOE accelerated and expanded efforts that had been under way in the city since the mid-1990s to close low-performing schools and open new small schools in their stead.[11] The chancellor's reform efforts were supported by a consortium of funders led by the Bill & Melinda Gates Foundation — which ultimately invested over $150 million in New York City[12] — and were implemented in partnership with the teachers and principals unions.[13] The resulting changes in the high school landscape transpired with unprecedented scale and rapidity. By 2008, 23 dysfunctional high schools — defined as those with graduation rates below 45 percent — had been targeted for closure,[14] and 216 new small schools had been opened.

Box 1.1 describes the range of new small school types that were opened during this period. While the district advocated a "portfolio" approach and established a variety of models ranging from transfer schools designed to serve students who had struggled in conventional high schools to specialized schools intended to serve the district's highest-performing students, the predominant model was the small school of choice (SSC):[15] small, nonselective general high schools intended to serve grades 9 to 12 at capacity. As conceived, all of the district's new small schools were intended to provide a range of geographically accessible options for students whose neighborhood high schools were closing. SSCs, which did not impose academic admissions requirements, represented a particularly viable option for those students. SSCs gave preference to students who (1) had geographic priority (usually residing within the same borough as the school), and (2) had attended a school's open house or the school's booth at a school fair,[16] or who were otherwise "known" to the school.

Table 1.1 shows the distribution, by school type, of new small schools and their enrollees between the 2005-2006 and 2008-2009 academic years. The table not only illustrates the

[11]A history of small schools in New York City appears in Quint, Smith, Unterman, and Moedano (2010), including the efforts undertaken by New Visions for Public Schools — which launched the New Century High Schools initiative — that immediately preceded and served as the model for the school creation efforts under the Bloomberg/Klein administration. Similarly, the report notes that of the 23 schools closed between 2002 and 2008, three had been identified prior to that time period.

[12]The Gates Foundation supported the DOE's new school creation efforts in partnership with the Carnegie Corporation of New York and the Open Society Institute, and other systemwide initiatives benefited from more than $230 million worth of funding from philanthropies including the Wallace Foundation, the Michael & Susan Dell Foundation, and the Eli and Edythe Broad Foundation. See Quint, Smith, Unterman, and Moedano (2010) and NYC Department of Education Fund for Public Schools (n.d.).

[13]New Visions for Public Schools (2005).

[14]Schools targeted for closure were typically phased out by ceasing admission of first-time freshmen but allowing enrolled students to advance through the upper grades. See Quint, Smith, Unterman, and Moedano (2010).

[15]The "of choice" in "small schools of choice," a term coined by the researchers, is meant to emphasize the fact that these nonselective schools are accessible to students of all academic levels.

[16]New York City holds several city and boroughwide school fairs to give students an opportunity to talk with representatives of the city's public schools and learn about their programs.

Box 1.1

Types of New Small Schools Opened Between 2002 and 2008

General high schools offer a standard core curriculum in addition to elective courses and serve students at various levels of academic ability in grades 9-12.

- **Small schools of choice (SSCs)** are both small and academically nonselective (123 opened by the 2008-2009 school year).
- **Other general high schools** are small and academically selective (38 opened by the 2008-2009 school year).

Transfer schools are small, personalized, full-time schools designed to help overage and undercredited students overcome obstacles to graduation (21 opened by the 2008-2009 school year).

Middle/high schools, which typically serve grades 6-12 or 7-12, are intended to support students' transition from middle to high school by enabling them to maintain relationships with familiar staff members and stay within familiar surroundings (33 opened by the 2008-2009 school year).

Specialized high schools serve students who are high-performing academically and/or artistically. Admission usually depends on a student's score on the Specialized High Schools Admissions Test (SHSAT), which is taken during a student's eighth-grade year (1 opened by the 2008-2009 school year).

SOURCE: Quint, Smith, Unterman, and Moedano (2010). MDRC calculations use High School Application Processing System data from 2004-2005 to 2007-2008 and school-level administrative records provided by the DOE for the 2002-2003 to 2008-2009 school years.

pace and magnitude of the district's school creation efforts (the 216 new small secondary schools that had opened by 2008-2009 served 17,682 students), but also demonstrates the prevalence of the nonselective SSCs, which by 2008-2009 numbered 123 and served 12,448 first-time ninth-graders (70 percent of those served by all new small schools).

The SSCs were not just small and nonselective; they also shared four essential features with the other new small schools that were founded during this period:

1. They were predominantly located in disadvantaged communities whose neighborhood high schools were closing.

New York City Small Schools of Choice

Table 1.1

Number of New Small Schools and Their First-Time Ninth-Grade Student Enrollment, by School Type

School Type	Number of Schools				Number of First-Time 9th-Graders Enrolled			
	2005-2006	2006-2007	2007-2008	2008-2009	2005-2006	2006-2007	2007-2008	2008-2009
NYC Department of Education (DOE) New Small Schools								
Transfer[a]	8	9	14	21	--	--	--	--
Middle/high schools	17	21	27	33	1,382	1,760	2,314	2,570
High schools	102	117	137	162	10,666	12,307	13,323	15,112
Specialized high schools	0	1	1	1	0	65	37	90
General high schools	102	116	136	161	10,666	12,242	13,286	15,022
SSCs	85	96	110	123	8,869	10,219	11,347	12,448
Total number of schools or students	127	147	178	216	12,048	14,067	15,637	17,682

SOURCES: MDRC calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2007-2008, data from New York City Department of Education (DOE) enrollment files for the 2005-2006 to 2008-2009 school years, and school-level administrative records provided by the DOE for the 2002-2003 to 2008-2009 school years.

NOTES: Rounding may cause discrepancies in sums and differences.

Previous year's enrollment files were used to determine whether or not a student was a first-time ninth-grader.

[a]Transfer schools serve students who have been previously enrolled in a traditional high school, and are thus not intended to serve first-time ninth-grade students. Enrollment numbers are therefore not provided for this school type.

2. They were authorized through a demanding competitive proposal process that emphasized the common design principles of *academic rigor*, *personalization*, and *community partnerships*.

3. They benefited from an infusion of outside resources: new principals and teachers, partnerships with intermediary organizations, and start-up funding from the district and its philanthropic partners.

4. They received policy protections during their start-up period.

A Focus on Historically Underserved Communities

During the period under study, the closure of underperforming schools and the opening of new small schools were concentrated in the city's poorest boroughs — Brooklyn and the Bronx. Nineteen of the 23 large high schools that were closed by 2008 and 128 of the 216 new small secondary schools that opened were located in those two boroughs. Figure 1.1 illustrates the student population shift in Brooklyn and the Bronx as of the 2007-2008 school year at the 19 closed high schools and the 128 new small schools that were open at that point.[17] By 2007, those 128 schools served 38,922 students across grades 9-12 (with the 85 SSCs among them serving 28,016). The number of students served by the new small schools actually exceeds the 36,892 students whom the large closing schools had served six years earlier.

A Rigorous Planning Process and Common Design Principles

As noted above, the new small schools were authorized through a competitive proposal process that emphasized three core elements:[18]

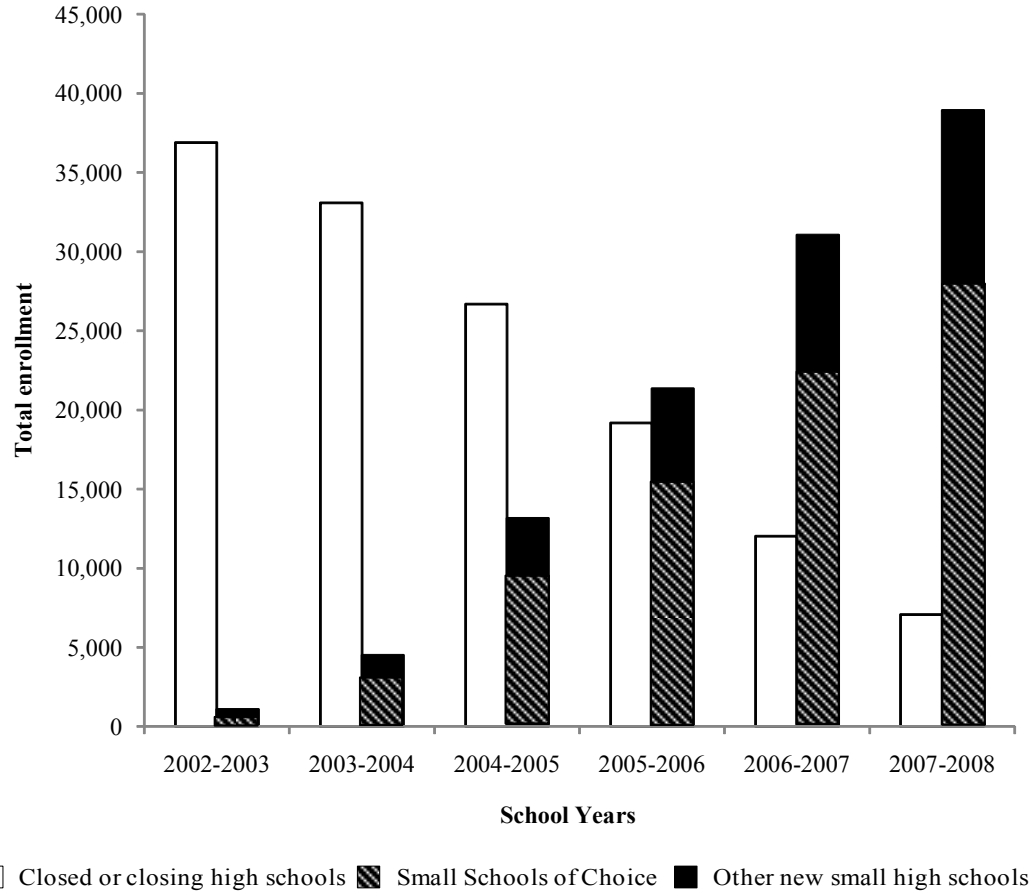
- **Academic Rigor.** Schools were expected to set high expectations for students and to offer a standards-based curriculum aligned with New York State graduation requirements. In fact, schools were encouraged to develop college-ready standards that exceeded basic graduation requirements and emphasized higher-order skills such as critical thinking.

[17]Figure 1.1 provides whole school enrollment information (grades 9-12) for the 2002-2003 school year through the 2007-2008 school year. In order to provide data for the years prior to the period of the present study, the authors rely on New York State school-level data, which were only available through the 2007-2008 school year at the time of publication. Thus, unlike other references in this analysis, the figure does not include the 2008-2009 school year.

[18]Quint, Smith, Unterman, and Moedano (2010).

Figure 1.1

Student Enrollment in Closing High Schools, Small Schools of Choice, and Other New Small Schools in Brooklyn and the Bronx



SOURCE: MDRC calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2007-2008, as well as New York State Report Card and school-level administrative records provided by the New York City Department of Education for school years 2002-2003 through 2007-2008.

NOTE: The figure presents whole school enrollment numbers corresponding to the following counts of schools in Brooklyn and the Bronx:19 schools that ceased admitting new ninth-grade students between the 2002-2003 and 2007-2008 school years, 85 small schools of choice, and 43 other new small schools.

- **Personalization.** Schools were to be small not only in size but also in function. Structures such as "Advisory,"[19] reduced teacher load, and common planning time (in which teachers meet together to discuss their students' progress and problems) were recommended to ensure that all students were known well and to promote strong, sustained relationships between students and teachers.

- **Community Partnerships.** The majority of new small schools were theme-based, with their curriculum organized around a theme such as business or law. Through partnerships with business and community partners, schools were intended to offer learning opportunities outside the classroom and to infuse classroom instruction with relevant real-world examples. Partners were expected to bolster school capacity in areas ranging from curriculum and instruction to youth development and community outreach.

An Infusion of External Resources

The new small schools were started from scratch, fueled by new ideas, talent, and capital that came from sources beyond the school district.

- The new small schools were founded by teams of teachers and administrators that had self-affiliated and participated in a rigorous planning and proposal process in order to win school approval. These planning teams developed the mission and vision for each new school as well as the planned curriculum and student services.

- Teams were encouraged to involve community partners, and the majority did so. While these partners were sometimes small community-based organizations, they were more likely to be established education intermediaries — nonprofit organizations that served both as fiscal agents for distributing grant funds to schools and as central sources of experience and technical support related to the creation and operation of small schools. Most of these intermediary organizations received funding from the Bill & Melinda Gates Foundation to start schools in New York City, and the large majority had started new schools before receiving Gates funding to do so. Once the new small schools

[19] "Advisory" (also known as "Family Group") is a counseling model whereby teachers, administrators, and other adults in the building act as "advisors" to small groups of students, with whom they meet as part of the regular schedule to address academic and socioemotional issues.

were open, intermediaries were charged with providing ongoing technical assistance, largely in the areas of leadership development, instructional support, and college-readiness services.

- Finally, new small schools were provided with start-up grants to support costs associated with implementation. Those schools that were affiliated with Gates-funded intermediaries received four- or five-year grants averaging $400,000 per school. Other new small schools received supplemental grants directly from the DOE.

Support for Start-up

As noted earlier, the district's efforts to create new small schools was informed by previous local school creation efforts. The implementation challenges that had been experienced historically were well documented, and district planners put several measures in place to buffer and support this wave of new small schools from similar pitfalls during their nascent years:

- Schools opened with only one founding grade of students (ninth grade), gradually phasing in by admitting an additional cohort each year until reaching capacity for all four grades of a standard high school curriculum.
- New small schools that opened between 2002 and 2007 were not required to serve English language learners or special education students in their first two years of start-up operations while internal capacity was still being built.[20]
- District offices that were devoted to new school support were intended to facilitate procurement and hiring issues (which were difficult logistically because the schools were new administrative entities) and to support issues related to school facilities and shared campuses.

In summary, between 2002 and 2008, the district established more than 200 new small schools, which were distinguished by several key features beyond their size. Over the course of that period, SSCs — academically nonselective small schools serving mostly disadvantaged students in grades 9 through 12 — emerged as a prevalent and established school model, particularly in those communities that had previously been served by the large zoned high schools.

[20]By their third year of operations, schools that opened between 2002 and 2007 were required to admit students with special needs. Schools that opened in 2008 or later were expected to serve students with special needs from their inception.

Choice for All

Concurrent with the change in the *supply* of high school options, the DOE overhauled the process by which students express *demand* for those schools. Historically, high school admission was managed through an uncoordinated set of processes in which some families were able to exercise choice over the high schools attended because they were informed about the options that were available to them and because they were able to successfully fulfill admissions criteria. However, many students — especially those in disadvantaged communities — were enrolled into their neighborhood high school as a matter of course. Then, in the 2003-2004 academic year (for students slated to enter high school in fall 2004), the city introduced the High School Application Processing System (HSAPS), a centralized choice process that was to govern the placement of all entering ninth-grade students.

Box 1.2 details the features that distinguished HSAPS from its antecedent. Notably, the new process was intended to compel *all* rising ninth-graders to exercise choice (by requiring that they each select up to 12 high schools) and to render admissions decisions in an objective and standardized manner. HSAPS used a computer-based algorithm to match student choices against school eligibility criteria in order to produce a single assignment for every participant.

Figure 1.2 illustrates the channels by which students move from eighth to ninth grade since the introduction of HSAPS. Table 1.2 presents HSAPS participation rates over the course of the study period. Viewed together, Figure 1.2 and Table 1.2 illustrate several key operational outcomes associated with the implementation of HSAPS.

In terms of *efficacy:*

- The process functions at an unprecedented scale, averaging just under 80,000 participants each year between the 2004-2005 and 2007-2008 school years.
- HSAPS produced an offer for the vast majority of participants — 91 percent, on average — and most students are matched to one of their top three choices, at a rate that increased from 65.7 percent in 2005 to 78.2 percent in 2008. In other words, on average, approximately 72,500 students are assigned to high school via HSAPS each year.

In terms of *participation:*

- Among those enrolled in eighth grade, there was near-universal participation, with 92 percent of DOE eighth-graders participating on average.

New York City Small Schools of Choice

Box 1.2

Key Differences Between New York City's High School Application Processing System (HSAPS) and the System It Replaced

- **HSAPS involves all students.** In the previous system, participation was voluntary, which resulted in a self-selected applicant pool that represented more sophisticated students and parents. Under HSAPS, all rising ninth-graders are required to exercise choice by submitting an application listing up to 12 high school programs. The city launched extensive public outreach efforts to inform students and parents of their options, publishing informational materials in languages ranging from Creole to Urdu, distributing a phone book-sized high school directory (and an online analog) with information about every high school program in the district, and hosting multi-day high school fairs where representatives from every high school in the city provide information about their programs to tens of thousands of students and families.
- **HSAPS sets standards for all schools.** Previously, despite a nominally "centralized" process, schools often had widely varying application requirements and deadlines, and rendered admissions decisions independently. As part of the new system, an Office of Student Enrollment was established to standardize the steps of the admissions process across many different types of schools, and to funnel all applications and admissions decisions through the centralized HSAPS system.
- **HSAPS guarantees all students a single "offer."** Under the previous system, schools were independent arbiters of their admissions. As a result, some participants (often high-performing students) received offers from multiple schools while others received none. Other unaware or unmotivated students didn't participate at all and were often siphoned into zoned, neighborhood schools. HSAPS was designed to provide every student with a single offer of admission that, barring extenuating circumstances, was intended to be his or her final placement.

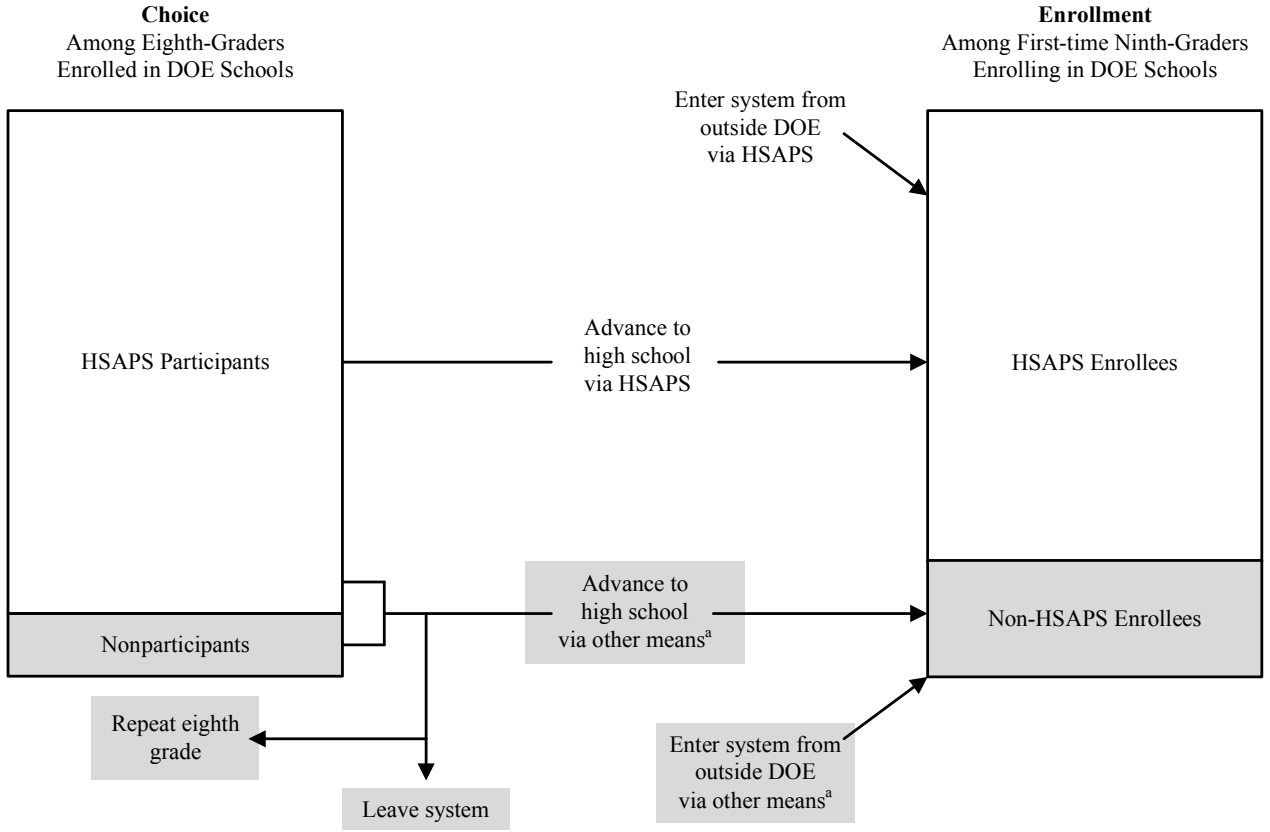
SOURCES: Abdulkadirouglu, Pathak, and Roth (2009); Hemphill and Nauer (2009).

- Among those who enter ninth grade, the vast majority do so via HSAPS — on average, 86 percent of all first-time students (including those who arrive new to the system and may not have had the opportunity to participate) and 97 percent of those first-time students advancing from DOE middle schools.

Together, these statistics demonstrate that the DOE was able to successfully implement a districtwide choice process that operated at scale and achieved its primary objective of producing

Figure 1.2

Student Flow from Eighth-Grade Choice to Ninth-Grade Enrollment Among Students Enrolled in DOE Schools



NOTES: DOE = New York City Department of Education. HSAPS = High School Admissions Processing System.

[a]A student may move into the district or transfer from a parochial school, for example, after the HSAPS process has concluded, or may not receive a match via HSAPS. In those instances, a student enrolls through a borough enrollment office.

New York City Small Schools of Choice

Table 1.2

HSAPS Participation Patterns by Year

Students	2005	2006	2007	2008
General participation				
Total number of HSAPS participants (including students not enrolled in DOE schools)	81,643	82,464	77,999	75,577
Percent of all 8th-grade participants receiving a match	89.9	89.2	93.0	93.2
Percent of all 8th-grade participants matched to choice 1-3	65.7	71.4	73.8	78.2
Participation among students enrolled in DOE schools				
At the point of 8th-grade choice (spring)				
Total number of 8th-graders	84,774	83,122	80,912	78,984
Percent of all 8th-graders who participate	91.8	92.9	92.8	92.0
At the point of 9th-grade enrollment (fall)				
Total number of first-time 9th-graders	84,191	81,945	80,212	78,209
Percent of all first-time 9th-graders who participated	85.1	86.3	86.0	85.5
Total number of first-time 9th-graders advancing from DOE schools	72,311	70,728	69,580	67,417
Percent of all first-time 9th-graders advancing from DOE schools who participated	96.2	97.2	96.7	96.9

SOURCES: MDRC's calculations use High School Application Processing System (HSAPS) data from eighth-graders in 2004-2005 to 2007-2008, as well as data from New York City Department of Education (DOE) enrollment files from the 2005-2006 to 2008-2009 school years.

a high school placement for nearly every student. By 2008, the last year of the study period, HSAPS processed applications for 75,577 students and matched nearly 80 percent of them to one of their top three choices. No longer was "choice" the exclusive territory of informed parents and students; it was now the modus operandi for almost all rising ninth-graders in New York City.

Contributing to the Evidence Base Around Small Schools

Among many reforms that have been suggested to improve secondary education, the notion of small schools has held a singular appeal to school districts, policymakers, and philanthropists. Reports estimate that nearly every major American urban district, and all but four states in the country, have undertaken efforts to create new small schools or to transform large schools into campuses of "small learning communities" (SLCs) — cohorts of students who take

their core classes together with the same group of teachers.[21] Spurred by an infusion of resources from private funders and government sources, the movement to make high schools smaller has gained traction at the federal, state, and local levels.

The national movement to create small schools had grassroots beginnings as early as the 1960s, when urban educators and community organizations began implementing smaller school structures as an alternative to the large high schools that dominated the landscape, many of which were failing. Notable among early small school initiatives were two based in New York City that served as precursors to the SSCs in this analysis: (1) the school creation work in East Harlem's District 4 in the late-1970s and 1980s, where the introduction of several small secondary schools (including Deborah Meier's Central Park East Secondary School) as "choice-based" alternatives to the neighborhood zoned schools was credited with improved student outcomes among the district's largely at-risk student body; and (2) the Annenberg-sponsored work during the 1990s, through which campuses of wall-to-wall small schools were created to replace large, comprehensive high schools.

By the late 1990s, small schools had emerged as a national reform strategy championed by affinity groups (such as the Coalition of Essential Schools and the Small Schools Workshop) and professional organizations (such as the National Association of Secondary School Principals), and proliferated through district and foundation-led initiatives in several major cities — including Chicago, Philadelphia, Boston, and Oakland in addition to New York. In 2000, the Bill & Melinda Gates Foundation launched a national campaign to improve failing urban high schools, with small schools as its centerpiece.[22] Within four years, the Gates Foundation had granted $735 million toward small school creation (or conversion) efforts at 1,500 high schools.[23] Thus, by the first decade of the twenty-first century, the small school approach that had begun as a "quiet revolution"[24] in mostly poor, minority communities was being pursued as a scalable reform strategy by the largest education reform funder in recent American history.

Despite small schools' growing popularity and widespread implementation, there is a dearth of reliable and consistent information about their effectiveness. Much of the literature about small schools converges around a common theory of change whereby smaller school size promotes stronger and more multidimensional relationships between students and adults. These

[21]Many large schools across the country have been restructured into SLCs as a means of fostering a more personalized environment and stronger bonds between students and their teachers. By 2008, 46 of 50 states and the District of Columbia had received multimillion-dollar federal SLC grants. See U.S. Department of Education (n.d.).

[22]While the Gates Foundation's stated goal was to support the creation of schools that possessed seven "Attributes of High Performing Schools," it was the structural focus on school size (not to exceed 100 students per grade) that became the foundation's grant-making hallmark. See Evan et al. (2006).

[23]Miner (2005).

[24]Fine (2005).

enhanced relationships, in turn, produce increased levels of student engagement and better position teachers to identify and respond to students' academic and social needs.[25]

Research on small schools suggests that they can produce effects on key outcomes, including higher levels of student achievement and lower dropout rates.[26] Some literature suggests that these effects are most pronounced among disadvantaged students.[27] While a full review of the literature is beyond the scope of this report, the voluminous amount of research on the subject of small schools is a testament to the educational community's interest in the model.[28] Unfortunately, given the nonexperimental nature of this research, the studies cannot establish a causal link between small schools and impacts on student outcomes.

Studying New York City's Small Schools of Choice

The unique set of conditions that have existed in New York City over the past decade provide researchers with the opportunity to launch a study that overcomes two limitations of prior work:

- The analysis takes advantage of the lotteries created within the high school admissions process to identify a valid comparison for measuring the effects of SSC enrollment on student achievement.
- The scale of the district's reforms provided an unusually large sample — 105 schools and more than 20,000 students — constituting a representative sample of a large-scale district reform.

The primary research question of the present study is: What effects do small schools of choice have on students' transition into high school, their progress toward graduation, and their ability to graduate from high school compared with what these outcomes would have been had students enrolled in high school elsewhere?

To answer this question, it is important to restate the basic premise of the research design: In instances where SSCs have more available applicants than seats, HSAPS creates school lotteries to render admission decisions.[29] Researchers compare the academic progress of

[25]See Finn and Voelkl (1993); Lee and Loeb (2000); Wasley et al. (2000); Klem and Connell (2004).

[26]For student achievement, see Haller, Monk, and Tien (1993); Howley (1989); Howley and Huang (1991); Lee and Smith (1997). For dropout rates, see Pittman and Haughwout (1987); McMullen, Sipe, and Wolf (1994).

[27]See Lee and Smith (1993); Lee and Smith (1995); Lee and Smith (1997).

[28]See the Bibliography at the end of this report for selected works on small schools in New York City.

[29]In order to be oversubscribed for lottery purposes, an SSC must have more available applicants (who have not already been matched to one of their prior school choices) than seats. Thus, some schools that appear to have

(continued)

students who win these lotteries and attend an SSC with that of their control group counterparts who enroll elsewhere.[30]

Recall, too, that SSCs are *more* than just small, stand-alone institutions serving ninth- through twelfth-graders that do not screen students based on their prior academic achievement. While structurally similar to the thousands of small high schools that now exist across the country, SSCs have the other distinctive features described in detail earlier:

- They serve a concentration of highly disadvantaged students.
- They are not only small in overall size but are organized to have smaller, more personalized units in which teachers work together and students see a smaller number of teachers over a given period of time.
- They were created through a structured and demanding process that mobilized teachers, principals, and partner organizations. Many of the teachers and principals were new to the system, and the majority of schools were founded in partnership with intermediary organizations that had experience opening new schools.
- They received policy protections and a range of supports from the district during their start-up phase.

In addition, SSCs were created amidst an evolving high school reform landscape, which has implications for the comparison drawn in this study. By 2008, a student entering high school through HSAPS could choose from over 400 schools, representing a wide range of options in terms of their sizes, themes, academic programs, and extracurricular offerings. Those students who chose SSCs but were randomized elsewhere ultimately enrolled in schools that, while generally larger and older than the SSCs, varied along many other dimensions (including theme and organizational structure, for example). Thus, this study does not provide a direct comparison of small schools to large schools or of the SSCs to the failing schools they replaced.

Finally, while the natural occurrence of lotteries provides a unique research opportunity, it also defines the schools and students included in the study sample as those who listed an SSC as one of their choices *and* participated in a lottery for that choice. Thus:

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been oversubscribed (for example, a school described in the DOE High School Handbook as having had 500 "total applicants" for 108 "program seats") may not have actually been oversubscribed for the purposes of generating a lottery. See Appendix A for a detailed description of how HSAPS assigns students to SSCs.

[30] As noted earlier and explained in Appendix A, to estimate the effects of enrolling in an SSC, the estimated effects of winning an SSC lottery are adjusted to account for the proportion of SSC lottery winners who do not enroll in an SSC and the proportion of control group members who do enroll in an SSC, using a well-known statistical approach called instrumental variables analysis.

- Although the majority (85 percent) of SSCs had at least one lottery over the course of the study period (in other words, nonlottery schools are the exception to the rule), the present study does not attempt to generalize beyond the schools included in the sample.
- Similarly, while the vast majority of SSC enrollees arrive via HSAPS, this study does not attempt to generalize its findings to non-HSAPS enrollees.

The following chapters present the methodology and results of this analysis. Chapter 2 describes the study design and analysis that was used to generate the present findings. Chapter 3 compares the study SSCs with the schools that were attended by students in the comparison group and presents the estimated effects of enrolling in an SSC on the transition to high school, progress toward graduation, and ultimately graduation rates. Chapter 4 reprises the report's key themes and outlines a learning agenda for future work.

Chapter 2

Research Design and Analysis

As explained in Chapter 1, New York City's High School Application Processing System (HSAPS) has been in place since 2004 to assign students from across the district to high school. Lotteries for "small schools of choice" (SSCs) are a little-known byproduct of that system.[1] To understand the context for this chapter, recall that, unlike the former system, in which better-informed students were most likely to go to the higher-performing schools while less savvy students were often relegated to the city's underperforming schools, HSAPS requires all eighth-graders to indicate, in order of preference, up to 12 high schools that they would like to attend. When an SSC has more applicants than available seats, a randomized, lottery-like process determines which students are assigned to that SSC.[2]

Randomization is useful for evaluating interventions such as SSCs objectively and reliably, in that it allows researchers to compare groups of study participants (the "sample" or "study sample") that differ only in terms of whether they experience the intervention under study (the "treatment group") or do not experience it (the "control group"). In other words, as a group, the study participants start off with the same characteristics, on average — that is, they are truly comparable. At the end of the study period, then, any differences between the two study groups can be reliably attributed to the intervention.

As noted in Chapter 1, the HSAPS system and the SSC lotteries allowed researchers to launch an unusually large and rigorous study. In this evaluation of New York City's SSCs, observed differences in average academic performance and achievement (and other select academic outcomes) between students who win SSC lotteries ("SSC lottery winners" in this report) and students who lose them ("control group members" in this report) are valid estimates of the effects of winning an SSC lottery.[3]

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[1]For the purposes of identifying the study sample, SSCs were defined as high schools that were intended to serve grades 9 through 12 rather than grades 6 through 12 or 7 through 12, were founded in 2002 or later, and used the "limited unscreened" selection method in HSAPS. Schools that use the limited unscreened selection method do not impose academic requirements but instead give preference to students who live within a certain geographic area and have attended a school's open house or the school's booth at a school fair, or who are otherwise "known" to the school.

[2]Abdulkadiroglu et al. (2009) and Hastings, Kane, and Staiger (2006) also base their research on district-wide student assignment processes that create randomized lotteries (in Boston and in Charlotte-Mecklenburg, North Carolina, respectively).

[3]The evaluation research literature refers to the type of validity implied here as "internal validity."

However, the presence of the lotteries also presents two methodological challenges. The challenges arise because a number of students participate in HSAPS lotteries for more than one school on their rank-ordered list of choices. Appendix A describes how these challenges are overcome. The two challenges are as follows:

- **One-fourth of the participants in SSC lotteries lost a lottery for a school that they ranked higher than the SSC in whose lottery they were participating.** For example, a student could lose a lottery for his first-choice school and then be in a lottery for his second-choice school, which is also an SSC. For reasons described in Appendix A, this situation could, in theory, produce pre-existing differences between SSC lottery winners and control group members. In practice, however, there is no observable difference between the two groups.[4] In addition, it is possible to estimate students' probability of winning prior lotteries and thereby control for it statistically. Furthermore, as discussed in Chapter 3, the estimated effect of SSCs for the full study is virtually identical to that for the three-fourths of sample members who were not in a prior lottery.

- **HSAPS can legitimately assign a student who loses a lottery for one SSC to a different SSC.** Thus, losing an SSC lottery does not mean the same thing as not being assigned to an SSC. Consequently, the effect of winning or losing an SSC lottery is not the same as the effect of being assigned or not being assigned to an SSC.[5] Indeed, the effect of winning an SSC lottery does not have a meaningful interpretation. Consequently, all findings in the present study are converted into estimates of something that does have a meaningful (and policy-relevant) interpretation: the effect of enrolling in an SSC.[6] This conversion is based on data for all SSC lottery winners and all control group members. Appendix A describes how it is made and the assumptions upon which it is based.

This chapter is organized into the following sections in order to help readers understand how the findings that follow in Chapter 3 were obtained: (1) how students and SSCs interact with the HSAPS assignment process to create randomized SSC lotteries; (2) how estimates of

[4]If these baseline characteristics were randomized, then unobserved characteristics also should have been randomized.

[5]The effect of being assigned to an intervention or treatment is referred to in the literature as the effect of "intent to treat."

[6]The effect of enrolling in an SSC is an example of what is referred to in the literature as a "local average treatment effect." Students are considered to be enrolled in an SSC if they were enrolled at any time during or before the follow-up year represented by a given analysis.

effects of winning an SSC lottery are obtained from follow-up data for lottery winners and control group members; (3) why and how these estimates are converted into estimated effects of enrolling in an SSC; (4) the sizes of samples used for these analyses and their data availability; (5) the primary sources of data used; and (6) the generalizability of findings obtained. Appendix A provides further detail.

How HSAPS Creates SSC Lotteries

As noted above, HSAPS assignment is based on rank-ordered preferences submitted by all rising ninth-graders for up to 12 high schools. This is how students and their families express school choice. HSAPS assignment is also based on indications from each high school of its priorities for students. Because SSCs do not screen students academically, their priorities are not based on information about students' past performance. Instead, these priorities are based solely on students' geographic proximity and whether or not they are "known" to the SSC (by having contacted it, visited it, or met with one of its representatives). Geographically, most SSCs distinguish only between residents of their borough and all other New York City residents.[7] Within these categories, the highest priority is given to students who both satisfy the school's geographic preference and are known to the school, whereas the lowest priority is given to students who do not carry a geographic preference and are not known to the school.

HSAPS assigns students to schools based on students' choices and schools' priorities. The order in which HSAPS chooses each of the roughly 80,000 participants each year for assignment is determined *randomly*. During the assignment process, as schools begin to fill up, their student priorities begin to take effect. For example, if a student's first choice is already filled with students of higher priority (based on their "known" and geographic status), that student cannot be assigned to that school. Instead, he is assigned to the next school on his list that has available space. Consider what happens each time HSAPS tries to assign a student to a school that is full. If that school gives higher priority to Student A, for example, than to some students who are already assigned there, Student A "bumps" the last student assigned who was the lowest priority for that school (Student B). Student B is then assigned to his or her next-preferred school that has available slots, possibly bumping another student who had been placed there previously. This process continues until HSAPS works through the entire randomly ordered list of incoming students.

A little-known byproduct of *the rules* of HSAPS assignment is a randomized lottery for each SSC that is oversubscribed in a given year. (SSCs that are not oversubscribed in a given

[7]Some SSCs have three geographic priorities: (1) residents of a nearby catchment area, (2) other residents of their borough, and (3) other residents of New York City.

year do not have a lottery for that year.) This is because the "winners" and "losers" in a given lottery are determined solely by the random order in which HSAPS assigns its participants. Students who are assigned early in the process become lottery winners, and students who are assigned later in the process become lottery losers. In this way, eligible and available students are randomly assigned either to the SSC ("lottery winners") or to its control group. A further important feature of each SSC lottery (explained in Appendix A) is that it only involves students from within one of the priority categories described earlier (for example, being both known and fulfilling geographic preference).[8]

In many ways, SSC lotteries are like other lotteries that are used to assign students to schools or, more generally, used to allocate scarce resources to individuals or groups. However, two features of SSC lotteries distinguish them from most others. First, SSC lotteries are "invisible" to the participating students and their parents; they know only that students are assigned to one of their chosen schools, but not how that process occurs. Second, a single student can be in multiple lotteries. For example, a student could lose a lottery for his first-choice SSC and win a lottery for his second-choice SSC (assuming he has indicated more than one SSC in his list of 12). This student is a control group member for the first SSC and a lottery winner for the second SSC. As noted above, Appendix A demonstrates that multiple lottery participation does not pose a threat to the validity of estimated effects of winning an SSC lottery if the analysis properly accounts for this phenomenon.

How Effects of Winning an SSC Lottery Are Estimated

Students who win an SSC lottery are assigned by HSAPS to that SSC. These students are analogous to treatment group members for a medical trial. Students who do not win a particular SSC lottery and are assigned to some other public high school in New York City become control group members for the SSC whose lottery they lost. Differences in mean future outcomes — such as credit accumulation — for lottery winners and control group members, therefore, are valid estimates of the effects of winning an SSC lottery. These estimates are reported in Appendix B and are the *starting point* for the present analysis.

Randomization is crucial for such estimates because in a large sample, randomization creates a "treatment group" (in this case, the SSC lottery winners) and a "control group" (the lottery losers) that are the same at baseline in all ways, observable or not, and can therefore be compared in a meaningful way. In the current study, therefore, any future differences between the two groups must be the result of winning an SSC lottery. Because the sample of students for

[8] A student's level of preference (or rank order) for an SSC does not affect his priority for it. For example, the priority for a student who is in an SSC lottery for his first choice is the same as that for a student who is in the same lottery for his twelfth choice.

a single lottery is typically small, pre-existing differences between its lottery winners and control group members occur by chance. Winners of some lotteries will have stronger average academic backgrounds than will control group members, whereas for other lotteries the reverse will be true. For some lotteries these differences will be large and for other lotteries these differences will be small. Because pre-existing differences occur by chance, their average approaches zero (that is, they amount to essentially *no* differences) when lottery samples are combined because the sample size for all lotteries together is much larger than that for any single lottery.

The full sample for the present study represents 297 SSC lotteries with 12,978 observations on lottery winners and 17,981 observations on control group members who were eighth-grade HSAPS participants in the 2004-2005 through 2007-2008 school years. Because, as noted, some students participate in more than one lottery, the total number of *students* in the full sample (21,085) is less than the total number of student *observations* (30,959).

Table 2.1 provides strong evidence of the baseline equivalence of the present sample of SSC lottery winners and control group members. This table compares the two groups in terms of a number of characteristics that typically predict high school success.[9] The first column in the table reports means for SSC lottery winners. The second column reports means for control group members. The third column reports differences between means for the two groups and the fourth column reports the statistical significance (probability value, or p-value) of these differences — or the probability that an observed difference for a sample could have occurred by chance if there were *no difference* in the population.[10] As can be seen, all differences are quite small and none is statistically significant. Thus, differences in mean future outcomes for SSC lottery winners and their control group counterparts provide valid estimates of the effects of winning an SSC lottery.

Converting Estimated Effects of Winning an SSC Lottery into Estimated Effects of Enrolling in an SSC

The previous section demonstrates that observed differences in average future outcomes for SSC lottery winners and control group members are valid estimates of the effects of winning

[9]Means for SSC lottery winners are computed directly from data for their pooled sample. Means for control group members are computed as weighted averages of means for each SSC lottery, with weights proportional to the number of winners for each lottery. This accounts for differences among lotteries in their ratio of lottery winners to control group members.

[10]Conventional practice (although conventions vary) is to consider a difference statistically significant (and thus real) if its p-value is 0.05 or less.

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Table 2.1

Baseline Characteristics of SSC Lottery Participants: First Year of High School, Cohorts 1 to 4

Characteristic (%)	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value for Estimated Difference
Race/ethnicity				
Hispanic	47.3	47.9	-0.6	0.480
Black	43.6	43.2	0.4	0.641
Other	7.9	7.5	0.3	0.428
Male	46.0	45.5	0.5	0.525
Eligible for free/reduced-price lunch	84.0	84.5	-0.5	0.467
English language learner	8.4	7.6	0.8	0.114
Special education[a]	6.6	6.7	-0.1	0.826
Overage for 8th grade[b]	16.7	18.1	-1.4	0.153
8th-grade reading proficiency[c]				
Did not meet standards (level 1)	6.9	6.6	0.3	0.486
Partially met standards (level 2)	60.5	61.4	-0.8	0.328
Fully met standards (level 3)	28.4	27.6	0.8	0.287
Met standards with distinction (level 4)	0.7	0.7	0.1	0.580
8th-grade math proficiency[c]				
Did not meet standards (level 1)	18.8	19.2	-0.3	0.628
Partially met standards (level 2)	45.1	44.9	0.3	0.759
Fully met standards (level 3)	32.8	31.9	0.9	0.238
Met standards with distinction (level 4)	2.3	2.2	0.1	0.598
Total number of student observations = 30,959				

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (DOE) state test data for eighth-graders from the 2004-2005 to 2007-2008 school years, as well as data from DOE enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a 0/1 indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

(continued)

Table 2.1 (continued)

A chi-square test was used to assess the statistical significance of the overall difference between lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting chi-square value is not statistically significant (p-value = 0.387).

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]This sample includes special education students who can be taught in the regular classroom setting. Special education students classified by the DOE as requiring collaborative team teaching services or self-contained classes are not part of the sample.

[b]Lottery participants are classified as "overage for eighth grade" if they were 14 or older on September 1 of the eighth-grade school year.

[c]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

an SSC lottery — an important starting point for this analysis, as noted earlier, and presented in Appendix B. However, this is not the whole story. About 7 percent of SSC lottery winners do not enroll in an SSC and thus do not experience this type of high school. This is similar to a medical trial in which some treatment group members do not take their assigned medicine (that is, they do not receive their intended treatment). In such cases, differences between future outcomes for treatment group members and control group members understate the effects of receiving the treatment, because some proportion of the treatment group did not, in actuality, receive the treatment. For the present study, this implies that the observed effects of *winning an SSC lottery* understate the actual effects of *enrolling in an SSC*.

In addition, about 25 percent of study participants who lose an SSC lottery (and thus become control group members) enroll in another SSC because HSAPS ultimately assigns them to one. For those students, *losing a lottery for a particular SSC is not the same as not being assigned to any SSC*. Hence, for control group members who are subsequently assigned to an SSC, the effect of *winning* an SSC lottery is not the same as the effect of being assigned to an SSC.[11] Indeed, it is not clear what the effect of winning an SSC lottery means for these students.

Furthermore, about 10 percent of control group members enroll in an SSC through an avenue other than HSAPS. Both types of control group members who enroll in an SSC — those who arrive there through an HSAPS assignment and those who do not — experience SSCs, which further dilutes the difference in this experience between lottery winners and control group

[11]As noted earlier, the effect of being assigned to or offered a "treatment" is referred to as the effect of "intent to treat" in the statistics literature on causal inference. (See, for example, Angrist, Imbens, and Rubin, 1996.) The effect of winning an SSC lottery is therefore not the same as the effect of intent to treat (or the effect of enrolling in an SSC).

members. This dilution causes the estimated effects of winning an SSC lottery to further understate the effects of enrolling in an SSC.

Because of the diluted contrast in SSC experiences between the two study groups and because the estimated effects of winning an SSC lottery cannot be interpreted in a meaningful way, it was necessary to convert them into estimates of something that does have a meaningful interpretation: the effects of *enrolling* in an SSC. Appendix A explains how this conversion was done using a well-known approach called "instrumental variables analysis." The appendix also presents the assumptions upon which this analysis is based and demonstrates their plausibility for the present analysis.

It is beyond the scope of this chapter to explain this analysis in detail. However, it is important to reiterate that it starts by estimating the effects of winning an SSC lottery based on existing data for all lottery winners and control group members (again, shown in Appendix B). Consequently, it does not drop any students with existing data from the analysis, and by not doing so it avoids the potential for "selection bias," which can occur if students are selectively (as opposed to randomly) omitted from a treatment group or a control group.[12] Instead, the present analysis adjusts estimates of the effects of winning an SSC lottery for the proportion of lottery winners who do not enroll in an SSC and for the proportion of control group members who do enroll in an SSC. This adjustment corrects for the dilution that these sample members cause when looking at the difference between the two groups in their exposure to SSCs.

Given the nature of the adjustment, the estimates of SSC enrollment effects that it produces are for a subgroup of SSC lottery winners who are referred to throughout this report as "target SSC enrollees." This label is used to denote that members of the subgroup are the *target of estimation*. The subgroup comprises about 58 percent of all SSC lottery winners, and all findings on SSC enrollment effects in the following chapters are for this subgroup. (See Appendix A for more details.)

Size of the Sample, Its Data Availability, and Implications of Missing Data

As noted, the present analysis is based on data for four annual cohorts of entering ninth-graders. Analyses of student progress in their first year of high school are based on data for all four cohorts; analyses of student progress in their second year are based on data for three cohorts; analyses of student progress in their third year are based on data for two cohorts; and analyses of student progress in their fourth year are based on data for one cohort (the earliest one).

[12]Bloom (2006).

Table 2.2 reports the size of the randomized sample for each high school year and lists the percentage of sample members for whom follow-up data are available. Sample sizes are reported as numbers of student observations. The first and second columns in the table indicate the number of student observations for SSC lottery winners and control group members. This ranges from 12,978 for lottery winners and 17,981 for control group members in the first-year sample to 3,152 for SSC lottery winners and 5,131 for control group members in the fourth-year sample.

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Table 2.2

Sample Sizes and Data Availability

	Number of Student Observations		Percentage with Course Credits Follow-up Data			
Study Sample	SSC Lottery Winners	Control Group Members	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value for Estimated Difference
Year 1 of high school (4 cohorts)	12,978	17,981	89.7	89.8	-0.1	0.798
Year 2 of high school (3 cohorts)	10,377	16,308	83.3	83.5	-0.2	0.755
Year 3 of high school (2 cohorts)	6,471	11,513	75.9	76.5	-0.5	0.545
Year 4 of high school (1 cohort)	3,152	5,131	68.3	69.4	-1.1	0.397

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2007-2008, as well as data from New York City Department of Education course credit and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a 0/1 indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

As described below, estimates of SSC effects are based on administrative data from the New York City Department of Education. These data are only available for students who enroll in a New York City public school. They are not available for students who move out of the city, transfer to a private or parochial school, or drop out of school. The third and fourth columns in the table indicate the percentage of SSC lottery winners and control group members for whom follow-up data are available.[13]

Note, in the last two columns of the table, that for all four years of high school, *differences* in rates of data availability for SSC lottery winners and control group members are small and not statistically significant. Thus, rates of sample attrition are the same for SSC lottery winners and control group members. In addition, Appendix Tables C.1 through C.4 demonstrate that for all four years of high school, mean background characteristics of SCC lottery winners with follow-up data are the same as those of control group members with follow-up data. This indicates that, although some members of the study sample drop out, the baseline characteristics of the two groups remain similar, which implies that attrition does not weaken the validity of estimates of SSC effects.

Note next that the percentage of student observations with follow-up data declines from a high of almost 90 percent in the first year of high school to a low of just under 70 percent in the fourth year. Thus, the scope of the study sample narrows over time. However, the baseline equivalence between SSC lottery winners and control group members who have follow-up data remains strong (see Appendix C). This indicates that study findings are most likely valid for students with follow-up data. Missing data are only likely to affect the generalizability of these findings.

Without follow-up data for all students, SSC effects cannot be estimated for the full study sample. Thus, the findings that are presented in this report are only for students who have follow-up data. However, studies such as this one generally consider how missing data for some students might affect the results for the full sample. Typically, this is done by assuming values for the missing data ("imputing" these values) and repeating the analysis with the assumed values. While there are numerous approaches for imputation, they vary markedly in their complexity, transparency, and assumptions, and no consensus exists about which approach is most appropriate. Thus, in the absence of a compelling reason to use a particular approach, the analysis presented in this report uses two simple approaches to illustrate what SSC enrollment effects might possibly be for the full study sample.

[13]Simple percentages are reported for SSC lottery winners, and average percentages are reported for control group members, weighted by the number of winners per lottery. This accounts for lottery differences in the ratio of winners to control group members.

The two imputation approaches, and the associated effects, are presented in Appendix D. The first — direct — approach makes the relatively conservative assumption that any student with missing data for an outcome was unsuccessful on that outcome. (For example, any student who is missing graduation data is assumed to have not graduated.) The second approach utilizes DOE discharge codes to distinguish between students who are identified as dropouts and all other students for whom data are missing. Students who are identified as dropouts are coded as not having graduated. Other students with missing data are randomly assigned a code of "graduated" or "not graduated" in proportion to the graduation rate for control group students who have follow-up data.[14]

As expected, estimated effects obtained using the preceding two imputation approaches compared with estimates of SSC effects on graduation rates without imputation (for students who were not missing follow-up data) are somewhat smaller and are almost identical for the two imputation approaches. However, all three estimates are positive and statistically significant, indicating that SSCs increase graduation rates.

Remember, however, that findings based on imputation are speculative only. Hence, as noted above, this report focuses solely on estimates of SSC effects for students with follow-up data.

The Data and Their Sources

The primary sources of data for this report are information from HSAPS and from public school records for individual students. This information was obtained from the New York City Department of Education. In addition, publically available data on school characteristics were obtained from New York State's School Report Cards. Appendix E describes these data and their sources.

HSAPS data were used to identify students who participated in an SSC lottery in order to determine the school to which they were assigned, to describe their background characteristics, and to compare background characteristics of SSC lottery winners and control group members. These data include student's rank-ordered high school preferences and demographic characteristics at the point of eighth-grade choice plus SSCs' student priorities based on their geographic and "known" status.

Students' school records data were used to determine follow-up measures of academic progress, which are the basis for estimating SSC effects. This information includes enrollment,

[14]Information on student discharge codes was not used as part of the primary estimation approach for the present analysis because this type of information is typically unreliable.

attendance, and course credits earned, plus state test scores and results of state Regents examinations. Eighth-grade standardized test scores in reading and math were obtained for baseline comparisons of SSC lottery winners and control group members.

Publicly available data on school characteristics from New York State's School Report Cards were used to compare SSCs with other public high schools in New York City. These data were also used to compare features of the schools attended by SSC lottery winners and control group members, such as their size, their number of years in existence, and characteristics of their teachers and students.

Who Is Represented by the Findings?

As noted, this analysis is based on data for students from 297 randomized lotteries. The lotteries were held for 105 of the 123 SSCs that were operating by fall 2008. These lotteries are spread across four annual cohorts of ninth-graders who entered high school between fall 2005 and fall 2008. Estimates of effects of enrolling in an SSC are reported for the roughly 58 percent of SSC lottery winners who are referred to as "target SSC enrollees." (Appendix A describes how this group is defined and identified.) Given the large size of this sample (about 7,559 students), findings for it are policy-relevant in their own right.

Nevertheless, it is important to consider how well these findings generalize to all 42,528 students who entered ninth grade at the 105 study SSCs during the period of analysis. This larger group of students, which is the most immediate and direct population of interest, is referred to as "all enrollees in the study SSCs." To provide an even broader context, it is also useful to compare target SSC enrollees with all first-time ninth-graders in New York City public high schools. Although this study makes no pretense of generalizing findings to this much larger population, a comparison of the study sample with that larger population helps to place in context just who the study represents.

Table 2.3 facilitates these comparisons. The first column reports mean background characteristics for target SSC enrollees. Appendix A describes how these characteristics are estimated. The second column reports this information for all enrollees in study SSCs, which is estimated from their individual data. The third column reports the same information for all first-time ninth-graders in New York City public high schools, which is also estimated from their individual data.

Findings in the table indicate that target SSC enrollees are the same on average as all enrollees in the study's SSCs in terms of every characteristic, with two exceptions. There is almost no discernable difference in their race/ethnicity, gender, eligibility for free or reduced-price lunch (a proxy for low-income status), English language learner status, likelihood of being over-

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Table 2.3

Baseline Characteristics of Target SSC Enrollees, All HSAPS Enrollees in Study SSCs, and All First-Time Ninth-Grade Students in New York City: First Year of High School, Cohorts 1 to 4

Characteristic (%)	Target SSC Enrollees	All HSAPS Enrollees in Study SSCs	All First-Time Ninth-Grade Students in NYC
Race/ethnicity			
Hispanic	48.9	48.4	39.8
Black	43.7	45.2	34.2
Other	7.3	6.4	26.0
Male	47.9	50.8	51.3
Eligible for free/reduced-price lunch	83.2	83.8	74.9
Special education[a]	6.7	15.5	14.0
English language learner	7.3	8.1	11.7
Overage for 8th grade[b]	21.2	24.4	21.7
8th-grade reading proficiency[c]			
Did not meet standards (level 1)	7.0	10.9	10.2
Partially met standards (level 2)	62.9	62.8	51.7
Fully met standards (level 3)	29.3	25.7	34.8
Met standards with distinction (level 4)	0.8	0.7	3.3
8th-grade math proficiency[c]			
Did not meet standards (level 1)	18.0	22.4	18.2
Partially met standards (level 2)	45.4	44.8	36.0
Fully met standards (level 3)	34.2	30.9	36.9
Met standards with distinction (level 4)	2.4	1.9	9.0
Borough (home residence)			
Bronx	54.9	49.3	22.9
Brooklyn	28.4	30.9	32.0
Manhattan	8.3	11.4	12.1
Queens	6.2	7.4	26.9
Staten Island	2.1	0.9	5.6
Total number of students = 42,528			

SOURCES: MDRC's calculations use High School Application Processing System (HSAPS) and New York City Department of Education (DOE) state test data from eighth-graders in 2004-2005 to 2007-2008, as well as data from DOE enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

Previous year's enrollment files were used to determine whether or not a student was a first-time ninth-grader.

(continued)

Table 2.3 (continued)

[a]The target SSC enrollee sample includes special education students who can be taught in the regular classroom setting. Special education students classified by the DOE as requiring collaborative team teaching services or self-contained classes are not part of the sample but are enrolled in study SSCs and are thus included in the "All HSAPS Enrollees in Study SSCs" column.

[b]Students are classified as "overage for eighth grade" if they were 14 or older on September 1 of the eighth-grade school year.

[c]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

age for grade, and (perhaps most important) their prior performance on standardized tests of reading and math administered by the State of New York during eighth grade. The first observed difference between the two groups is a six-point gap in the percentage of students who live in the Bronx (with the target SSC enrollees more likely to reside in the borough). The second difference relates to the percentage of students with special education status. As a result of data collection issues, the HSAPS-based study sample includes only special education students who can be taught in a regular (mainstream) classroom setting. However, a broader group of special education students, including those requiring collaborative team teaching services or self-contained classes, are served by the study SSCs. This results in a noticeable difference in the proportion of special education students among target SSC enrollees (6.7 percent) versus among all enrollees in the study SSCs (15.5 percent).

Thus, although it is never possible to know for sure whether a study's findings generalize adequately to a given population (because a study's sample can differ in unobserved ways from the population), it is likely that findings for target SSC enrollees represent the high school experiences of most students who enrolled in 105 of the 123 SSCs that existed (or came into being) during the present analysis period.

Now compare the sample of target SSC enrollees with the population of all first-time ninth-graders in New York City public high schools, as shown in Table 2.3. Note first that a much greater percentage of sample members are black or Hispanic (92.6 percent versus 74 percent). Thus, as intended, SSCs are attracting large numbers of students of color. Note next that a somewhat greater percentage of target SSC enrollees are eligible for free or reduced-price lunches than is the case for all entering ninth-graders in New York City (83.2 percent versus 74.9 percent). Thus, also as intended, SSCs are attracting large numbers of low-income students. Note next that differences between the percentage of target SSC enrollees who are English language learners, designated for special education, and/or overage for grade are relatively small (especially for the latter group). Thus, SSCs are not excluding these important subgroups of children. Note next that the prior proficiency in reading and math for the study sample is, on balance, relatively similar to that of incoming ninth-graders citywide. If anything, students in

the study sample are somewhat less proficient, but this difference is neither large nor consistent across the four proficiency levels reported by New York State. However, both in the sample and citywide, well over half of incoming ninth-graders were performing below grade level in reading and in math as they entered high school.[15] Thus, as intended, SSCs are attracting large numbers of students who are struggling in school.

The only other marked difference between target SSC enrollees and all incoming ninth-graders citywide is where they live. For example, target SSC enrollees are much more likely to be from the Bronx and much less likely to be from Queens, which is not surprising given the locations of the SSCs.

Overall, then, it appears that as they enter high school, target SSC enrollees "look" very much like all enrollees at SSCs in the study and represent in large numbers (as intended) students of color, students living in poverty, and students who are struggling in school. It is the high school experiences of these students that the findings in the next chapter represents.

[15]Over the course of the study period, citywide averages of prior proficiency of incoming ninth-graders indicate that 61.9 percent were performing below grade level in reading and 54.2 percent were performing below grade level in math. For the study sample, 69.9 percent were performing below grade level in reading and 63.4 percent were performing below grade level in math.

Chapter 3

The Effects of Enrolling in Small Schools of Choice on Students' High School Academic Progress

This chapter reports the estimated effects of enrolling in a small school of choice (SSC) for target SSC enrollees.[1] The chapter briefly compares the key features of the SSCs that were attended by the target SSC enrollees with those of schools attended by their control group counterparts, noting in particular that target SSC enrollees attend schools that are much newer — they were founded in 2002 or later — and smaller than those attended by their control group counterparts.

The resulting findings indicate that the SSCs have a strong and sustained positive impact on student achievement, leading to improved graduation rates:

- Target SSC enrollees have a more successful academic transition into high school during ninth grade than do their control group counterparts.
- The effect of a more successful transition into high school is observed for a broad range of students who differ in terms of prior academic proficiency, race/ethnicity, gender, eligibility for free or reduced-price lunch, and stated preference for their SSC.
- These SSC effects are sustained during students' second and third years of high school and culminate in higher rates of graduation by their fourth year.

Schools Attended by Target SSC Enrollees and by Their Control Group Counterparts

To properly interpret estimates of SSC effects, it is necessary to understand the differences that exist between schools attended by target SSC enrollees and those attended by their control group counterparts. It is these differences that produce the effects observed.

As explained earlier, New York City's High School Application Processing System (HSAPS) and the lotteries it created yielded an unprecedented opportunity to launch a rigorous

[1] As explained in Chapter 2, target SSC enrollees make up the subgroup of SSC lottery winners who are represented by adjusting the estimated effects of winning an SSC lottery (presented in Appendix Tables B.1 through B.4) for the proportion of winners who do not enroll in an SSC and the proportion of their control group counterparts who do.

and credible study of a large number of schools at the system level. At the same time, the retrospective nature of the study means that it was not possible to obtain information on many potentially important features of schools, such as instructional practices, school climate, and qualitative measures of student experience. In addition, the study's control group members attend a broad range of high schools located throughout New York City, not just schools that are large or old or underperforming, making it difficult to describe those schools succinctly. Still, the scale of the study in terms of both number of students and the proportion of schools (105 SSCs out of 123 existing SSCs), the level of diversity it covered, the existence of randomization, the study population of historically underserved students, and the rapidity with which the reforms were implemented all contributed to the relevance and reliability of the findings presented here.

Table 3.1 compares features of the schools attended by the average target SSC enrollee with those attended by the average control group counterpart. The table focuses first on the defining features of SSCs: (1) their age, or when they were established, keeping in mind that New York City began creating SSCs in 2002; and (2) their size, which is noteworthy because SSCs are intended to offer students a small, personalized environment.

As expected, high schools attended by control group counterparts are much older than those attended by target SSC enrollees. Only 9.0 percent of control group members attended a high school that had opened since 2002. An additional 15.8 percent attended a high school that was restructured in 2002 or thereafter into small learning communities (SLCs) and/or career or technical education programs. The remaining 66.8 percent of control group counterparts attended high schools that were opened before (often well before) 2002 and had not been restructured recently.

Also as expected, high schools attended by target SSC enrollees are much smaller than those attended by control group counterparts. For example, there were 129 students in the average target SSC enrollee's ninth-grade class versus 635 for the average control group counterpart. Because some of the city's large, comprehensive high schools have been restructured into small learning communities, potentially providing a "smaller" experience than a school's size alone would indicate, this table separately indicates the 12.5 percent of control group counterparts enrolled in such a school.[2]

[2]It could be argued that in high schools with small learning communities, a new student does not experience the full school population of ninth-graders but rather the student population of the small learning community. However, because reliable data on the number of students enrolled in individual SLCs does not exist, those schools' full ninth-grade population is used to calculate the average ninth-grade size for control group counterparts. In an effort to address the potentially more personalized experience provided by schools with SLCs, when described in terms of their total size, SLCs are not characterized as simply small, medium, or large, but instead as medium or large *with SLCs*.

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Table 3.1

Characteristics of Schools Attended by Target SSC Enrollees Compared with Characteristics of Schools Attended by Their Control Group Counterparts: First Year of High School, Cohorts 1 to 4

School Characteristic	Schools attended by: Target SSC Enrollees	Schools attended by: Control Group Counterparts	Estimated Difference	P-Value for Estimated Difference
School age (%)				
School opened since 2002	100.0	9.0	91.0 **	0.000
School was reformed/restructured since 2002	0.0	15.8	-15.8 **	0.000
School established before 2002	0.0	66.8	-66.8 **	0.000
School size[a]				
Number of students enrolled in ninth grade	129.0	634.9	-505.9 **	0.000
Small - 550 students or less (%)	100.0	20.7	79.3 **	0.000
Medium - 551-1,400 students (%)	0.0	20.3	-20.3 **	0.000
Large - more than 1,400 students (%)	0.0	32.4	-32.4 **	0.000
Medium and large with small learning communities (%)	0.0	12.5	-12.5 **	0.000
School's 9th grade population (%)				
Race/ethnicity				
Hispanic	48.9	51.8	-3.0 **	0.000
Black	43.1	40.2	2.9 **	0.000
Other	8.1	8.0	0.1	0.704
Eligible for free/reduced-price lunch	83.0	84.7	-1.7 **	0.000
Special education	14.9	16.7	-1.8 **	0.000
English language learners	7.9	12.9	-5.0 **	0.000
Scored at or above 8th-grade level in reading[b]	28.6	23.3	5.3 **	0.000
Scored at or above 8th-grade level in math[b]	35.4	30.5	5.0 **	0.000
Overage for 8th grade[c]	21.0	25.9	-4.9 **	0.000
9th-grade repeaters	13.2	28.3	-15.1 **	0.000
Teacher characteristics (%)				
Less than 3 years of teaching experience	37.8	22.8	15.0 **	0.000
Doctorate or master's degree plus 30 hours	21.7	30.9	-9.2 **	0.000

Total number of student observations = 29,811

(continued)

Table 3.1 (continued)

SOURCES: MDRC calculations use High School Application Processing System and New York City Department of Education (DOE) state test data from eighth-graders in 2004-2005 to 2007-2008, data from the New York State Report Card for 2002-2003 to 2007-2008 school years, DOE enrollment and course credit files for the 2005-2006 to 2008-2009 school years, and DOE school-level administrative records for the 2002-2003 to 2008-2009 school years.

NOTES: This table presents the estimated differences for students who have follow-up course credits data. Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Difference" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]Roughly 14 percent of the control group counterparts enrolled in schools that are not easily defined by their size: 12 percent enrolled in middle/high schools and 2 percent enrolled in specialized high schools.

[b]Students scoring at proficiency levels 3 and 4 are considered to be performing at or above grade level for state math and reading exams.

[c]Lottery participants are classified as "overage for eighth grade" if they were 14 or older on September 1 of the eighth-grade school year.

Corresponding differences exist in the total sizes of schools attended by the two groups (for grades 9 through 12). Every target SSC enrollee attended a school with 550 or fewer students, whereas control group counterparts attended schools that range from 550 or fewer students (for 20.7 percent) to between 551 and 1,400 students (for 20.3 percent) to over 1,400 students (for 32.4 percent).

The next part of Table 3.1 describes the ninth-grade student populations of the schools that the two groups attend — that is, not just the members of the study sample, but the full ninth-grade student population at each school (that is, their peers). This information makes it possible to compare student peers of target SSC enrollees with those of control group counterparts. It is important to note that these findings represent *features of the schools attended* by sample members, not characteristics of the sample members themselves.

In terms of socioeconomic characteristics, ninth-grade peers of the two groups are quite similar. For example, 48.9 percent of peers for the average target SSC enrollee are Hispanic and 43.1 percent are black versus 51.8 and 40.2 percent, respectively, for the average control group counterpart. In addition, 83.0 percent of the peers of target SSC enrollees are eligible for free or reduced-prices lunches, 14.9 percent are designated for special education, and 7.9 percent are English language learners, versus 84.7, 16.7, and 12.9 percent, respectively, for control group counterparts.

However, the ninth-grade peers of target SSC enrollees appear somewhat stronger academically than the peers of control group counterparts. This difference requires some explanation, because its magnitude (and thus interpretation) depends on whether it is viewed through the lens of prior characteristics of current ninth-grade students (which describe them before entering high school) or current characteristics (which describe them after entering high school). In terms of pre-existing characteristics, the ninth-grade peers of target SSC enrollees have a 5 percentage point academic advantage over the ninth-grade peers of control group counterparts. They are 5.0 and 5.3 percentage points more likely to have scored at or above the eighth-grade level on their New York State tests of reading and math, respectively; they are 4.9 percentage points less likely to have been overage for eighth-grade (that is, *before* entering high school); and they are 5.0 percentage points less likely to be English language learners. However, in terms of current characteristics, the ninth-grade peers of target SSC enrollees are 15.1 percentage points less likely to have repeated ninth grade than are the ninth-grade peers of control group counterparts.

The simplest, most direct, and thus most plausible explanation for this marked disparity in differences is that SSCs facilitate high school academic progress more effectively than do the schools attended by control group members. This conclusion is confirmed by the fact demonstrated below that SSCs increase the percentage of ninth-graders who make adequate progress toward graduation by 10.0 percentage points (which implies that SSCs reduce the likelihood of repeating ninth grade by about the same margin). Consequently, most of whatever advantage target SSC enrollees experience because of their ninth-grade peers is probably caused by what SSCs do for students, not by the type of students they attract.

The last two lines of Table 3.1 provide a limited comparison of the teachers of target SSC enrollees with those of their control group counterparts. As can be seen, teachers of target SSC enrollees have fewer years of experience and are less likely to have graduate school credits or degrees than are teachers of control group counterparts.[3] This finding aligns with the prevailing wisdom that SSCs generally attracted teachers who were new to the system or the profession. However, it is not clear what these differences mean in terms of students' classroom experiences.

Effects of SSC Enrollment on High School Academic Success

It is well known that making a successful transition into high school is a critical step toward graduation. For example, the Consortium on Chicago School Research found that high

[3]These comparisons are made in terms of school-level teacher characteristics because it was not possible to obtain information on specific teachers for each sample member.

school students who are on track toward graduation by the end of their first year (based on an "on-track indicator" that is replicated for the purposes of the present study) are three and a half times more likely to graduate in four years than are other students.[4] Conversely, a substantial body of literature documents that for many low-performing youths, the transition into high school is marked by disengagement and declining motivation, which are precursors to school dropout.[5] For these reasons, the present chapter begins its story with students' academic progress in the first year of high school.

Of course, the bottom-line indicator of a high school's success is its students' ability to graduate and advance to employment that is economically and personally fulfilling. This path might include further education after high school (which is becoming increasingly important as workplace skills become more sophisticated) or it might involve an immediate move into the job market. But without a high school diploma, these paths are not readily available. This fact of modern life makes it all the more important that a solution be found to the chronically high dropout rates that exist in many urban high schools, especially for students who live in poverty and are often black or Hispanic. As noted, New York City created SSCs with the explicit goal of addressing this very pressing problem. Following a discussion of the transition into high school, this chapter presents the effects of enrolling in an SSC on progress toward graduation and the attainment of a recognized diploma. The results indicate that SSCs are in fact making progress toward their stated goal.

Average Effects During the First Year of High School

Table 3.2 presents estimates of SSC effects on students' likelihood of being on track toward graduation at the end of their first year of high school plus estimates of SSC effects on students' attendance during that year. (Box 3.1 describes those outcomes.) Findings in the first row of the table indicate that by the end of the year, 58.5 percent of target SSC enrollees were on track to graduate in four years compared with 48.5 percent of their control group counterparts. The 10.0 percentage point difference is both large in size (and thus policy-relevant) and statistically significant (and thus unlikely to represent a chance result due to random error).[6]

This first-year SSC effect helps to explain the apparent transformation in peer academic differences discussed alongside Table 3.1 above because (1) it determines the likelihood of repeating ninth grade, and (2) its size is equivalent to the magnitude of the transformation. Hence,

[4] Allensworth and Easton (2005).

[5] National Research Council (2004).

[6] As noted in Chapter 2, this result for the full study sample is virtually identical to its counterpart for the three-fourths of sample members who were not in an HSAPS lottery for a preferred school. The estimated effect for the subsample is an increase of 9.78 percentage points in the likelihood of making adequate progress toward graduation in ninth grade (p-value = <0.0001).

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Table 3.2

Estimated Effects of SSC Enrollment on the Transition into High School: First Year of High School, Cohorts 1 to 4

Outcome	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Course credits					
9th-grade on-track indicator[a] (%)	58.5	48.5	10.0 **		0.000
Earned 10 or more credits	73.1	62.3	10.8 **		0.000
Failed more than 1 semester of a core subject	39.0	46.8	-7.8 **		0.000
Total credits earned toward graduation[b]	11.3	10.4	0.9 **	0.21 **	0.000
Attendance (%)					
Overall attendance rate	87.3	86.5	0.8		0.094
Regular attendance rate (90 percent or higher)	60.5	55.1	5.4 **		0.000

Total number of student observations = 29,811

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2007-2008, as well as data from New York City Department of Education attendance, course credits, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size is calculated as a proportion of the standard deviation of the outcome for control group counterparts.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]The on-track composite measure indicates whether students earned at least 10 credits in their first year of high school and had no more than one semester of failure in a core subject in that school year (English, math, science, and social studies).

[b]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

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Box 3.1

Definitions of Outcomes: Transition Into and Progress Through High School

Course Credits

- **Ninth-grade on-track indicator:** The on-track indicator, a composite measure, indicates whether students earned at least 10 credits in their first year of high school and had failed no more than one semester of a core subject (English, math, science, and social studies) in that school year.
- **Failed more than one semester of a core subject:** This measure indicates that a student has failed more than one semester in a core subject.
- **Earned 10 or more credits:** This measure indicates that a student has earned at least 10 credits by the end of the first year of high school. It acts as a proxy for fulfilling the requirements for promotion to tenth grade in the following year.
- **Earned 20 or more credits:** This measure indicates that a student has earned at least 20 credits by the end of the second year of high school. It acts as a proxy for fulfilling the requirements for promotion to eleventh grade in the following year.
- **Earned 30 or more credits:** This measure indicates that a student has earned at least 30 credits by the end of the third year of high school. It acts as a proxy for fulfilling the requirements for promotion to twelfth grade in the following year.
- **Total credits earned toward graduation:** In order to graduate, New York State requires that students earn 44 credits: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

Attendance

- **Overall attendance rate:** The total number of days a student was present during the school year, divided by the total number of days a student was enrolled.
- **Regular attendance rate (90 percent or higher):** A binary measure for a student's attendance rate being greater than 90 percent, or attended at least 9 out of every 10 days enrolled, over the course of the school year.

Regents Exams

- **Total Regents exams passed toward graduation:** In order to receive a New York State diploma, students must pass the following core subject Regents exams: English Language Arts, Math A, U.S. History, Global History, and one of the science exams (Chemistry, Physics, Earth Science, Biology, or Living Environment). The "total Regents exams passed toward graduation" measure counts the number of required Regents exams that a student has passed with a score of 65 or above.

most of whatever advantage target SSC enrollees experience because of academically stronger peers is probably caused by what SSCs do for these peers, not by what these peers bring to SSCs.

The "on-track indicator" in Table 3.2 consists of the two components listed below it. The first component is whether or not a student earns at least 10 credits during the first year of high school. Enrolling in an SSC increases the likelihood of doing so by 10.8 percentage points — from 62.3 percent to 73.1 percent. To place this finding in context, note that, in terms of student performance, it is the equivalent of an improvement in a school's position from the twenty-eighth percentile to the fifty-third percentile among all public high schools in New York City.[7] In other words, it is equivalent to almost a full quartile difference in the distribution of the city's public high schools, spanning roughly 100 schools.[8]

The second component of the on-track indicator is whether or not students fail more than a single core course (Box 3.1 lists core subjects) during one semester. Findings in the table indicate that enrolling in an SSC reduces the likelihood of such failure by 7.8 percentage points — from 46.8 percent to 39.0 percent.

The net result of the preceding two SSC effects is that during the first year of high school, target SSC enrollees earn almost one full credit more (0.9 credit) toward graduation than do their control group counterparts.

Two measures are used to examine SSC effects on student attendance (second panel of Table 3.2), which is a rough proxy for student engagement. Findings for the first measure indicate that enrolling in an SSC has at most a small effect on overall average attendance for ninth grade. However, findings for the second measure indicate that enrolling in an SSC increases the percentage of ninth-graders who attend school regularly — that is, they attend for at least 9 out of 10 days enrolled — by 5.4 percentage points. This evidence suggests that SSCs promote greater student engagement.

Effects for Student Subgroups During the First Year of High School

Table 3.3 demonstrates that students from many different subgroups experience positive SSC enrollment effects during the first year of high school. For this analysis, an estimate of the effect of SSC enrollment on the "on track to graduate" measure described above is reported for each subgroup. Results are positive for all subgroups and statistically significant for all but the

[7]School performance percentiles are based on publicly available 2007-2008 DOE Report Card data.

[8]Information on the distribution of school performance for this measure was obtained from 2007-2008 Report Card data produced by the New York City Department of Education (DOE). Such publically available information is not available for the on-track indicator.

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Table 3.3

Variation in Effects of SSC Enrollment on Ninth-Grade On-Track Indicator, by Student Characteristics: First Year of High School, Cohorts 1 to 4

Student Characteristic	Estimated Effect	P-Value for Estimated Effect
8th-grade reading proficiency[a]		
Did not meet standards (level 1)	10.3 *	0.026
Partially met standards (level 2)	12.0 **	< 0.001
Fully met standards (level 3)	11.9 **	< 0.001
Met standards with distinction (level 4)	--	--
8th-grade math proficiency[a]		
Did not meet standards (level 1)	10.0 **	0.001
Partially met standards (level 2)	10.8 **	<0.001
Fully met standards (level 3)	15.2 **	<0.001
Met standards with distinction (level 4)	--	--
Low-income status		
Eligible for free/reduced-price lunch	12.3 **	< 0.001
Not eligible for free/reduced-price lunch	8.2 **	< 0.001
Race/ethnicity, by gender		
Black male	8.5 **	0.001
Hispanic male	7.7 **	0.001
Other male	7.4	0.118
Black female	13.5 **	< 0.001
Hispanic female	12.0 **	< 0.001
Other female	9.7	0.062
Choice level (of 12) at which enrollee participated in lottery		
1st choice	7.1 *	0.011
2nd-3rd choices	11.5 **	< 0.001
All other choices	11.6 **	< 0.001

(continued)

Table 3.3 (continued)

Student Characteristic	Estimated Effect	P-Value for Estimated Effect
Known / not known HSAPS status[b]		
Known to SSC	7.4 **	0.001
Not known to SSC	11.8 **	< 0.001
Cohort		
Cohort 1 (2004-2005)	11.9 **	< 0.001
Cohort 2 (2005-2006)	8.2 **	< 0.001
Cohort 3 (2006-2007)	11.1 **	< 0.001
Cohort 4 (2007-2008)	10.9 **	< 0.001

SOURCES: MDRC's calculations use High School Application Processing System (HSAPS) and New York City Department of Education (DOE) state test data from eighth-graders in 2004-2005 to 2007-2008, as well as data from DOE course credits and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Each panel in this table divides students into subgroups based on a given characteristic. Within each subgroup a two-tailed t-test was applied to the estimated effect, with statistical significance levels indicated as: ** = 1 percent; * = 5 percent. An F-test was used to assess the statistical significance between subgroups; none of the subgroup differences in this table is statistically significant.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

Effects on level 4 math and reading proficiency subgroups are not estimable due to small sample sizes.

[a]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams.

[b]"Known / not known HSAPS status" is a measure of whether the SSC to which a student was assigned indicated that the student was known to the school. Known status was collected consistently in the HSAPS data for cohorts 2, 3, and 4, but not for cohort 1, which is thus not included in these calculations.

two smallest. In addition, few subgroup differences are statistically significant. What this means is that SSCs are having a strong positive effect for all the subgroups, and that the strength of those effects is of similar magnitude.

Consider first the findings for subgroups defined by students' prior academic proficiency, as measured by their eighth-grade state test scores in reading and math. Recall from Chapter 2 that New York State reports these results in four levels. Levels 1 and 2 (did not meet or partially met standards) represent student performance that is below grade level, and levels 3 and 4 (fully met standards or met standards with distinction), the two highest levels, represent student

performance that is at or above grade level. Since very few sample members score in the top level, no estimates of SSC effects are reported for them.

Results for all of these prior proficiency subgroups indicate that SSCs improve the transition into high school. Estimates range from a 10.0 point to a 15.2 point increase in the percentage of students who are on track toward graduation. Thus, SSCs improve the transition into high school for students at widely varying levels of prior academic proficiency.

Consider next the results for subgroups of students defined by an indicator of low-income status: their eligibility for free or reduced-price lunches. Once again, there are consistently positive effects for each subgroup. The roughly four out of five target SSC enrollees who are eligible for this government assistance experience a 12.3 percentage point gain in the likelihood of being on track toward graduation. The one out of five target SSC enrollees who are not eligible experience an 8.2 percentage point gain. The difference between these two estimates is not statistically significant — meaning that regardless of the income level of the target SSC enrollee, the "on track for graduation" measure improved.

Findings for subgroups defined in terms of students' race/ethnicity are also consistently positive and do not show statistically significant variation overall. However, the pattern of these results is somewhat complex. On the one hand, they corroborate much past research that finds that educational initiatives benefit black and Hispanic females by more than they do black and Hispanic males. SSC enrollment effects are 13.5 and 12.0 percentage points for black and Hispanic females, respectively, versus 8.5 and 7.7 percentage points for black and Hispanic males. In addition, the overall difference in effects between females and males among these students of color is statistically significant.[9] On the other hand, the results stand in stark contrast to much past research that indicates that it is very difficult to improve educational outcomes for black and Hispanic males. In other words, black females did better than black males, but unlike past study results, the black males did improve.

The next results in the table are for student subgroups defined in terms of the way each student ranked the SSC to which HSAPS assigned him.[10] The estimated effect on progress toward graduation is 7.1 percentage points for students who were assigned to a first-choice SSC, 11.5 percentage points for students who were assigned to a second- or third-choice SSC, and 11.6 percentage points for students who were assigned to an SSC that was their fourth through twelfth choice. The overall variation in these estimates is not statistically significant, although

[9]The *difference* between estimates for black and Hispanic females and black and Hispanic males is statistically significant (p-value = 0.037), although given the many significance tests for subgroup findings in Table 3.3, that difference may have occurred by chance as a result of random error.

[10]Although by necessity these subgroups are defined in terms of students' rank-ordered choice for the SSC to which they were *assigned,* all results are reported in terms of effects of *enrolling* in an SSC.

the difference between estimates for first-choice students and all others is significant.[11] Nevertheless, SSCs had a positive effect on students' academic transition into high school regardless of the choice level at which students had ranked the SSC to which they were assigned.

The subgroups in the next panel of Table 3.3 distinguish between students who were known and those who were not known to the SSC to which HSAPS assigned them.[12] As noted, a student can become known to an SSC in many ways, including contacting it in person or by telephone, visiting it, and/or meeting with its representative at a high school fair. While there are many hypotheses about why and how students become known to a school, it is likely that for some students and families this is the result of taking the initiative and expending the effort to contact and learn about the school. Findings in the table indicate that students who were known to their SSC had an SSC enrollment effect of 7.4 percentage points and students who were not known had an estimated effect of 11.8 percentage points.[13] The difference between these two estimates is not statistically significant; in other words, both students who were known to their SSC and students who were not known experienced a positive SSC enrollment effect.

The last set of student subgroups in the table comprises the four annual cohorts in the study sample. As noted, the first of these cohorts entered ninth grade in fall 2005 and the last entered in fall 2008. Estimates of SSC effects range from 8.2 to 11.9 percentage points and do not show any statistically significant variation, even though many things were changing rapidly in the New York City public school system as these cohorts were entering high school.

On balance, then, estimated ninth-grade effects of enrolling in an SSC are robust across many student subgroups. This result indicates that SSCs are not just effective for certain types of students but rather are effective for a broad range of students who are interested enough to list an SSC among their 12 high school choices.

Average Effects During the Second and Third Years of High School

This section follows students' academic progress through their second and third years of high school. To maximize precision and generalizability, findings are presented first for the largest samples possible. Table 3.4 presents the findings for Year 2 of high school based on data for three cohorts. Table 3.5 presents the findings for Year 3 of high school based on data for two

[11]Given the many significance tests for subgroup findings in Table 3.3, it is possible that the statistical significance of the difference between estimates for students enrolled in their first-choice schools and all others (p-value = 0.034) occurred by chance due to random error.

[12]These subgroups are also defined in terms of students' rank-ordered choice for the SSC to which they were *assigned,* even though results are reported in terms of effects of *enrolling* in an SSC.

[13]Known status was collected consistently in the HSAPS data for cohorts 2, 3, and 4, but not for cohort 1, which is thus not included in these calculations.

cohorts. Because these samples differ from each other and from the four-cohort sample used to estimate first-year SSC effects, it is not possible to use their findings to study the trajectory over time of SSC effects for a given group of students. Table 3.6 makes this possible by presenting selected findings by high school year for the one cohort for which this information is available. This more flexible analysis is limited, however, in terms of its precision and generalizability.

Consider the second-year findings in Table 3.4. By that time, 69.4 percent of target SSC enrollees (from three cohorts) had earned 20 or more credits toward graduation as opposed to 58.3 percent of control group counterparts. The 11.1 percentage point difference between the two groups reflects the magnitude of the difference in their likelihoods of promotion to eleventh grade.[14] In addition, by the end of their second year of high school, target SSC enrollees had accumulated an average of 22.3 credits toward graduation as opposed to 19.8 for control group counterparts, for a difference of 2.6 credits.

The next panel in Table 3.4 reports an estimate of the SSC enrollment effect on the average number of New York State Regents examinations passed by the end of students' second year of high school. Passing a specified set of these examinations is required for students to graduate from high school with a New York State diploma. As can be seen, SSCs have a positive effect on this important outcome. However, interpreting SSC effects on it at an early point in students' high school careers is difficult because schools' philosophies and policies vary with respect to the appropriate time to administer Regents exams. Some schools administer these exams as early as possible, whereas other schools delay their administration as a conscious educational strategy. Therefore, it is not *when* students take and pass these examinations that counts, but, rather, *whether* they do so by their fourth year of high school, in order to graduate on time.

The findings in the bottom panel of Table 3.4 focus on students' attendance during their second year of high school. They indicate that SSCs increase the average overall attendance rate by 2.4 percentage points (from 82.5 percent for control group counterparts to 84.8 percent for target SSC enrollees) and increase the percentage of students who attend school regularly — that is, at least 90 percent of the time — by 6.2 percentage points (from 49.0 percent for control group counterparts to 55.2 percent for target SSC enrollees). Hence, SSCs continue to increase students' engagement during their second year of high school.

Now consider the third-year findings for two cohorts in Table 3.5.[15] These findings indicate that (1) SSCs increase the percentage of students earning 30 or more credits by 7.1 percentage points; (2) SSCs increase the average number of credits earned toward graduation by 2.4 credits; and (3) SSCs increase the average number of Regents examinations passed by 0.11

[14]Earning 10 or more credits each year is generally considered as being on track for grade-level promotion.

[15]Third-year findings in Table 3.5 should not be compared with second-year findings in Table 3.4 or with first-year findings in Table 3.2 because they represent different samples.

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Table 3.4

Estimated Effects of SSC Enrollment on Progress Toward Graduation: Second Year of High School, Cohorts 1 to 3

Outcome	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Course credits					
Earned 20 or more credits (%)	69.4	58.3	11.1 **		0.000
Total credits earned toward graduation[a]	22.3	19.8	2.6 **	0.31 **	0.000
Regents exams					
Total Regents exams passed toward graduation[b]	1.5	1.4	0.1 *	0.06 *	0.032
Attendance (%)					
Overall attendance rate	84.8	82.5	2.4 **		0.000
Regular attendance rate (90 percent or higher)	55.2	49.0	6.2 **		0.000
Total number of student observations = 21,822					

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2006-2007, as well as data from New York City Department of Education attendance, course credits, Regents exam, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size for each measure is calculated as a proportion of the standard deviation of the outcome for control group counterparts.

Cohorts 1, 2, and 3 consist of students in the study who were eighth-graders in the spring of 2005, 2006, and 2007, respectively.

[a]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

[b]In order to receive a New York State diploma, students must pass the following core subject Regents exams: English Language Arts, Math A, U.S. History, Global History, and one of the science exams (Chemistry, Physics, Earth Science, Biology, or Living Environment). The "total Regents exams passed toward graduation" measure counts the number of required Regents exams that a student has passed with a score of 65 or above.

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Table 3.5

Estimated Effects of SSC Enrollment on Progress Toward Graduation: Third Year of High School, Cohorts 1 and 2

Outcome	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Course credits					
Earned 30 or more credits (%)	69.5	62.4	7.1 **		0.000
Total credits earned toward graduation[a]	32.2	29.7	2.4 **	0.23 **	0.000
Regents exams					
Total Regents exams passed toward graduation[b]	2.7	2.5	0.2 **	0.11 **	0.001
Attendance (%)					
Overall attendance rate	82.4	79.4	3.0 **		0.001
Regular attendance rate (90 percent or higher)	51.6	43.4	8.1 **		0.000
Total number of student observations = 13,297					

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005 and 2005-2006, as well as data from New York City Department of Education attendance, course credits, Regents exam, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size for each measure is calculated as a proportion of the standard deviation of the outcome for control group counterparts.

Cohorts 1 and 2 consist of students in the study who were eighth-graders in the spring of 2005 and 2006, respectively.

[a]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

[b]In order to receive a New York State diploma, students must pass the following core subject Regents exams: English Language Arts, Math A, U.S. History, Global History, and one of the science exams (Chemistry, Physics, Earth Science, Biology, or Living Environment). The "total Regents exams passed toward graduation" measure counts the number of required Regents exams that a student has passed with a score of 65 or above.

exam. The findings also indicate that SSCs increase average attendance during students' third year of high school by 3.0 percentage points and increase the percentage of students who attend regularly by 8.1 percentage points. Thus, it appears that SSCs continue to improve student progress toward graduation and their engagement in school during the third year in high school.

Now turn to Table 3.6, which reports findings for a single cohort of students (the earliest one) over the full four years of high school. This table differs from Tables 3.4 and 3.5, which, as described in Chapter 2, present analyses based on the largest available sample for a given point in time. Instead, this table follows a single consistent cohort and thus examines how enrolling in an SSC affects students' academic trajectory *over time*. This trajectory is reported in terms of course credits earned and Regents examinations passed. The first measure counts only courses that are required for graduation with a New York State diploma and the second measure counts only Regents examinations that count toward graduation with a New York State diploma.[16]

As can be seen, enrollment in an SSC increases the number of course credits earned toward graduation in each of the first three years of high school and in the fourth year as well. In this way, they "lift" the entire student trajectory toward graduation. On average, target SSC enrollees accumulate, over time, 10.8, then 21.6, then 31.9, and finally 39.4 credits toward graduation during their first four years of high school.[17] During the same period, control group counterparts accumulate 10.2, then 19.8, then 30.2, and then 38.2 credits toward graduation. Thus, the average effects of SSCs are stable across the four-year timeframe of this study.

Findings with respect to the accumulation of Regents examinations over time are less clear, most likely because of variation in schools' policies about when these exams are administered. There is no SSC effect on this outcome in the first year of high school, which is well before most Regents exams are typically administered and thus before many students had begun to take them. There is still no effect on the accumulation of these examinations by the second year of high school. In the third and fourth years of high school, there is a small, positive SSC effect, which is not statistically significant and thus may simply reflect random error.

In summary, then, findings to this point indicate that SSCs consistently improve student academic outcomes during their first three years of high school and into their fourth year. The next logical question to address is: To what extent do these academic gains translate into increased rates of high school graduation?

[16]Not all courses or Regents examinations are required for graduation with a New York State diploma. Thus, not all courses or Regents examinations count toward graduation requirements.

[17]Recall that not all students who graduate do so at the end of their fourth year of high school.

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Table 3.6

Estimated Effects of SSC Enrollment Over Time on Total Credits Earned and Total Regents Exams Passed Toward Graduation: Cohort 1

Outcome	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Year 1 of high school					
Total credits earned toward graduation[a]	10.8	10.2	0.6 **	0.16 **	0.002
Total Regents exams passed toward graduation[b]	0.3	0.3	0.0	-0.03	0.541
Total number of student observations = 7,891					
Year 2 of high school					
Total credits earned toward graduation[a]	21.6	19.8	1.9 **	0.24 **	0.000
Total Regents exams passed toward graduation[b]	1.3	1.3	0.0	0.03	0.572
Total number of student observations = 7,492					
Year 3 of high school					
Total credits earned toward graduation[a]	31.9	30.2	1.7 **	0.16 **	0.006
Total Regents exams passed toward graduation[b]	2.6	2.5	0.1	0.04	0.375
Total number of student observations = 6,736					
Year 4 of high school					
Total credits earned toward graduation[a]	39.4	38.2	1.2 *	0.13 *	0.036
Total Regents exams passed toward graduation[b]	3.3	3.2	0.1	0.03	0.513
Total number of student observations = 5,363					

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005, as well as data from New York City Department of Education attendance, course credits, Regents exam, transactional, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size for each measure is calculated as a proportion of the standard deviation of the outcome for control group counterparts.

Cohort 1 consists of students in the study who were eighth-graders in the spring of 2005.

[a]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

[b]In order to receive a New York State diploma, students must pass the following core subject Regents exams: English Language Arts, Math A, U.S. History, Global History, and one of the science exams (Chemistry, Physics, Earth Science, Biology, or Living Environment). The "total Regents exams passed toward graduation" measure counts the number of required Regents exams that a student has passed with a score of 65 or above.

Average Effects on High School Graduation During the Fourth Year of High School

Table 3.7 presents estimates of SSC effects on graduation rates as of students' fourth year of high school. (See Box 3.2 for definitions of the outcomes presented in the table.) These estimates are presented for the earliest cohort of students to enter the study sample (Cohort 1)

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Table 3.7

Estimated Effects of SSC Enrollment on Graduation: Fourth Year of High School, Cohort 1

Outcome (%)	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	P-Value for Estimated Effect
Graduation				
Graduated from high school	68.7	61.9	6.8 *	0.013
Local diploma granted	24.6	21.9	2.8	0.261
Regents diploma granted	39.5	34.6	4.9	0.074
Advanced Regents diploma granted	4.4	5.5	-1.1	0.366
College readiness				
Math A Regents exam score of 75 or above	22.2	22.8	-0.6	0.787
English Regents exam score of 75 or above	34.1	28.8	5.3 *	0.021
Attendance				
Overall attendance rate	80.9	79.0	1.9	0.153
Regular attendance rate (90 percent or higher)	42.6	40.1	2.6	0.394
Total number of student observations = 5,363				

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005, as well as data from New York City Department of Education attendance, course credits, Regents exam, transactional, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Cohort 1 consists of students in the study who were eighth-graders in the spring of 2005.

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Box 3.2

Definitions of Outcomes: Graduation and College Readiness

Graduation

- **Graduated from high school:** This measure includes all students who have received a local, Regents, or Advanced Regents high school diploma from the New York State public school system.
- **Local diploma:** The local diploma represents the most basic graduation requirements in the New York State public school system. Over the course of this study, the New York State Department of Education phased in new graduation requirements, which will result in the elimination of the local diploma except for special education students. To obtain a local diploma in the 2009 school year, a student must have completed the 44 credits required for graduation, and have passed two of the five core Regents exams with a score of 65 or above. The remaining three core Regents exams can be passed with a score of 55 or above.
- **Regents diploma:** The Regents diploma is the standard diploma granted by New York City. To obtain a Regents diploma, a student must complete the 44 credits required for graduation and pass the five core Regents exams with a score of 65 or above.
- **Advanced Regents diploma:** The Advanced Regents diploma is used to signify that a student has fulfilled requirements above and beyond what is required for the Regents diploma. To obtain an Advanced Regents diploma, a student must complete the 44 credits required for graduation (including a full six semesters of foreign language) and must pass a total of eight Regents exams with a score of 65 or above: the five core Regents exams, a foreign language exam, a higher-level math exam, and a second science exam.

College Readiness

- **Math A Regents exam score of 75 or above:** A binary measure for students who pass the Math A Regents exam with a score of 75 or above, thus testing out of developmental math in the City University of New York system.
- **English Regents exam score of 75 or above:** A binary measure for students who pass the English Regents exam with a score of 75 or above, thus testing out of developmental English in the City University of New York system.

because this is the only cohort for which such information was available. The small size of the sample for this analysis (relative to those for earlier high school years) limits the precision of its findings.[18] In addition, the limited duration of follow-up for the analysis (four years) minimizes the conclusiveness of its findings because many disadvantaged students in large urban districts (like those in the present sample) graduate from high school five and six years after they enter. Consequently, not all of the graduation "returns" are in for the present cohort.

The top panel in the table presents estimates of SSC effects on fourth-year graduation rates overall and by type of diploma received. These findings indicate that SSCs increase overall graduation rates by 6.8 percentage points, from 61.9 percent for control group counterparts to 68.7 percent for target SSC enrollees. The 6.8 percentage point increase is equivalent in magnitude to the difference in student graduation rates for schools at the thirty-eighth and fifty-second percentiles of the performance distribution for all public high schools in New York City — in other words, moving up by approximately 50 schools among the roughly 300 that grant diplomas.[19] Thus, for the first cohort of students studied and their first four years of high school, the evidence indicates that SSC improvements in students' academic progress and school engagement during the early years of high school translate into higher rates of on-time graduation.

Furthermore, findings in the table suggest that a majority of the SSC effect on graduation rates reflects an increase in receipt of New York State Regents diplomas.[20] For this type of diploma, students must pass a series of Regents examinations with a score of 65 points or above and pass all of their required courses. A minority of the SSC effect on graduation rates reflects an increase in receipt of local diplomas, which has less stringent standards for scores on Regents examinations. This type of a diploma will be phased out by New York State for the high school class graduating in 2010.[21]

The middle panel of Table 3.7 reports estimates of SSC effects on the percentage of students who pass the Math A or English Regents examinations with scores of 75 points or higher. This is a higher standard than is necessary to pass each examination (which is 65 points) and represents the threshold for exempting incoming students at the City University of New York from remedial courses in these subjects. These findings are included to begin to explore

[18]Findings for student subgroups for fourth-year outcomes are presented in Appendix Table F.1. Because of the small sample size, few findings are statistically significant (all for those subgroups that are themselves relatively large). Thus, most of the effects reported in the table could be understood as having occurred by chance.

[19]School performance percentiles are based on publicly available 2007-2008 DOE Report Card data.

[20]The effect on the percentage of students receiving a NYS Regents diploma (p-value = 0.074) approaches the level of statistical significance at the 0.05 level.

[21]In the 2007-2008 school year, the citywide overall graduation rate was 60.7 percent. That included 40.9 percent of the students earning a Regents diploma, which is considered by New York State to be the standard diploma, and 15.5 percent of the students earning a local diploma, which New York State was phasing out over time.

SSC effects on students' college readiness. There is no observed effect in math and a 5.3 percentage point increase in English.

Lastly, the bottom panel of Table 3.7 suggests that during the fourth year of high school, SSCs continue to improve students' regular attendance — and, thus, students' school engagement — although these findings are not statistically significant.

In closing, the current analyses reveal that SSCs exhibited promising effects on the first cohort of target SSC enrollees that were sustained throughout four years of high school, leading to improved graduation rates for this group. While the findings are very promising, they represent only one cohort of students, and the follow-up period does not capture all potential SSC graduation effects even for this cohort (because some students take more than four years to graduate). When data for future cohorts and follow-up years become available, it will be important to learn whether these early positive findings are sustained and replicated.

Chapter 4

Conclusions and Next Steps

This report emerges at a moment when policymakers, practitioners, and researchers have identified the high school years as the point of greatest need within the education pipeline. The rationale for this collective focus is clear: far too many students drop out of high school, and the consequences of entering adult life without a high school diploma are increasingly grave. Amid a national call for change and a dearth of effective responses, the findings presented in this report provide encouraging and reliable evidence that:

- In roughly six years' time it is possible to create a large system of small high schools of choice (SSCs) that markedly improve graduation prospects for many disadvantaged students who choose to attend these schools.
- Positive effects on students' progress toward high school graduation first become apparent during the ninth grade; these effects are sustained during the next two years, when most students are in grades 10 and 11; by the end of four years of high school, these effects culminate in higher rates of graduation.
- These effects are experienced by a broad range of students who differ in terms of their demographic characteristics, economic circumstances, and academic preparation. Of particular note is that these effects are experienced by male high school students of color, whose educational prospects have been historically difficult to improve.

This chapter contextualizes these findings and identifies their key implications for future policy, practice, and knowledge building.

Interpreting the Findings

The effects of small high schools of choice described in this report should be understood through three important lenses: (1) their scale, (2) the comparison they represent, and (3) the group of highly disadvantaged students for whom they occurred.

Effecting Change at Scale

As described in the preceding chapters, the present study estimates the effects of 105 small schools of choice on student achievement. At capacity, those schools will serve over

45,000 students.[1] That is roughly equivalent to the entire high school population of Houston, which is the seventh largest school district in the country.[2] Readers should understand the magnitude of the present report's findings in that context — imagine, *for a school district the size of Houston*, increasing the percentage of ninth-graders who are eligible for on-time promotion by 10.8 percentage points,[3] the percentage of black males on track to graduate by the end of ninth grade by 8.5 percentage points, or the percentage of high school graduates by 6.8 percentage points. Given the scale of the SSC initiative, even seemingly minor gains can be understood as affecting thousands of high school students over time. In fact, the 6.8 percentage point increase in four-year graduation rates is roughly one-third the size of the gap in New York City's graduation rates between white students and students of color.

Additionally, because the reported effects of SSCs are not the product of a small, targeted intervention but rather of a large system of small schools, the effects can be understood as reflecting the mean performance of a model implemented at scale. Reported effects are not the product of the best or most popular of the SSCs but of 105 schools on average. Although it is beyond the scope of this study to analyze variation in effects based on *school* characteristics, a review of the data suggests that the average effects reported are produced by a mix of higher- and lower-performing schools. In other words, the findings represent a *real-world test* of an intervention launched at the scale of a large-sized urban school district.

Understanding What Distinguishes Small Schools of Choice from Other Schools

As described in the first three chapters of this report, the reported effects on student achievement are driven by the special school experience of students enrolled in SSCs compared with the experiences of their counterparts who enrolled in a wide range of other public high schools in New York City. In interpreting the findings, it is important to review the essential elements of both of those experiences.

Students enrolled in SSCs did not just attend schools that were *small*. SSC enrollees attended schools that were purposefully organized around smaller, personalized units of adults and students, where students had a better chance of being known and noticed, and teachers had

[1] SSCs are intended to serve 108 students per grade, for a capacity of approximately 430 students throughout grades 9-12.

[2] See Houston Independent School District (2009).

[3] See Table 3.2 and note that the measure listed as "Earned 10 or more credits" in the first year of high school serves as a proxy for on-time promotion to the tenth grade.

a better chance of knowing enough about their charges to provide appropriate academic and socioemotional supports.[4]

Similarly, SSCs were not only *new* but were mission-driven. Their recent establishment via a demanding authorization process, which resulted in more schools being denied than approved,[5] required that a prospective school leadership team articulate an educational philosophy and demonstrate how it would motivate teachers, community members, and partner organizations around it. The purposeful process employed to create new schools required new school leadership to articulate and justify a viable improvement strategy. And the district's commitment to acting as a steward for new schools through their start-up period generated a set of supports and protections as these schools got up and running. This scenario stands in contrast to school closing and opening processes in some other districts where schools close and later reopen as a set of small schools or learning communities, but with the same leadership, teachers, and students.[6]

Finally, SSCs benefited from an influx of external ideas, talent, and resources. A 2006 MDRC report synthesizing five overarching lessons drawn from studies of whole school reform models notes that significant amounts of "time, energy, and know-how" are required to stimulate large-scale change.[7] As noted elsewhere in this report, SSCs seemingly had a supply of all three: a protected start-up period; a newer teaching corps; and the support of independent, external, nonprofit intermediary organizations that had experience starting and operating small schools.

The other set of school experiences that must be understood in order to interpret SSC enrollment effects are those of the study's control group counterparts, which serve as the comparison to the school experience described above. This "counterfactual" school experience represents the environment that target SSC enrollees would have experienced had they not been randomly assigned to an SSC, and it is the contrast between the two states that drives the reported effects.

Importantly, this report does not contrast the experience of target SSC enrollees with that of the students who attended the 23 failing high schools that the SSCs replaced. Because the closing schools ceased to admit freshmen as new SSCs came into being, the two options were not simultaneously available to incoming students. Because the present report could not contrast SSC effects with this original counterfactual, it likely *understates* the effects of SSCs

[4]Appendix H contains a sample of the DOE's New School Application, which details many of the specialized supports that new small schools were intended to provide to their students.

[5]Internal memo, New Visions for Public Schools (2005).

[6]See Evan et al. (2006).

[7]Quint (2006), p. 53.

that might have been attained if the SSCs could have been reliably compared with their antecedents.

Instead, the counterfactual in this study comprises not simply one school type but rather a broad range of high schools that differ along several dimensions. While the schools attended by control group counterparts are larger and older on average, they are not universally so. For example, while the schools attended by control group counterparts had 506 more students in their average ninth-grade class than did schools attended by target SSC enrollees, 12.5 percent of the control group counterparts attended comprehensive schools that, although they may have had large incoming classes, had been reorganized into small learning communities, thus providing a "smaller" experience. While control group counterparts attended schools that were generally older, a full one-fourth of them attended schools that, like those attended by target SSC enrollees, had been created or restructured since 2002.

The diversity of high school options experienced by control group counterparts underscores two important points. First, this report does not provide a straightforward comparison of small schools to large schools or new schools to old ones, but rather a comparison of SSCs to a range of contemporaneous alternatives. Second, the comparison is drawn at a point when the system was undergoing a wholesale transformation. Neither the SSC "treatment" nor the counterfactual experience had yet reached a "steady state."

A Strategy to Serve Disadvantaged Students

SSCs were intended to be a viable and accessible option for the district's most disadvantaged students, and over the course of the study period, they served a population that almost exclusively comprised low-income students of color.[8] The fact that SSCs targeted and served this population gives the reported findings even greater policy significance, as it is precisely these sorts of students who find themselves at the bottom end of the country's persistent achievement gap, and who are least likely to graduate from high school on time, if at all. For certain subgroups, the statistics are particularly alarming. For example, a recent analysis by researchers at New York University revealed that among the cohort that began high school in New York City in 2001, only 44 percent of black and Latino males had graduated after *six* years.[9]

Given the small number, and typically limited scale, of interventions that have demonstrated success serving low-income students of color, the effects produced by SSCs mark these

[8]Table 2.3 characterizes first-time ninth-graders who were enrolled in the study SSCs. In summary, 93.6 percent of those students were black or Latino, and 83.8 percent came from low-income households, as indicated by their qualification for free or reduced price lunch.

[9]See Meade, Gaytan, Fergus, and Noguera (2009).

schools as a model that can serve such students en masse. Furthermore, the robust positive SSC enrollment effects for many different types of students, including young men of color, represent findings that are highly encouraging.

Implications of the Findings

This section considers how the preceding findings can be applied to current educational policy and practice, and identifies the open questions raised by the findings that should be addressed through future research.

For Policy and Practice

The timeliness of the present study hinges largely on the country's current focus on high school reform, which can be seen at the federal, state, and local levels on the part of legislators and practitioners alike. As part of the 2009 stimulus package, the federal government committed billions of dollars toward education reform, prompting states and districts to develop action plans for the use of formula-based dollars and comprehensive proposals for the competitive funding streams that were established. At the outset of the 2010 calendar year, Congress began debating the reauthorization of the Elementary and Secondary Education Act (last reauthorized as No Child Left Behind), which will govern the next generation of federal education policy. And at the district level, as state and district education budgets fall victim to the current economic crisis, superintendents are being compelled to do more with less, targeting limited resources at those points believed to give them the greatest leverage.

With respect to high schools in particular, much of the national discussion focuses on three areas where the education community has struggled to demonstrate success: (1) improving the academic outcomes of the most disadvantaged students, particularly with respect to high school graduation and college readiness; (2) identifying turnaround strategies for historically underperforming schools; and (3) implementing effective interventions at scale. The present study sits at the nexus of all three themes, and its findings demonstrate that, in a short period of time, an effective model can be implemented at scale and can improve the academic trajectories of large numbers of traditionally underserved students.

The reforms implemented in New York City should be considered as a package of integrated, reinforcing strategies. The effects are not simply the result of closing low-performing schools or of creating SSCs, but rather a purposeful marriage of the two strategies supported by the implementation of several enabling reforms (such as the introduction of a districtwide choice process). Decision-makers interested in replicating the district's strategy should devote as much attention to *how* these reforms were operationalized as they do to *what* was conceptualized. Closing the failing schools would likely not have been singularly effective without the

intentional creation of a range of alternative options to pick up the slack. Similarly, the creation of new schools would likely not have gained the traction it did without the introduction of a districtwide choice process that compelled previously disenfranchised communities to explore their high school options and exercise choice. Thus, while this study provides compelling evidence in support of a particular small school model, that model cannot be understood as existing in isolation but rather as an integral component of a comprehensive and coordinated set of district reforms.

For Knowledge Building

The findings presented in this report should provide much-needed encouragement to educational policymakers, practitioners, and researchers by demonstrating that it is possible to transform a major system of high schools in ways that benefit large numbers of disadvantaged students. To build on these findings, future research should focus on what is needed to facilitate educational improvement on a broad scale with a high probability of success.

To address these further questions, the present research should be advanced on three fronts: (1) quantitative and qualitative analyses of what it is about the *nature* of new small high schools of choice in New York City that make them effective for disadvantaged students; (2) statistical analyses of SSC effects on graduation rates for additional student cohorts and after students' first four years of high school, and the extent to which high school effects translate into gains on future educational outcomes (such as college-going and success) and economic outcomes (employment and earnings); and (3) quantitative analyses of whether effects persist as the school system of which they are a part evolves.

Identifying the Locus of the Impacts

The present analysis focuses mainly on average effects of SSCs and, to a limited extent, on how these effects vary across different types of students. But much more should be done to explore in detail the magnitude and nature of variation in effects across different types of SSCs. In other words, it is essential to begin to unpack the "black box" of the current preliminary analysis in order to develop a more comprehensive understanding of "what works best for whom, when, where, and why."

The more robust the effects are for different types of SSCs, the more confidence one can have that SSCs created under the conditions experienced by those in New York will have similar effects in other places, at other times, and for other students. The less robust these effects are, the more uncertainty there will be about the likely effectiveness of any given future attempt to replicate SSCs.

This research should begin by using existing data to study how variation in SSC effectiveness is related to *characteristics* of SSCs and the *partnerships* through which they were created and operated. For example, statistical analysis could explore the extent to which variation in SSC effectiveness is related to the SSCs' *educational approach* by categorizing schools as being more explicitly focused on a traditional, liberal arts curriculum or on experiential elements such as work-based or service learning. Similarly, analyses might explore whether the SSC effectiveness varies based on schools' *model of intermediary support* — that is, the SSCs' affiliation with an intermediary that prioritized leadership development, teacher and student services, or community relations. Finally, future analyses could investigate whether SSC effectiveness is related to the *experience and turnover of teachers and principals*, characteristics that have been identified in the literature as being correlated with student outcomes.[10]

A second important line of research that can begin now with analyses of existing data, but will require additional data in the future to complete, is a systematic analysis of how the effectiveness of SSCs evolves as they mature over time. This future research would build directly on past research indicating that three to five years are required for a major school reform to become effective.[11] This research would also build directly on the expectations of funders and creators of New York's SSCs who provided them with special protection and support during their first two years of operation. This assistance was provided in anticipation that the first two years of an SSC's operation would be especially difficult.

Preliminary analyses conducted by the authors suggest that there was variation in the effects produced by study SSCs that were in their first two years of operation compared with schools that had been in operation for three or more years. However, it is not yet possible to identify whether the effectiveness of SSCs *changes* as they mature over time. This problem arises because many new SSCs were created each year during the present analysis period. Thus, the group of SSCs that were in their first two years of operation is largely *different* from the group of SSCs that had been in operation for three years or more. With four cohorts of data and the development of a more sophisticated statistical model, it should be possible to begin to shed further light on this issue.[12] And with future data for additional cohorts of incoming ninth-graders, it should be possible for this analysis to be conclusive.

[10]See Weinstein et al. (2009).

[11]Borman, Hughes, Overman, and Brown (2003).

[12]For this purpose, it will be helpful to specify differences in effects across SSCs and over their developmental trajectories as random effects, which will require an extension of the instrumental variables analysis framework used for the present report.

Understanding Long-Term Effects on Student Achievement

The findings presented in this report are particularly notable because of the effects on graduation rates, which have been absent from many other studies of whole school reform models, even those that showed strong effects in earlier years. Thus, it will be important to analyze graduation rates and longer-term effects in greater detail using additional data that can be obtained in the future.

One such analysis will include the *variation in graduation rates* across subgroups of students. That analysis was quite limited for the present report because data on graduation rates are available only for one annual cohort of students. But as data for additional cohorts become available, much more can be learned about the robustness of the "bottom-line effect" of SSCs.

A second line of research is analysis of SSC effects on graduation rates that account for the fact that many disadvantaged students who graduate from high school do so only after five or six years. Such an analysis would extend current findings on four-year graduation rates in a way that provides a more complete picture of the effects of SSCs on students' academic success.

A third area of analysis aims to identify some of the key *leverage points* associated with increased graduation rates. That analysis will investigate whether certain course- and Regents-taking patterns are correlated with graduation effects.

Another extension of the present research is analysis of the extent to which SSC effects on high school graduation translate into positive effects on future educational outcomes, such as college or community college enrollment, persistence, and graduation, and future economic outcomes, such as employment and earnings. This research could follow existing and future cohorts of students through administrative records on college-going obtained from the National Student Clearinghouse and New York City's public university system, and on future earnings and employment data obtained from state unemployment insurance records. Given the promising findings to date with respect to SSC effects on four-year high school graduation rates, it is especially important that the potential longer-term effects of this initiative be examined.

Understanding Whether Effects Persist as the System Moves Toward "Steady State"

A final area of analysis that can begin with existing data but requires additional data in the future is an exploration of how the effectiveness of SSCs as a group changes over time as their school system undergoes major changes. As noted earlier, the four annual cohorts of incoming ninth-grade students in the present analysis *all* experienced similar effects of enrolling

in an SSC. This is surprising given the dramatic changes that were occurring concurrently throughout the New York City school system during this period.[13]

Some of the literature describing the small schools created in New York City suggests that the schools that had been created as part of earlier waves of the district's reforms were better positioned to operate effectively — competing against a relatively small group of other new schools for motivated, entrepreneurial educators and for an abundance of foundation and district resources.[14] This line of reasoning suggests that over time, as many more new small schools came into existence, they were increasingly forced to compete for a shrinking group of top principals and teachers, thereby diminishing their likely chances of success. Additionally, if the New York City Department of Education is correct in hypothesizing that systemic changes related to the principles of accountability, leadership, and empowerment would cause all boats to rise, there is the potential for a diminished contrast over time between the school experience offered by the front-runner SSCs and those offered by the remainder of the system's schools.

Conclusion

This study provides important findings about an unusually promising educational initiative — reliably demonstrating for the first time that transformation in a large urban school system at scale, serving disadvantaged students, is possible in a relatively short time period. But the true value of this study lies in its potential contribution to improving future education policy and practice, because while these impacts were strong, they are not enough. There remains much to learn and do in order to build on the process described here and to make future reform possible, so that concrete results can be achieved — particularly in terms of narrowing the educational achievement gap between historically underserved students and their better-off peers. Given the robust positive findings observed to date, however, there is good reason to believe that turning around our lowest-performing schools and thereby improving the academic prospects of this country's most disadvantaged children is a realistic goal.

[13]Once again, however, it was not possible to reliably separate differences among SSCs (because new SSCs were opening every year) from changes in the same SSCs over time.

[14]See Hemphill and Nauer (2009); Foley, Klinge, and Reisner (2007).

Appendix A

More About the Study's Research Design and Analysis

For readers who are interested in further details about the present study's research design and analysis, this appendix describes:

- How New York City's High School Application Processing System (HSAPS) creates randomized SSC lotteries
- How lotteries for small schools of choice (SSCs) are used to estimate effects of winning them
- How these estimates are converted into estimated effects of enrolling in an SSC
- How the plausibility of assumptions needed for estimates is assessed
- How estimates are reported

How HSAPS Creates SSC Lotteries

This section briefly describes how HSAPS creates the statistical equivalent of a randomized lottery for each SSC that is oversubscribed in a given year. An SSC that is not oversubscribed in a particular year does not have a lottery for that year. Although HSAPS assignment does not operate literally as described below, the *results* of HSAPS are the same as those produced by the assignment rules and statistical properties described below.

Recall that each student provides a list of up to 12 high schools that he or she would like to attend, in order of preference. Also recall that each SSC gives to HSAPS its student priorities based on their geographic proximity and whether they are "known" to the SCC (by having contacted it, having visited it, or having met with one of its representatives). As noted in Chapter 2, geographically most SSCs distinguish only between residents of their borough and all other New York City residents.[1] Within these categories, the highest priority is given to students who both satisfy the school's geographic preference and are known to the school, whereas the lowest priority is given to students who do not carry a geographic preference and are not known to the school.

HSAPS assigns students to schools based on the inputs from both parties. The key to this process, and its ability to create randomized SSC lotteries, is the fact that the order in which students are chosen for school assignment is *random*. Using a computer algorithm, HSAPS chooses randomly the first student to be assigned, the second student to be assigned, the third student to be assigned, and so forth, all the way to the last of roughly 80,000 students to be assigned. Students who are chosen for assignment very early in this process are the most likely to

[1]A minority of SSCs have one or more additional geographic priorities, such as priority to residents of a nearby catchment area.

receive their first choice because at this point no schools are filled to capacity. (However, higher-priority students who are assigned later in the process can "bump" students who were assigned earlier in the process but had lower priority for that school.) At some point in the assignment process, however, schools begin to fill up and their student priorities start to take effect. For example, if Student A's first-choice school is already filled by students with equal or higher priority, Student A cannot be assigned to that school. Instead, HSAPS assigns Student A to the next-preferred school on the student's list with available slots. (Consider what happens each time the algorithm tries to assign a student to a school that is full. If the current student has higher priority for that school than do one or more students who are assigned there already, the current student bumps the last student assigned who had the lowest priority. The student who is bumped is then assigned to his or her next-preferred school with available slots, following the same rules.) This process continues until HSAPS works through the entire randomly ordered cohort of incoming students.

Figures A.1 and A.2 provide heuristic descriptions of what *the results* of HSAPS assignment are like for a hypothetical student and a hypothetical SSC. Figure A.1 illustrates what these results are like for a student who is assigned to his third-choice school, which happens to be an SSC. In this scenario, the student is not assigned to his first-choice school (an SSC) because his randomly assigned order within HSAPS was "too late" (after other students with the same priority had filled up that school). As explained below, this means that the student "lost a lottery" for the SSC and is a member of its control group. In the scenario shown, the student also does not get assigned to his second-choice school, which is not an SSC. The reason he does not get assigned to this school is that it ultimately is filled to capacity with students who have higher priority. Thus, the student is not in a lottery for his second-choice school. Finally, the student is assigned by HSAPS to his third-choice school, which happens to be another SSC. Because this SSC is ultimately oversubscribed by students with the same priority as that of the current student, in effect he is a lottery winner, or a member of the "treatment group" for that SSC.

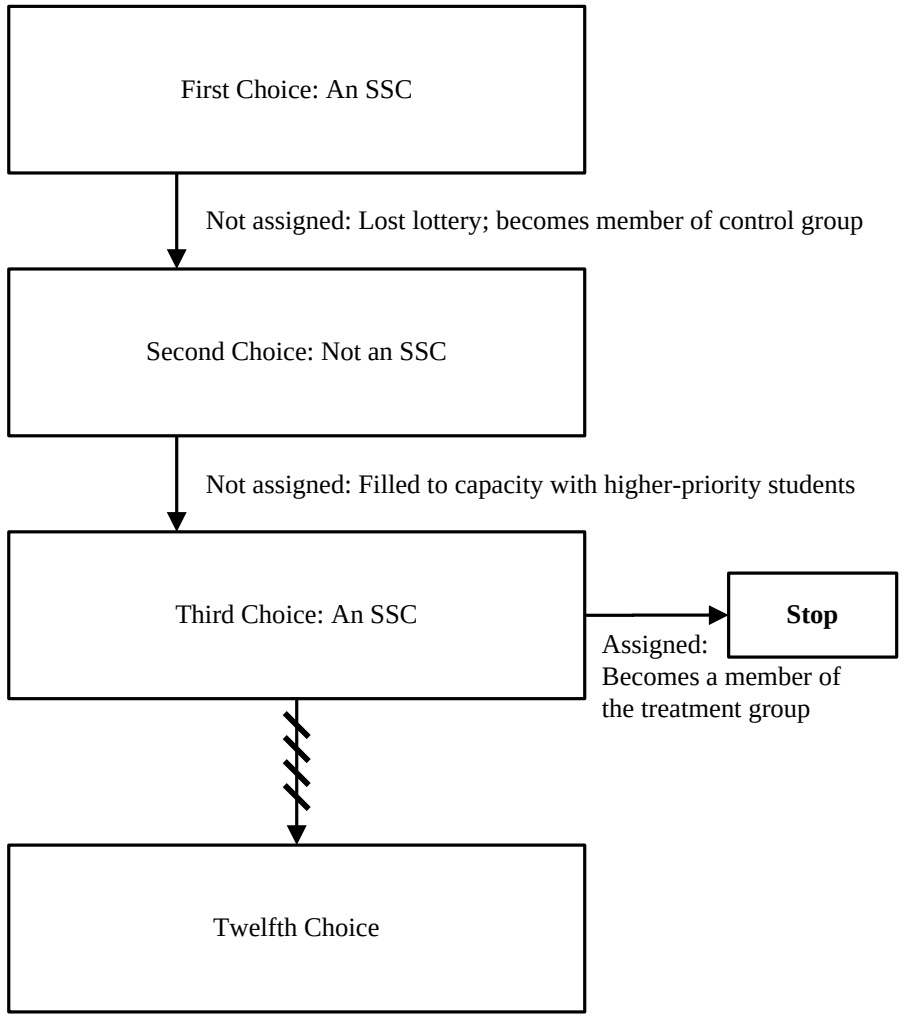
In summary, then, HSAPS assignment for the hypothetical student involves (1) losing a lottery for the first-choice school (an SSC) and thereby becoming a control group member for it; (2) not being assigned to the second-choice school (which is not an SSC) because it was filled by other students who had higher priority for the school based on whatever method that school used to select students; and (3) winning a lottery for the third-choice school (another SSC) and thereby being assigned to it. Students and their families, however, see only the rank-ordered list of schools they submit to HSAPS and the school to which HSAPS assigns the student; the lottery itself is invisible to them.

Figure A.2 illustrates the results of HSAPS assignment for a hypothetical SSC that can accommodate up to 120 incoming ninth-graders. These results represent all of the students that HSAPS attempted to assign to the SSC and can only be finalized after the HSAPS assignment

New York City Small Schools of Choice

Appendix Figure A.1

HSAPS Assignment Process for a Hypothetical Student

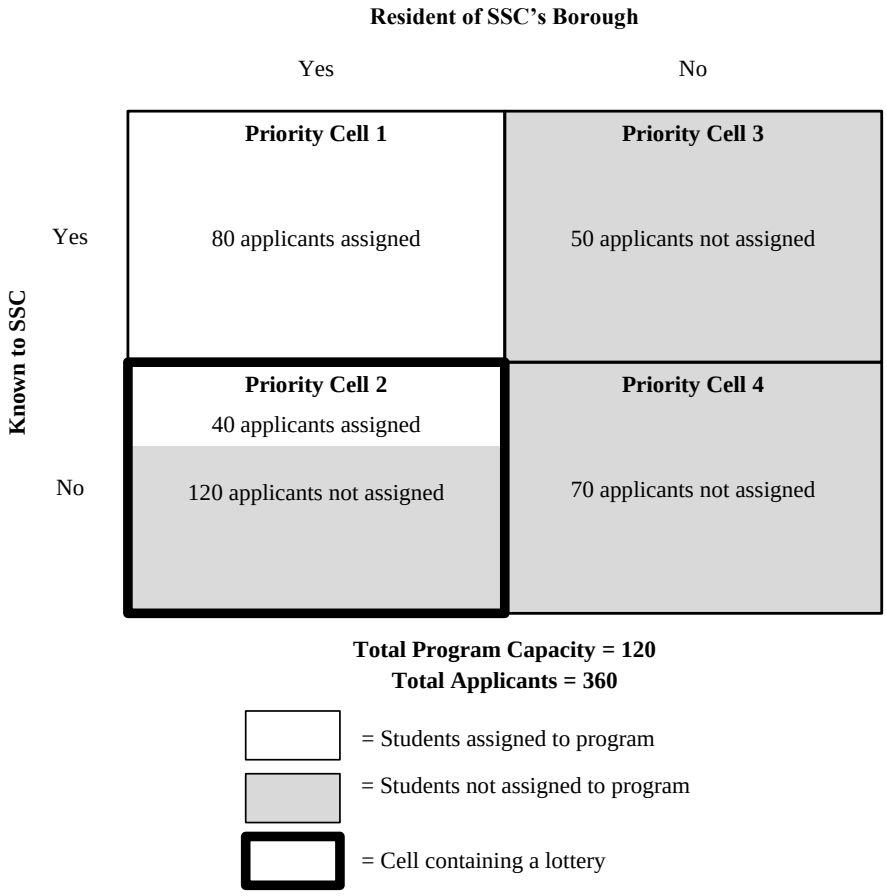


process has run to completion. First note that HSAPS will attempt to assign to this SSC *all students who list it as a choice and have not been assigned to one of the choices they prefer more*. For example, students who list the SSC as their third choice and are not placed into their first or second choice are considered for assignment to this SSC. However, students who list the SSC as their third choice but *are* placed into their first choice or second choice are not considered for assignment to this SSC because they already are assigned elsewhere.

New York City Small Schools of Choice

Appendix Figure A.2

HSAPS Assignment Process for a Hypothetical SSC



In Figure A.2, 360 students have listed the hypothetical SSC as a choice and have not yet been placed elsewhere. Thus, this SSC has 360 "potential assignees" for its 120 places. Eighty of those potential assignees are both known to the SSC and they reside in its borough, so they have first priority for this school (Priority Cell 1); 160 are not known to the school but they reside in the school's borough, so they have second priority (Priority Cell 2); 50 are known to the school but do not reside in its borough, and so have third priority (Priority Cell 3); and 70 are neither known to the school nor reside in its borough, so they have fourth, or last, priority (Priority Cell 4). Given the SSC's capacity of 120 available ninth-grade spaces, it can accept all 80 students from Priority Cell 1 plus the first 40 students assigned by HSAPS (in random order)

from Priority Cell 2. It cannot accept the last 120 students assigned from Priority Cell 2 or any students from Priority Cells 3 and 4.[2]

Because Priority Cell 2 is oversubscribed, it represents the equivalent of a randomized lottery for assignment to the SSC. The 160 students in this cell are effectively "lottery participants." The first 40 of these participants whom HSAPS selects randomly are lottery winners and are assigned to the SSC, thereby becoming members of its treatment group. The last 120 participants whom HSAPS selects randomly are lottery losers and are not assigned to the SSC, thereby becoming members of its control group.

No lottery exists for Priority Cell 1 because all of its potential assignees can be accommodated by the SSC; no lottery exists for Priority Cells 3 and 4 because none of their potential assignees can be accommodated by the SSC. This is what HSAPS assignment is like for an oversubscribed SSC. However, all that the SSC sees is the list of known students that it submits to HSAPS and the list of students that HSAPS assigns to it.[3]

Most lotteries are for Priority Cells 1 and 2. Very few are for Priority Cells 3 and 4. As stated earlier, HSAPS lotteries are not held for SSCs that are not oversubscribed in a given year and they are not represented in the present analysis for that year.

How Effects of Winning an SSC Lottery Are Estimated

This section outlines the basic approach used to estimate effects of winning an SSC lottery, describes two necessary extensions to this approach, and presents the resulting statistical model.

Basic Approach

Randomization ensures that observed mean outcomes for control group members are valid estimates of what the outcomes would have been for SSC lottery winners had they lost their lottery — known as "counterfactual" outcomes for SSC lottery winners. Observed differences between mean outcomes for SSC lottery winners and outcomes for control group members, therefore, are valid estimates of the average effects of winning (as opposed to losing) an

[2]In this heuristic, the priority sequence of the SSC's cells is defined as (1) geographic preference and known, (2) geographic preference and not known, (3) no geographic preference and known, and (4) no geographic preference and not known. In other words, geographic preference trumps whether a student is known to the school (note the sequence of Priority Cells 2 and 3). This may not have been the case in all years of HSAPS, and may change in future years to reflect DOE policy. However, the sequence of the cells does not affect the randomized results of the SSC lottery as lotteries take place in just one cell per school, among students who all share the same priority combination.

[3]HSAPS determines the geographic priority of each student for each school based on the addresses of the student and the school and the geographic priority categories of the school.

SSC lottery. The basic approach for the present analysis is thus to estimate for each SSC lottery differences in mean outcomes for winners and control group members and to average the results across lotteries. Because of technical issues created by HSAPS assignment, the following two extensions of the basic approach were required.

Extension 1: Accounting for Clustering Produced by Students Who Participate in More Than One SSC Lottery

Recall that the hypothetical student in the HSAPS assignment process described above (Figure A.1) lost an SSC lottery for his first-choice school and won an SSC lottery for his third-choice school. Thus, he participated in two SSC lotteries. It is actually possible for a student to participate in *more* than two SSC lotteries, for example, by losing two or more lotteries before winning one or by losing more than two lotteries. Consequently, 24 percent of students in the present sample are participants in more than one SSC lottery.[4] This implies that they represent more than one "student observation" in the analysis. For example, the hypothetical student in the discussion above is represented as an SSC lottery winner (or student observation in the treatment group) for his third-choice school and as an SSC lottery loser (or student observation in the control group) for his first-choice SSC. This student, therefore, is represented by two observations for any given estimate of the average effect of winning an SSC lottery. However, because of the way these estimates are computed (by estimating the effect of winning each SSC lottery and averaging those estimates across lotteries), each individual student carries an appropriate weight in the overall result. This is directly analogous to how "matching with replacement" is used to estimate intervention effects.[5] Thus, no additional steps are required to account for multiple lottery participation in order to compute unbiased estimates of the average effects of winning an SSC lottery.

It is necessary, however, to account for multiple lottery participation in order to obtain appropriate estimates of standard errors, because multiple observations for a given student are correlated with each other. Indeed, they are perfectly correlated with each other and thus have an intraclass correlation of 1.0.[6] To properly account for this fact, all observations on a given outcome for a given student can be specified as being "clustered" by that student. This can be accomplished using the standard clustering option that exists for most current statistical soft-

[4]Specifically, 75.6 percent of all students in the sample participated in one SSC lottery, 19.3 percent participated in two SSC lotteries, 4.0 percent participated in three SSC lotteries, and 1.2 percent participated in four or more SSC lotteries.

[5]See Austin (2008).

[6]The intraclass correlation for student clusters of observations equals a value of 1.0 because outcomes do not vary across observations for a given student.

ware.[7] In this way, unbiased estimates of standard errors were obtained for results in the present report.

Adding this clustering option to estimates of effects of winning an SSC lottery on the likelihood of making adequate progress toward graduation in ninth grade for the full study sample of four entering cohorts increases the resulting standard error by about 6 percent of its value without accounting for clustering. Thus, although in principle students' participation in multiple lotteries could have a major effect on the precision of the present analysis, in practice it has very little effect.

Extension 2: Controlling for Variation in the Probability of Students' Prior Assignment Created by Participation in Lotteries for Preferred (or Prior-Choice) Schools

There is one and only one potential threat to the randomization produced by an SSC lottery. This potential threat derives from variation in students' *ex ante* probability of assignment to a preferred (or prior-choice) school based on their random HSAPS assignment order. The probability of prior assignment for an SSC lottery participant is the probability that HSAPS could have *by chance* assigned him or her "early enough" to win a lottery for a prior-choice school. As explained below, variation in this probability can in theory cause SSC lotteries to produce lottery winners and control group members who differ at baseline and thus have different mean counterfactual outcomes. In practice, however, this does not appear to occur.

For three-fourths of SSC lottery participants there is *no chance* that HSAPS assignment order can enable them to win a lottery for a prior-choice school. This is either because they had no prior-choice school (the current lottery was for their first choice) or because lotteries had nothing to do with why they did not get a prior choice — that is, they were preempted by students with higher priority or students who satisfied admissions criteria (for schools that were not SSCs). For this majority of lottery participants, the probability of prior assignment equals 0 and *there is no threat to randomization.*

For one-fourth of SSC lottery participants, there is *some chance* that HSAPS assignment order could enable them to win a lottery for a prior-choice school. This is because they were in a lottery for one or more prior school choices.[8] For participants in one prior lottery, the probability of prior assignment is approximately the proportion of participants who won that

[7]White's cluster-robust standard errors are used to account for student-level clustering, which occurs because some students appear in multiple lotteries and are therefore included in the analysis more than once.

[8]Some high schools that are not SSCs are oversubscribed in some years and thus have an HSAPS lottery. Their lotteries are accounted for in the present analysis.

lottery.[9] For example, if one out of three participants won this prior lottery, the probability of prior assignment equals about 33 percent. For participants in more than one prior lottery, the probability of prior assignment equals approximately the proportion of lottery participants who won their least competitive lottery. This is because they only had to win it to be assigned by HSAPS to a prior-choice school; they did not also have to win a more competitive lottery. For example, if a student were in two prior lotteries, with a one-out-of-three chance of winning one lottery and a one-out-of-four chance of winning the other lottery, the probability of prior assignment would equal one-third (the probability of winning the less competitive lottery).

For this minority of lottery participants, the probability of prior assignment can vary from just above 0 to just below 1, and *this variation can pose a threat to randomization*. For example, assume that academically weak students choose unpopular schools whose lotteries are weakly competitive (9 out of 10 participants win). Assume that all other students choose more popular schools with more competitive lotteries (1 out of 10 participants wins). Because weak students are in weakly competitive prior lotteries, those who lose these lotteries must have been assigned especially "late" by HSAPS (otherwise they would have won). In contrast, because other students are in more competitive prior lotteries, students who lose these lotteries can have a mix of "early" and "late" HSAPS assignments.

Recall that among students who participate in prior lotteries, only those who lose are available to participate in a subsequent lottery; prior-lottery winners get assigned to the school for their prior lottery. In this way, the population of participants in subsequent lotteries is "prescreened" on their HSAPS assignment order. Consequently, this order may not be fully randomized across the remaining subpopulation of participants in subsequent lotteries.

In the present hypothetical example, the HSAPS assignment orders of weak students in a current lottery are later than those of other students in the current lottery because of their prescreening by prior lotteries. Weak students, therefore, will be more likely than others to lose the current lottery and be in its control group. Mean future outcomes for control group members in the current lottery thus will understate counterfactual outcomes for lottery winners.

[9]Exact values of this probability also depend on the degree to which other prior choices for lottery participants are oversubscribed. Thus, it is possible that lotteries with the same ratio of winners to participants could involve students with different distributions of HSAPS assignment orders. Hence, a student's prior probability of winning these lotteries might differ. In theory, this possibility could be controlled for (for the one-fourth of lottery participants who were in prior lotteries) by grouping students into "risk sets" defined by exact permutations of their prior choices (as done by Hastings, Kane, and Staiger, 2006, and Abdulkadiroglu et al., 2009). In practice, this is not feasible for the present analysis because it would require tens of thousands of risk sets, most of which would contain a single student and thus not represent a lottery. Furthermore, as demonstrated below, this approach is not necessary for the present analysis because without any statistical adjustments the baseline characteristics of SSC lottery winners and control group members are virtually identical. Thus, randomization appears not to be compromised by this theoretically possible phenomenon.

Consequently, future outcome differences for the two groups will *overstate* the effect of winning the SSC lottery.

The preceding illustration is, of course, only a theoretical possibility. Its practical importance depends on the strength of whatever systematic relationships exist among students' counterfactual future outcomes, their prior school choices, and the degree to which those prior choices are oversubscribed. There is no compelling theoretical reason to expect these relationships (especially their overall product) to be strong given the large amount of random variation that exists for each factor. However, whether these relationships are strong enough to be problematic remains an empirical question.

The most direct empirical evidence on this question is generated by the comparison of mean baseline characteristics for SSC lottery winners and control group members (presented in Table 2.1 of Chapter 2 and repeated here in Appendix Table A.1). These findings clearly indicate that the two groups are *virtually identical* at baseline on a wide range of characteristics that typically predict future academic success, including students' scores on standardized tests of reading and math in eighth grade.

If variation in the prior probability of assignment were sufficiently problematic to create a systematic difference in counterfactual outcomes for SSC lottery winners and control group members, then a reflection of this difference should be visible in their baseline characteristics, especially in their eighth-grade test scores. There is no sign of this difference, however.

Appendix Table A.2 (see page 80) provides further evidence that no such difference exists by comparing SSC lottery winners and control group members in terms of their number of preferred choices not received prior to the current lottery in which they are participating.[10] These findings indicate that 41.3 percent of observations for both lottery winners and control group members have zero preferred choices (because they are for participation in a first-choice lottery), 27.2 percent have one preferred choice, and 8.1 percent have two preferred choices. This equivalence holds for all 12 possible school choices. Appendix Table A.3 (see page 81) presents corresponding results for the 24 percent of observations that involved students who had participated in a prior lottery. Even for this subgroup of students — which, in theory, could be affected by variation in their probability of prior assignment — there is no systematic difference between SSC lottery winners and control group members.

[10]Results for SSC lottery winners represent the simple percentage distribution of their student observations across school choice categories. Results for control group members are computed first for each SSC lottery. They are then averaged across lotteries with weights proportional to each lottery's number of winners. This properly accounts for lottery differences in the ratio of winners to control group members.

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Appendix Table A.1

Baseline Characteristics of SSC Lottery Participants: First Year of High School, Cohorts 1 to 4

Characteristic (%)	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value for Estimated Difference
Race/ethnicity				
Hispanic	47.3	47.9	-0.6	0.480
Black	43.6	43.2	0.4	0.641
Other	7.9	7.5	0.3	0.428
Male	46.0	45.5	0.5	0.525
Eligible for free/reduced-price lunch	84.0	84.5	-0.5	0.467
English language learner	8.4	7.6	0.8	0.114
Special education[a]	6.6	6.7	-0.1	0.826
Overage for 8th grade[b]	16.7	18.1	-1.4	0.153
8th-grade reading proficiency[c]				
Did not meet standards (level 1)	6.9	6.6	0.3	0.486
Partially met standards (level 2)	60.5	61.4	-0.8	0.328
Fully met standards (level 3)	28.4	27.6	0.8	0.287
Met standards with distinction (level 4)	0.7	0.7	0.1	0.580
8th-grade math proficiency[c]				
Did not meet standards (level 1)	18.8	19.2	-0.3	0.628
Partially met standards (level 2)	45.1	44.9	0.3	0.759
Fully met standards (level 3)	32.8	31.9	0.9	0.238
Met standards with distinction (level 4)	2.3	2.2	0.1	0.598
Total number of student observations = 30,959				

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (DOE) state test data for eighth-graders from the 2004-2005 to 2007-2008 school years, as well as data from DOE enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a 0/1 indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

(continued)

Appendix Table A.1 (continued)

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

A chi-square test was used to assess the statistical significance of the overall difference between lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting chi-square value is not statistically significant (p-value = 0.387).

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]This sample includes special education students who can be taught in the regular classroom setting. Special education students classified by the DOE as requiring collaborative team teaching services or self-contained classes are not part of the sample.

[b]Lottery participants are classified as "overage for eighth grade" if they were 14 or older on September 1 of the eighth-grade school year.

[c]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

Thus, although it is theoretically possible that differences in the relative competitiveness of prior school lotteries for 24 percent of sample members could produce pre-existing differences between SSC lottery winners and control group members for the full study sample, there is strong empirical evidence that this did not occur. Nevertheless, to further limit this possibility, the estimated prior probability of assignment was included as a covariate in regression-adjusted estimates of effects of winning an SSC lottery. This covariate had no systematic effect on the results, however, providing further evidence that there are no pre-existing differences to control for.[11]

The Resulting Statistical Model

To implement the preceding extensions of the study's basic analytic approach, to pool findings across SSC lotteries, and to increase the precision of these findings, the regression

[11]Empirical analysis cannot determine *with certainty* whether there are pre-existing differences between SSC lottery winners and control group members because such analysis is limited to observed student characteristics, and it is always possible that unobserved differences exist. Nonetheless, the present empirical analysis is particularly telling because there is every reason to expect that if students' counterfactual outcomes are prescreened by their probability of prior assignment (which is the *only* potential source of a problem), then any systematic differences in future counterfactual outcomes that result should be reflected as differences in eighth-grade test scores (which does not occur).

This situation differs from nonrandomized studies that match comparison students to treatment students based on their pretests. In those studies, the *mechanism* that chooses comparison students is not the same as the *mechanism* that chooses treatment students. Thus, unobserved differences between the two groups can exist when they look the same on observed characteristics that are used to match them. In the present case, only one mechanism distinguishes between observed characteristics and unobserved characteristics of SSC lottery winners and control group members: their probability of prior assignment. If this mechanism prescreens SSC lottery winners and control group members differentially on their academic potential, it should produce systematic differences in their eighth-grade test scores. If there are no systematic differences in these test scores, there should be no systematic differences in students' academic potential.

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Appendix Table A.2

Distribution of Lottery Participants by Their Number of Prior Choices Not Obtained: Cohorts 1 to 4

Number of prior choices not obtained (%)	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value Estimated Difference
0	41.3	41.3	0.0	0.576
1	27.2	27.2	0.0	0.840
2	8.1	8.1	0.0	0.973
3	8.0	7.9	0.0	0.710
4	4.9	4.9	0.0	0.729
5	3.9	3.9	0.0	0.975
6	2.5	2.5	0.0	0.818
7	1.5	1.5	0.0	0.770
8	1.1	1.1	0.0	0.916
9	0.8	0.8	0.0	0.845
10	0.5	0.5	0.0	0.901
11	0.2	0.2	0.0	0.903
Total number of student observations = 29,811				

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2007-2008, as well as data from New York City Department of Education enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals one for lottery winners and zero for the lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a zero/one indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

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Appendix Table A.3

Distribution of Lottery Participants by Their Number of Prior Choices Not Obtained: Students in Cohorts 1 to 4 Who Were in Multiple Lotteries

Number of prior choices not obtained (%)	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value Estimated Difference
0	0.0	0.0	0.0	1.000
1	27.4	27.5	-0.1	0.792
2	13.8	13.5	0.3	0.292
3	16.4	16.6	-0.2	0.546
4	12.4	12.7	-0.3	0.220
5	9.9	9.7	0.2	0.300
6	7.1	7.4	-0.3	0.106
7	5.3	5.0	0.3	0.093
8	3.4	3.7	-0.3	0.098
9	2.2	2.0	0.2	0.094
10	1.5	1.4	0.0	0.733
11	0.7	0.5	0.1 *	0.028

Total number of student observations = 7,274

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2007-2008, as well as data from New York City Department of Education enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals one for lottery winners and zero for the lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a zero/one indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

model shown in Equation A.1 was used to compare mean outcomes for SSC lottery winners and control group members. This type of model is often used for multisite randomized trials.

Equation A.1:

$$Y_{ij} = \sum_i \alpha_i \cdot L_i + \beta_0 \cdot W_{ij} + \beta_1 \cdot PPA_{ij} + \gamma_R \cdot S_{ijR}(1 - M_{ijR}) + \pi_R \cdot M_{ijR}$$

$$+ Y_M \cdot S_{ijM}(1 - M_{ijM}) + \pi_M \cdot M_{ijM} + \varepsilon_k + \varepsilon_{ij}$$

where:

Y_{ij} = an outcome for participant *j* in lottery *i*

L_i = a lottery indicator equal to 1 for lottery *i* and 0 otherwise

W_{ij} = a lottery-winner indicator equal to 1 if participant *j* wins lottery *i,* and equal to 0 otherwise

PPA_{ij} = the probability of prior assignment for participant *j* in lottery *i*

S_{ijR} and S_{ijM} = the eighth-grade test score in reading and in math, respectively, for participant *j* in lottery *i*

M_{ijR} and M_{ijM} = a missing data indicator for eighth-grade test scores in reading and math, respectively, equal to 1 if data on the score are missing for participant *j* in lottery *i* and 0 otherwise

ε_k = a random error for student *k,* assumed to be distributed independently and identically across students

ε_{ij} = a random error for participant *i* in lottery *j,* assumed to be distributed independently and identically across observations for a student

The first variables in Equation A.1 are a series of 0/1 indicators, L_i, which identify each SSC lottery. These indicators account for lottery differences in the ratios of winners to control group members. To facilitate computation, the indicators are implemented by centering values of all other variables on their means for the lottery to which they apply, instead of including the indicators as covariates in the model. This is a common approach for estimating regression models with many indicator variables.[12]

The next variable in the model is a 0/1 indicator, W_{ij}, that identifies SSC lottery *winners*. The estimated coefficient, β_0, for this variable is the regression-adjusted difference between mean outcomes for lottery winners and control group members. *This result is the estimated effect of winning an SSC lottery*. The standard error and statistical significance level (p-

[12]See Wooldridge (2000).

value) for this coefficient are the standard error and statistical significance level for the estimated effect. For reference, Appendix Tables B.1 through B.4 present estimated effects of winning an SSC lottery for each outcome and sample in the present report.

The next variable in the model is the probability of prior assignment, PPA_{ij}. Its value is equal to 0 for the 76 percent of student observations that are not in a prior lottery, and its value ranges from just above 0 to just below 1 for the 24 percent of student observations that are in a prior lottery.

Lastly, student scores on eighth-grade reading and math tests (S_{ijR} and S_{ijM}) are included to increase the precision of the analysis. Zero/one indicators (M_{ijR} and M_{ijM}) are included for these test scores to account for their missing data for some students.[13]

Converting Estimated Effects of Winning an SSC Lottery into Estimated Effects of Enrolling in an SSC

Chapter 2 indicates that for many students who participate in multiple SSC lotteries, *losing a lottery is not the same as not being assigned by HSAPS to an SSC*. This is because these students can win another lottery for a different SSC and be assigned to it by HSAPS. They also can be assigned by HSAPS to another SSC without participating in another lottery. This can occur either because the other SSC is not oversubscribed (so that all of its potential assignees are accepted) or because it is oversubscribed but has sufficient capacity to accept all potential assignees in the students' priority cell.

Because of this, the difference between winning and losing an SSC lottery is not the same as the difference between being assigned to an SSC and not being assigned to an SSC. For these students, then, the average effect of winning an SSC lottery (as opposed to losing the lottery) is not the same as the average effect of being assigned to an SSC (as opposed to not being assigned to an SSC). This means that the average effect of winning an SSC lottery is not the same as the average effect of "intent to treat," which is what most randomized studies report. Indeed, it is not clear what the average effect of winning an SSC lottery means.

This ambiguity makes it necessary to convert estimates of average effects of winning an SSC lottery into estimates of something that is more meaningful: average effects of enrolling in an SSC. This latter type of effect is an example of what is referred to in the statistics literature as a local average treatment effect.[14] For the present analysis, this local average treatment effect

[13]In the four-cohort sample for the ninth-grade on-track indicator discussed in Chapter 3, 3.4 percent of student observations are missing data for their eighth-grade reading test, and 0.8 percent are missing data for their eighth-grade math test. There is no statistically significant difference in these missing data rates for SSC lottery winners and control group members.

[14]See Angrist, Imbens, and Rubin (1996).

was estimated using what is now a standard application of instrumental variables analysis to a randomized trial.[15]

The following sections describe the instrumental variables model used, present the conceptual rationale for this model, examine its assumptions, and explain how its findings are reported.

Statistical Model

The present instrumental variables model produces estimates of average effects of enrolling in an SSC for students who enroll in an SSC *because* they win a lottery for that SSC. The members of this type of subgroup are typically referred to as "compliers" in the statistics literature.[16] The present report does not use this label, however, because it is not clear what "compliance" means for students who lose one SSC lottery and win another. These students can be noncompliers for their first lottery (because they eventually enroll in an SSC even though they lose a prior SSC lottery) and compliers for their second lottery (because they win their second lottery and enroll in that SSC). The report refers to this subgroup as "target SSC enrollees" because (as explained below) its members are the target of estimates of SSC enrollment effects.

Estimates of SSC enrollment effects for target SSC enrollees were obtained from two-stage least squares estimation of an instrumental variables model that includes a separate instrument for each lottery. In effect, this model uses two-stage least squares to estimate an SSC enrollment effect for each lottery, and pools resulting estimates across lotteries. The instrument for each lottery is an interaction between the 0/1 indicator (W_{ij}) that distinguishes SSC lottery winners from control group members and the 0/1 indicator (L_i) that identifies the lottery involved.

This approach has been used for past analyses of multisite randomized experiments and is becoming popular for use with randomized studies in general and lottery-based studies in particular.[17] The instruments used for the present analysis are valid because they are randomized and thus cannot be correlated with error terms for student outcomes. The instruments are "strong" because winning or losing an SSC lottery is highly correlated with enrolling or not enrolling in an SSC.[18] The resulting two-stage least squares model is as follows.

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[15]For instrumental variables analysis, see Angrist, Imbens, and Rubin (1996).

[16]See Angrist, Imbens, and Rubin (1996).

[17]For use of this approach with multisite randomized experiments, see Gennetian, Morris, Bos, and Bloom (2005) and Ludwig and Kling (2007); with randomized studies in general, see Angrist and Pischke (2009); and with lottery-based studies in particular, see Abulkadiroglu et al. (2009).

[18]See Bloom, Zhu, and Unlu (2010) or Angrist and Pischke (2009) for a discussion of instrument strength and finite sample bias. To avoid this bias, present results are only reported for models with a first-stage F statistic equal to 10 or more, as recommended by Stock and Yogo (2005).

First-Stage Equation

The first-stage equation in the model specifies enrollment or not in an SSC (by the follow-up year represented by the outcome measure) as a function of indicator variables that identify each lottery, an indicator variable that distinguishes between lottery winners and control group members, students' prior probabilities of assignment, students' pretest scores on eighth-grade standardized tests of reading and math, plus a missing data indicator for each pretest score. The first-stage equation is thus:

Equation A.2:

$$Z_{ij} = \sum_i \alpha_i \cdot L_i + \sum_i \beta_{0i} \cdot W_{ij} \cdot L_i + \beta_1 \cdot PPA_{ij} + \gamma_R \cdot S_{ijR}(1 - M_{ijR}) + \pi_R \cdot M_{ijR} + \gamma_M \cdot S_{ijM}(1 - M_{ijM}) + \pi_M \cdot S_{ijM} + \upsilon_k + \upsilon_{ij}$$

where:

$Z_{ij} =$ an SSC enrollment indicator equal to 1 if participant *j* in lottery *i* enrolled in an SSC by the follow-up year represented by the outcome measure and 0 otherwise

$L_i =$ a lottery indicator equal to 1 for lottery *i* and 0 otherwise

$W_{ij} =$ a lottery-winner indicator equal to 1 if participant *j* won lottery *i* and 0 otherwise

$PPA_{ij} =$ the probability of prior assignment for participant *j* in lottery *i*

S_{ijR} and $S_{ijM} =$ scores on eighth-grade tests of reading and math, respectively, for participant *j* in lottery *i*

M_{ijR} and $M_{ijM} =$ missing data indicators for eighth-grade tests of reading and math, respectively, equal to 1 if data are missing for participant *j* in lottery *i* and 0 otherwise

$\upsilon_k =$ a random error for student *k*, assumed to be distributed independently and identically across students

$\upsilon_{ij} =$ a random error for participant *i* in lottery *j*, assumed to be distributed independently and identically across observations for a student

For this analysis, SSC enrollment is defined as whether or not students had enrolled in an SSC at any time during or before the follow-up year represented by the outcome measure. Thus, for estimates of SSC effects on ninth-grade outcomes, SSC enrollment is defined as whether or not students had enrolled in an SSC at any time during their first year of high school. For estimates of SSC effects on four-year graduation rates, SSC enrollment is defined as whether or not students had enrolled in an SSC at any time during their first four years of high school.

Second Stage Equation

The second-stage equation in the model specifies the outcome, Y_{ij}, for each lottery participant as a function of the predicted value of his SSC enrollment indicator, $\hat{Z}_{ij}$, which equals the fitted value of the indicator from the first-stage equation. In addition, it is necessary to include in the second-stage equation all exogenous independent variables from the first stage.[19] The second-stage equation is thus:

Equation A.3:

$$Y_{ij} = \sum_i \phi_i \cdot L_i + \theta_0 \cdot \hat{Z}_{ij} + \theta_1 \cdot PPA_{ij} + \rho_R \cdot S_{ijR}\left(1 - M_{ijR}\right) + \omega_R \cdot M_R + \rho_M \cdot S_M\left(1 - M_{ijM}\right) + \omega_M \cdot M_{ijM} + \varepsilon'_k + \varepsilon'_{ij}$$

where:

ε'_k = a random error for student *k*, assumed to be distributed independently and identically across students

ε'_{ij} = a random error for participant *i* in lottery *j*, assumed to be distributed independently and identically across observations for a student

The estimated value of the enrollment coefficient (θ_0) in the second-stage equation is the estimated average effect of enrolling in an SSC for target SSC enrollees (their local average treatment effect). The estimated standard error and p-value for this coefficient are the estimated standard error and p-value for the estimated effect.

Conceptual Rationale

Appendix Figure A.3 illustrates sample subgroups that are the conceptual basis for converting estimated effects of winning an SSC lottery into estimated effects of SSC enrollment through instrumental variables analysis. This figure represents *a single hypothetical SSC lottery*, with a bar on the left side for lottery winners and a bar on the right side for control-group members.

The top segment of the bar for lottery winners represents members of this group who do not enroll in an SSC and thereby become "no-shows."[20] Only a small fraction of lottery winners are no-shows, as suggested by the small section of the bar that is allotted to this group. The top segment of the bar depicting the control group represents "no-show counterparts." These are students who lose the SSC lottery, do not enroll in an SSC, and would not have enrolled in one if they had won the lottery.

[19]See Angrist and Pischke (2009).
[20]See Bloom (1984).

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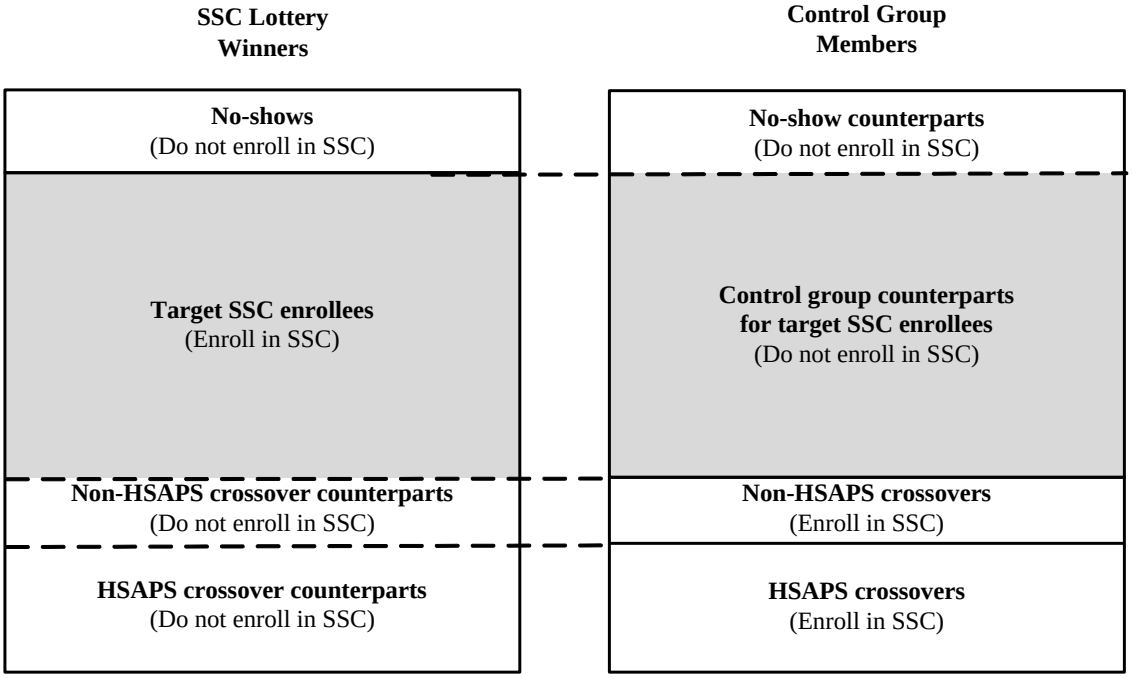
Appendix Figure A.3

A Model of SSC Enrollment Among Hypothetical SSC Lottery Winners and Control Group Members



Randomization ensures that the proportion of control group members who are no-show counterparts equals (in expectation) the proportion of SSC lottery winners who are no-shows. Randomization also ensures that mean counterfactual outcomes for no-show counterparts equal (in expectation) mean counterfactual outcomes for no-shows. It is possible to identify individual no-shows but it is not possible to identify individual no-show counterparts. However, all that is necessary for the analysis (as will be seen) is the statistical fact that no-shows and no-show counterparts have the same mean counterfactual outcomes and make up the same proportion of their experimental groups.

The bottom two segments of the control group bar represent control group members who, although they lose the present lottery, ultimately enroll in an SSC and thereby become "crossovers."[21] It is possible to identify individual crossovers among control group members but it is not possible to identify individual crossover counterparts among SSC lottery winners. Once again, all that is necessary for the analysis is that the relative sizes and mean counterfactual out-

[21]Bloom et al. (1996).

comes are the same for the corresponding subgroups. The bottom-most segment of the control group bar represents students who lose the present SSC lottery, are assigned by HSAPS to another SSC, and ultimately enroll in an SSC. This subgroup is referred to as "HSAPS crossovers" because their crossover status is caused by HSAPS. Randomization ensures that among winners of the present SSC lottery there is a subgroup of "HSAPS crossover counterparts" whose relative size and mean counterfactual outcomes are the same (in expectation) as those for HSAPS crossovers.

The second-to-bottom segment of the control group bar in Figure A.3 represents students who lose the current SSC lottery but enroll in an SSC through channels outside of HSAPS. (For example, a student may move into the district or transfer from a parochial school *after* the HSAPS process has concluded. In those instances, a student enrolls through a borough enrollment office.) This subgroup is referred to as "non-HSAPS crossovers." Randomization ensures that among winners of the present SSC lottery there is a subgroup of "non-HSAPS crossover counterparts" whose relative size and mean counterfactual outcomes are the same (in expectation) as those for non-HSAPS crossovers. Note that there are considerably more HSAPS crossovers than non-HSAPS crossovers, which is the case for the study sample.

The remaining (and by far the largest) subgroups of lottery winners and control group members who are depicted in Figure A.3 are target SSC enrollees and target SSC enrollee counterparts. As noted, these sample members are typically referred to as compliers. But given the ambiguity of the concept of compliance in the present situation, this label is not used.

Randomization ensures that the relative sizes and mean counterfactual outcomes of target SSC enrollees and their control group counterparts are the same in expectation. And as shown below, these are the only sample members whose high school experiences provide information about the effects of SSC enrollment. Hence, they are the only students for whom SSC enrollment effects can be estimated.

To do so requires the following assumptions:

- Assignment to an SSC by itself (without actually enrolling in the SSC) does not affect student outcomes.[22]
- Average effects of SSC enrollment are approximately the same (zero) for no-shows and no-show counterparts (because neither enrolls in an SSC).
- Average effects of SSC enrollment are approximately the same for crossovers and crossover counterparts (because both enroll in an SSC).

[22]This assumption is often called the "exclusion restriction" (Angrist, Imbens, and Rubin, 1996).

The preceding assumptions plus the counterfactual equivalence of the corresponding subgroups in Figure A.3, which is ensured by randomization, imply that in expectation there is zero difference in mean future outcomes for no-shows and no-show counterparts and there is zero difference in mean future outcomes for crossovers and crossover counterparts. Therefore, in expectation these sample members contribute zero difference to any observed difference in mean outcomes for the full sample of SSC lottery winners and control group members. *The only potential source of any difference is target SSC enrollees (who enroll in an SSC) and their control group counterparts (who do not enroll in an SSC).*

Consequently, the expected value of the observed difference in mean outcomes for SSC lottery winners and control group members is a weighted average of zero difference for no-shows and their counterparts plus zero difference for crossovers and their counterparts plus the average effect of SSC enrollment for target SSC enrollees and their counterparts. Weights for this average are proportional to the size of each subgroup. In symbols:

Equation A.4:

$$E_W = P_{NS} \cdot 0 + P_{HCC} \cdot 0 + P_{NHCC} \cdot 0 + (1 - P_{NS} - P_{HCC} - P_{NHCC}) \cdot E_E$$
$$= (1 - P_{NS} - P_{HCC} - P_{NHCC}) \cdot E_E$$

where:

E_W and E_E = the expected value of the average effect of winning an SSC lottery for all lottery participants and the expected value of the average effect of enrolling in an SSC for target SSC enrollees, respectively

$P_{NS}, P_{HCC},$ and P_{NHCC} = the expected proportions of SSC lottery winners who are no-shows, HSAPS crossover counterparts, and non-HSAPS crossover counterparts, respectively

Therefore,

Equation A.5:

$$E_E = \frac{E_W}{(1 - P_{NS} - P_{HCC} - P_{NHCC})}$$

Equation A.5 illustrates the simplest possible form of instrumental variables analysis, a Wald estimator.[23] For the present analysis, this estimator equals the ratio of the effect of winning an SSC lottery on students' outcomes (E_W) to the proportion of SSC lottery winners who are target SSC enrollees ($1 - P_{NS} - P_{HCC} - P_{NHCC}$).[24] For example, if the effect of winning the

[23]See Wald (1940).

[24]The proportion of SSC lottery winners who are target SSC enrollees is equivalent to the effect of winning an SSC lottery on the probability of enrolling in an SSC.

lottery were an increase of 7 percentage points in the likelihood of making adequate progress toward graduation, and the proportion of lottery winners who are target SSC enrollees were 0.5, then the effect of enrolling in an SSC would be (7/0.5), or 14 percentage points. This result could also be obtained using two-stage least squares analysis with a single instrument (winning the lottery or not winning the lottery).

Bridging the Gap Between the Statistical Model and the Implications of Its Conceptual Rationale

The preceding conceptual rationale and its corresponding Wald estimator are for a single SSC lottery with a single instrumental variable, whereas the present statistical model is for 297 lotteries with 297 instrumental variables. Thus, a simple Wald estimator is not used for the present analysis although its basic intuition holds for each SSC lottery included.

Consequently, for this analysis the relationship between estimated effects of winning an SSC lottery ($\hat{E}_W$) and estimated effects of enrolling in an SSC ($\hat{E}_E$) is not the same as that for a single lottery. To see this point, first rearrange Equation A.5 and substitute into it estimates of the two effects represented by $\hat{E}_W$ and $\hat{E}_E$. This yields the following equation.

Equation A.6:

$$1 - P_{NS} - P_{HCC} - P_{NHCC} = \frac{\hat{E}_W}{\hat{E}_E}$$

Equation A.6 indicates that for a single lottery, the proportion of SSC lottery winners who are target SSC enrollees can be estimated from the ratio of the estimated effect of winning an SSC lottery (obtained using ordinary least squares) and the estimated effect of enrolling in an SSC (obtained using two-stage least squares with a single instrument).

However, as noted, this simple relationship does not exist for analyses of multiple lotteries with multiple instruments.[26] In fact, this relationship is quite complex and could be a source of confusion if direct comparisons are made between estimates of SSC enrollment effects on student outcomes reported in Chapter 3 and corresponding estimates of effects of winning an SSC lottery presented in Appendix B.

For example, the ratio of these estimates for the ninth-grade on-track indicator equals 0.74. This implies that for these outcomes the effects of enrolling in an SSC are (1/0.74) or 1.35

[26]This issue arises because SSC enrollment effects (which are local average treatment effects) vary across lotteries, and the two-stage least squares approach, with a separate instrument for each lottery, produces a complex weighted average of estimates of these effects. Although this issue goes beyond the scope of the present study, the fact that such variation exists and is statistically significant was established using a "random effects" model.

times the size of effects of winning an SSC lottery. This can be confirmed by comparing estimates in Table 3.2 of Chapter 3 with their counterparts in Table B.1 of Appendix B.

Now recall that approximately 58 percent of all lottery winners in the ninth-grade on-track sample are target SSC enrollees. If the study sample were considered as a single composite lottery with a single instrument (which is possible to do but was judged not to be as appropriate as specifying a separate instrument for each lottery), the estimated effect of enrolling in an SSC would be (1/0.58) or 1.72 times the estimated effect of winning an SSC lottery. This larger multiple would produce estimates of SSC enrollment effects that are larger than those presented in this report. Indeed, one of the reasons that multiple instruments were used instead of a single instrument was a desire to be conservative about the size of the ratio that was used to convert estimates of winning an SSC lottery into estimates of enrolling in an SSC.

Plausibility of the Assumptions Used

To assess the validity of findings in this report, it is important to consider the plausibility of the assumptions upon which they are based. Recall that the first such assumption is that, by itself, HSAPS *assignment* of a student to a particular school (without the student actually *enrolling* in that school) has no effect on that student's future academic success. This assumption seems almost self-evident for no-shows who are assigned by HSAPS to an SSC but do not enroll in one. And it should apply with equal force to no-show counterparts. However, as discussed below, its plausibility is less obvious for crossovers.

The second assumption noted above is that no-shows and no-show counterparts experience the same average effect of enrolling in an SSC — zero effect. This assumption also seems self-evident because no members of either group enroll in an SSC and hence they do not experience an SSC as students.

The third assumption is that SSC enrollment effects are the same for crossovers in the control group and their counterparts among SSC lottery winners. The plausibility of this assumption should be considered separately for HSAPS crossovers and non-HSAPS crossovers.

Recall that non-HSAPS crossovers lose an SSC lottery and are not assigned by HSAPS to an SSC, but somehow manage to enroll in one. In contrast, their counterparts among SSC lottery winners are assigned by HSAPS to an SSC and simply enroll in the SSC to which they are assigned. To the extent that non-HSAPS crossovers must expend extra effort to enroll in an SSC, they may be especially motivated by getting what they worked for. In addition, it is possible that the school they wanted to attend is an especially good fit for them.

If either or both of these conditions exist, then non-HSAPS crossovers may experience larger SSC enrollment effects than do their counterparts among SSC lottery winners. If this is

the case, non-HSAPS crossovers and their counterparts will cause current estimates to *understate* the true effects of enrolling in an SSC.[27]

Although there is no direct empirical evidence about this issue, there is one piece of indirect evidence: the fact that estimated effects for students who are known to an SSC are no larger than those for students who are not known. Since some effort is involved in making oneself known to an SSC, this finding seems relevant for non-HSAPS crossovers and suggests that the third assumption above — that SSC enrollment effects are the same for non-HSAPS crossovers in the control group and their counterparts among SSC lottery winners — might hold for them.

Now recall that HSAPS crossovers lose an SSC lottery and are assigned by HSAPS to another SSC that is farther down in their list of choices. If school choice per se makes a positive difference in students' academic success, those students who enroll in a higher-choice SSC will experience larger enrollment effects. (To some extent this might be considered a violation of the first assumption described above that, by itself, HSAPS assignment of a student to a particular school has no effect on that student's future academic success). This violation of the third assumption would cause current estimates to *overstate* the true effects of SSC enrollment.[28]

Chapter 3 presents empirical evidence that suggests that it is unclear whether the effects of SSC enrollment vary systematically across the rank-ordered preference of the SSC to which students are assigned. Overall, there is not statistically significant variation in SSC effects among students who ranked the SSC to which they were assigned as their first choice, their second or third choice, or their fourth through twelfth choice. It does appear, however, that the effect of SSC enrollment may be *smaller* for students who rank the SSC to which they were assigned as their first-choice school relative to the SSC effects for all other students. If that is the case, then present estimates would understate the true effects of SSC enrollment on target SSC enrollees.

On balance, then, existing empirical evidence suggests that the present estimates do not overstate the effects of SSC enrollment.

[27]Instead of the assumed *zero difference* between mean outcomes for non-HSAPS crossovers and their counterparts among lottery winners, there would be a *negative difference*. This negative difference would be embedded in the observed difference in mean outcomes for all lottery winners and control group members, which would cause the observed difference to understate the true difference produced by target SSC enrollees and their control group counterparts.

[28]The situation here is the reverse of that in note 27.

Reporting the Findings

Table A.4 is a portion of Table 3.2 from Chapter 3. This table illustrates how estimates of SSC enrollment effects are reported. The first column in the table shell is for estimates of mean outcomes for target SSC enrollees; the second column is for estimates of mean outcomes for control group counterparts of target SSC enrollees; the third column is for estimates of differences between mean outcomes for the two groups; and the fourth column is for p-values of these estimated differences.

Findings for the last two columns are obtained directly from estimates of θ_0 in Equation A.3 and its p-value. For example, the last two numbers in the first row of the table indicate that the estimated effect of SSC enrollment on the likelihood of target SSC enrollees being on track toward graduation at the end of ninth grade is an increase of 10.0 percentage points with a p-value of 0.000 (which is highly statistically significant). Findings for the first column, which represent the mean value of each outcome measure for target SSC enrollees, are estimated as described below. The first number in the first row of the table indicates that 58.5 percent of target SSC enrollees were estimated to be on track toward graduation at the end of ninth grade. Findings for the second column, which represent the mean value of each outcome measure for the control group counterparts of target SSC enrollees, are obtained by subtracting the corresponding value in the third column ("Estimated effect") from that in the first column. For example, the second number in the first row of the table (48.5) was obtained by subtracting the third number (10.0) from the first number (58.5). This result indicates that 48.5 percent of the control group counterparts of target SSC enrollees were estimated to be on track toward graduation at the end of ninth grade.

The present approach to reporting results has been used in previous MDRC studies.[29] What differs from previous studies is that mean outcomes for this study must be reported for a subgroup of treatment group members (target SSC enrollees) who cannot be identified individually.[30] Fortunately, the statistical properties of randomization make it possible to obtain valid estimates of mean outcomes for this subgroup. All that is needed is information about the proportion of SSC lottery winners who enroll in an SSC ($P_{LWE} = 1 - P_{NS}$), the observed mean outcome for these enrollees ($\bar{Y}_{LWE}$), the proportion of control

[29]See Black et al. (2009); Corrin et al. (2008).

[30]Because most randomized studies only report estimates of average effects of intent to treat, they can present observed mean outcomes for *all treatment group members* as a contextual anchor for their estimates of treatment effects. However, because this type of effect does not have a meaningful interpretation for the present study, it was necessary instead (as noted above) to report estimates of local average treatment effects for target SSC enrollees. Since it is not possible to identify individual compliers, it is not possible to measure their mean outcomes directly. Instead, they must be estimated from observed outcomes for all treatment group members who receive treatment and all crossovers (as described in this section).

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Appendix Table A.4

Sample Partial Table of Estimated SSC Enrollment Effects

Outcome	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	P-Value for Estimated Effect
9th-grade on-track indicator[a] (%)	58.5	48.5	10.0 **	0.000
Earned 10 or more credits	73.1	62.3	10.8 **	0.000
Failed more than 1 semester of a core subject	39.0	46.8	-7.8 **	0.000
Total number of student observations = 29,811				

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in 2004-2005 to 2007-2008, as well as data from New York City Department of Education attendance, course credits, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

[a]The on-track composite measure indicates whether students earned at least 10 credits in their first year of high school and had no more than one semester of failure in a core subject in that school year (English, math, science, and social studies).

group members who are crossovers (P_{CO}), and the observed mean outcome for those crossovers ($\bar{Y}_{CO}$). Randomization ensures that P_{CO} and $\bar{Y}_{CO}$ are unbiased estimates of corresponding parameters for crossover counterparts among SSC lottery winners.

The next step is to note that a mean outcome for all SSC lottery winners who enroll in an SSC ($\bar{Y}_{LWE}$) is a weighted average of the corresponding mean outcome for target SSC enrollees ($\bar{Y}_{tarE}$) and crossover counterparts with weights equal to the size of each group. Then, note that the mean outcome for crossovers ($\hat{Y}_{C)}$) is an unbiased estimate of the mean outcome for crossover counterparts. Together, these facts imply that:

Equation A.7:

$$\bar{Y}_{LWE} = \left[\frac{1 - P_{NS} - P_{CO}}{1 - P_{NS}}\right] \cdot \bar{Y}_{tarE} + \left[\frac{P_{CO}}{1 - P_{NS}}\right] \cdot \bar{Y}_{CO}$$

Solving Equation A.7 for $\bar{Y}_{tarE}$ yields:

Equation A.8:

$$\bar{Y}_{tarE} = \left[\frac{1 - P_{NS}}{1 - P_{NS} - P_{CO}}\right] \cdot \bar{Y}_{LWE} + \left[\frac{P_{CO}}{1 - P_{NS} - P_{CO}}\right] \cdot \bar{Y}_{CO}$$

In this way, the implied value of $\bar{Y}_{tarE}$ can be estimated from observable values of $P_{NS}, P_{CO}, \bar{Y}_{LWE}$, and $\bar{Y}_{CO}$. This approach also works for estimating mean values of background characteristics of target SSC enrollees ($\bar{X}_{tarE}$).

Appendix B

Effects of Winning an SSC Lottery

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Appendix Table B.1

Estimated Effects of Winning an SSC Lottery on the Transition into High School: First Year of High School, Cohorts 1 to 4

Outcome	SSC Lottery Winners	Control Group Members	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Course credits					
Ninth-grade on-track indicator[a] (%)	57.9	50.5	7.4 **		0.000
Earned 10 or more credits (%)	72.0	64.5	7.4 **		0.000
Failed more than 1 semester of a core subject (%)	39.8	46.1	-6.3 **		0.000
Total credits earned toward graduation[b]	11.2	10.5	0.7 **	0.17 **	0.000
Attendance (%)					
Overall attendance rate	87.1	86.2	1.0 **		0.000
Regular attendance rate (90 percent or higher)	60.2	56.0	4.2 **		0.000
Total number of student observations = 29,811					

SOURCES: MDRC's calculations use High School Application Processing System (HSAPS) data from eighth-graders in 2004-2005 to 2007-2008, as well as data from New York City Department of Education attendance, course credits, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Estimated differences between SSC lottery winners and control group members are regression-adjusted as described by Equation A.1 in Appendix A. Variables in the regression are measured as deviations from their lottery mean in order to account for the lottery for each sample point. This approach is equivalent to directly accounting for each lottery by adding a zero/one indicator variable for it (Wooldridge, 2000). Values in the column labeled "SSC Lottery Winners" are observed means for lottery winners assigned by HSAPS to an SSC. Values in the column labeled "Control Group Members" are regression-adjusted means that match the distribution of SSC lottery winners across lotteries. In some cases, rounding may cause slight discrepancies when comparing the statistical significance of findings in this table (for effects of winning an SSC lottery) with the statistical significance of findings in Table 3.2 (for effects of enrolling in an SSC).

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size is calculated as a proportion of the standard deviation of the outcome for control group members.

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]The on-track composite measure indicates whether students earned at least 10 credits in their first year of high school and had no more than one semester of failure in a core subject in that school year (English, math, science, and social studies).

[b]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

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Appendix Table B.2

Estimated Effects of Winning an SSC Lottery on Progress Toward Graduation: Second Year of High School, Cohorts 1 to 3

Outcome	SSC Lottery Winners	Control Group Members	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Course credits					
Earned 20 or more credits (%)	68.8	62.8	6.1 **		0.000
Total credits earned toward graduation[a]	22.2	20.8	1.4 **	0.16 **	0.000
Regents exams					
Total Regents exams passed toward graduation[b]	1.5	1.4	0.0	0.03	0.070
Attendance (%)					
Overall attendance rate	84.7	83.4	1.3 **		0.000
Regular attendance rate (90 percent or higher)	55.2	52.1	3.1 **		0.001

Total number of student observations = 21,822

SOURCES: MDRC's calculations use High School Application Processing System (HSAPS) data from eighth-graders in 2004-2005 to 2006-2007, as well as data from New York City Department of Education attendance, course credits, Regents exam, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Estimated differences between SSC lottery winners and control group members are regression-adjusted as described by Equation A.1 in Appendix A. Variables in the regression are measured as deviations from their lottery mean in order to account for the lottery for each sample point. This approach is equivalent to directly accounting for each lottery by adding a zero/one indicator variable for it (Wooldridge, 2000). Values in the column labeled "SSC Lottery Winners" are observed means for lottery winners assigned by HSAPS to an SSC. Values in the column labeled "Control Group Members" are regression-adjusted means that match the distribution of SSC lottery winners across lotteries. In some cases, rounding may cause slight discrepancies when comparing the statistical significance of findings in this table (for effects of winning an SSC lottery) with the statistical significance of findings in Table 3.4 (for effects of enrolling in an SSC).

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size for each measure is calculated as a proportion of the standard deviation of the outcome for control group members.

Cohorts 1, 2, and 3 consist of students in the study who were eighth-graders in the spring of 2005, 2006, and 2007, respectively.

[a]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

[b]In order to receive a New York State diploma, students must pass the following core subject Regents exams: English Language Arts, Math A, U.S. History, Global History, and one of the science exams (Chemistry, Physics, Earth Science, Biology, or Living Environment). The "total Regents exams passed toward graduation" measure counts the number of required Regents exams that a student has passed with a score of 65 or above.

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Appendix Table B.3

Estimated Effects of Winning an SSC Lottery on Progress Toward Graduation: Third Year of High School, Cohorts 1 and 2

Outcome	SSC Lottery Winners	Control Group Members	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Course credits					
Earned 30 or more credits (%)	69.5	65.5	3.9 **		0.000
Total credits earned toward graduation[a]	32.1	30.8	1.3 **	0.12 **	0.000
Regents exams					
Total Regents exams passed toward graduation[b]	2.7	2.6	0.1 **	0.06 **	0.003
Attendance (%)					
Overall attendance rate	82.3	80.7	1.7 **		0.001
Regular attendance rate (90 percent or higher)	51.4	47.4	4.0 **		0.001
Total number of student observations = 13,297					

SOURCES: MDRC's calculations use High School Application Processing System (HSAPS) data from eighth-graders in 2004-2005 and 2005-2006, as well as data from New York City Department of Education attendance, course credits, Regents exam, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Estimated differences between SSC lottery winners and control group members are regression-adjusted as described by Equation A.1 in Appendix A. Variables in the regression are measured as deviations from their lottery mean in order to account for the lottery for each sample point. This approach is equivalent to directly accounting for each lottery by adding a zero/one indicator variable for it (Wooldridge, 2000). Values in the column labeled "SSC Lottery Winners" are observed means for lottery winners assigned by HSAPS to an SSC. Values in the column labeled "Control Group Members" are regression-adjusted means that match the distribution of SSC lottery winners across lotteries. In some cases, rounding may cause slight discrepancies when comparing the statistical significance of findings in this table (for effects of winning an SSC lottery) with the statistical significance of findings in Table 3.5 (for effects of enrolling in an SSC).

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size for each measure is calculated as a proportion of the standard deviation of the outcome for control group members.

Cohorts 1 and 2 consist of students in the study who were eighth-graders in the spring of 2005 and 2006, respectively.

[a]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

[b]In order to receive a New York State diploma, students must pass the following core subject Regents exams: English Language Arts, Math A, U.S. History, Global History, and one of the science exams (Chemistry, Physics, Earth Science, Biology, or Living Environment). The "total Regents exams passed toward graduation" measure counts the number of required Regents exams that a student has passed with a score of 65 or above.

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Appendix Table B.4

Estimated Effects of Winning an SSC Lottery on Graduation: Fourth Year of High School, Cohort 1

Outcome (%)	SSC Lottery Winners	Control Group Members	Estimated Effect	P-Value for Estimated Effect
Graduation				
Graduated from high school	68.1	63.8	4.4 **	0.006
Local diploma granted	24.2	21.8	2.5	0.082
Regents diploma granted	38.9	36.8	2.2	0.170
Advanced Regents diploma granted	4.7	5.2	-0.5	0.425
College readiness				
Math A Regents exam score of 75 or above	22.2	22.2	0.0	1.000
English Regents exam score of 75 or above	33.6	30.6	3.0 *	0.022
Attendance				
Overall attendance rate	80.8	79.6	1.2	0.121
Regular attendance rate (90 percent or higher)	42.9	42.1	0.7	0.669
Total number of student observations = 5,363				

SOURCES: MDRC's calculations use High School Application Processing System (HSAPS) data from eighth-graders in 2004-2005, as well as data from New York City Department of Education attendance, course credits, Regents exam, transactional, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Estimated differences between SSC lottery winners and control group members are regression-adjusted as described by Equation A.1 in Appendix A. Variables in the regression are measured as deviations from their lottery mean in order to account for the lottery for each sample point. This approach is equivalent to directly accounting for each lottery by adding a zero/one indicator variable for it (Wooldridge, 2000). Values in the column labeled "SSC Lottery Winners" are observed means for lottery winners assigned by HSAPS to an SSC. Values in the column labeled "Control Group Members" are regression-adjusted means that match the distribution of SSC lottery winners across lotteries. In some cases, rounding may cause slight discrepancies when comparing the statistical significance of findings in this table (for effects of winning an SSC lottery) with the statistical significance of findings in Table 3.7 (for effects of enrolling in an SSC).

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Cohort 1 consists of students in the study who were eighth-graders in the spring of 2005.

Appendix C

Baseline Characteristics of SSC Lottery Participants with Follow-up Data

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Appendix Table C.1

Baseline Characteristics of SSC Lottery Participants with Follow-up Data: First Year of High School, Cohorts 1 to 4

Characteristic (%)	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value for Estimated Difference
Race/ethnicity				
Hispanic	46.4	47.7	-1.3	0.251
Black	44.9	43.3	1.6	0.149
Other	7.1	7.2	-0.1	0.852
Male	46.2	44.8	1.5	0.178
Eligible for free/reduced-price lunch	84.3	85.1	-0.8	0.391
English language learner	6.3	6.3	0.0	0.960
Special education[a]	5.0	5.6	-0.6	0.223
Overage for 8th grade[b]	20.8	21.7	-0.9	0.337
8th-grade reading proficiency[c]				
Did not meet standards (level 1)	8.5	8.4	0.1	0.855
Partially met standards (level 2)	63.8	63.9	-0.2	0.877
Fully met standards (level 3)	21.8	21.4	0.4	0.663
Met standards with distinction (level 4)	0.9	0.7	0.2	0.216
8th-grade math proficiency[c]				
Did not meet standards (level 1)	23.9	23.4	0.5	0.593
Partially met standards (level 2)	48.3	47.7	0.6	0.582
Fully met standards (level 3)	25.5	25.7	-0.1	0.888
Met standards with distinction (level 4)	1.0	0.9	0.1	0.683
Total number of student observations = 29,811				

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (DOE) state test data for eighth-graders from the 2004-2005 to 2007-2008 school years, as well as data from DOE enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a 0/1 indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

(continued)

Appendix Table C.1 (continued)

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

A chi-square test was used to assess the statistical significance of the overall difference between the lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting chi-square value is not statistically significant (p-value = 0.474).

Cohorts 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]This sample includes special education students who can be taught in the regular classroom setting. Special education students classified by the DOE as requiring collaborative team teaching services or self-contained classes are not part of the sample.

[b]Lottery participants are classified as "overage for eighth grade" if they were 14 or older on September 1 of the eighth-grade school year.

[c]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

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Appendix Table C.2

Baseline Characteristics of SSC Lottery Participants with Follow-up Data: Second Year of High School, Cohorts 1 to 3

Characteristic (%)	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value for Estimated Difference
Race/ethnicity				
Hispanic	46.4	47.5	-1.1	0.357
Black	44.8	43.2	1.6	0.151
Other	7.3	7.6	-0.2	0.670
Male	46.2	44.4	1.7	0.128
Eligible for free/reduced-price lunch	84.5	84.6	-0.1	0.943
English language learner	6.1	6.1	0.0	0.947
Special education[a]	4.9	5.8	-0.9	0.116
Overage for 8th grade[b]	19.2	20.4	-1.2	0.230
8th-grade reading proficiency[c]				
Did not meet standards (level 1)	8.3	8.1	0.1	0.830
Partially met standards (level 2)	64.1	64.0	0.1	0.930
Fully met standards (level 3)	22.0	21.9	0.1	0.904
Met standards with distinction (level 4)	0.9	0.7	0.2	0.227
8th-grade math proficiency[c]				
Did not meet standards (level 1)	23.2	22.9	0.3	0.760
Partially met standards (level 2)	48.7	48.4	0.3	0.827
Fully met standards (level 3)	26.2	26.0	0.1	0.889
Met standards with distinction (level 4)	1.1	1.0	0.1	0.738
Total number of student observations = 21,822				

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (DOE) state test data for eighth-graders from the 2004-2005 to 2006-2007 school years, as well as data from DOE enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a 0/1 indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

(continued)

Appendix Table C.2 (continued)

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

A chi-square test was used to assess the statistical significance of the overall difference between lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting chi-square value is not statistically significant (p-value = 0.462).

Cohorts 1, 2, and 3 consist of students in the study who were eighth-graders in the spring of 2005, 2006, and 2007, respectively.

[a]This sample includes special education students who can be taught in the regular classroom setting. Special education students classified by the DOE as requiring collaborative team teaching services or self-contained classes are not part of the sample.

[b]Lottery participants are classified as "overage for eighth grade" if they were 14 or older on September 1 of the eighth-grade school year.

[c]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

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Appendix Table C.3

Baseline Characteristics of SSC Lottery Participants with Follow-up Data: Third Year of High School, Cohorts 1 and 2

Characteristic (%)	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value for Estimated Difference
Race/ethnicity				
Hispanic	45.9	47.4	-1.5	0.235
Black	45.0	43.2	1.8	0.129
Other	7.7	7.7	-0.1	0.919
Male	46.1	44.7	1.4	0.243
Eligible for free/reduced-price lunch	84.9	84.7	0.2	0.850
English language learner	6.0	6.0	-0.1	0.921
Special education[a]	4.9	5.4	-0.4	0.449
Overage for 8th grade[b]	16.9	17.4	-0.4	0.653
8th-grade reading proficiency[c]				
Did not meet standards (level 1)	7.9	7.6	0.2	0.748
Partially met standards (level 2)	64.1	64.2	0.0	0.967
Fully met standards (level 3)	22.5	22.5	0.0	0.967
Met standards with distinction (level 4)	1.0	0.8	0.2	0.292
8th-grade math proficiency[c]				
Did not meet standards (level 1)	22.1	22.0	0.1	0.942
Partially met standards (level 2)	48.9	48.3	0.6	0.638
Fully met standards (level 3)	27.1	27.3	-0.1	0.904
Met standards with distinction (level 4)	1.1	1.0	0.1	0.821
Total number of student observations = 13,297				

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (DOE) state test data for eighth-graders from the 2004-2005 and 2005-2006 school years, as well as data from DOE enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a 0/1 indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

(continued)

Appendix Table C.3 (continued)

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

A chi-square test was used to assess the statistical significance of the overall difference between lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting chi-square value is not statistically significant (p-value = 0.599).

Cohorts 1 and 2 consist of students in the study who were eighth-graders in the spring of 2005 and 2006, respectively.

[a]This sample includes special education students who can be taught in the regular classroom setting. Special education students classified by the DOE as requiring collaborative team teaching services or self-contained classes are not part of the sample.

[b]Lottery participants are classified as "overage for eighth grade" if they were 14 or older on September 1 of the eighth-grade school year.

[c]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

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Appendix Table C.4

Baseline Characteristics of SSC Lottery Participants with Follow-up Data: Fourth Year of High School, Cohort 1

Characteristic (%)	SSC Lottery Winners	Control Group Members	Estimated Difference	P-Value for Estimated Difference
Race/ethnicity				
Hispanic	45.0	46.9	-1.9	0.299
Black	45.7	43.3	2.4	0.197
Other	7.9	8.4	-0.5	0.606
Male	44.1	43.2	0.9	0.606
Eligible for free/reduced-price lunch	84.0	85.4	-1.4	0.337
Special education[a]	1.5	1.1	0.3	0.382
Overage for 8th grade[b]	14.3	12.8	1.5	0.284
8th-grade reading proficiency[c]				
Did not meet standards (level 1)	4.2	2.7	1.5 *	0.030
Partially met standards (level 2)	70.1	70.7	-0.6	0.735
Fully met standards (level 3)	22.4	22.8	-0.4	0.782
Met standards with distinction (level 4)	1.5	1.1	0.3	0.342
8th-grade math proficiency[c]				
Did not meet standards (level 1)	16.6	14.9	1.7	0.235
Partially met standards (level 2)	50.7	50.9	-0.2	0.899
Fully met standards (level 3)	30.8	32.3	-1.5	0.393
Met standards with distinction (level 4)	1.3	1.1	0.2	0.700
Total number of student observations = 5,363				

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (DOE) state test data for eighth-graders in the 2004-2005 school year, as well as data from DOE enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Values for SSC lottery winners are the simple means for all lottery winners. Values for the difference between SSC lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for SSC lottery winners minus the estimated difference between lottery winners and control group members. To facilitate computation, all variables are centered on the mean value for the lottery they represent. This approach is equivalent to directly accounting for each lottery by adding a 0/1 indicator variable for it (Wooldridge, 2000). In some cases, rounding may cause slight discrepancies.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

(continued)

Appendix Table C.4 (continued)

A chi-square test was used to assess the statistical significance of the overall difference between lottery winners and control group members reflected by the full set of baseline characteristics in the table. The resulting chi-square value is not statistically significant (p-value = 0.327).

Cohort 1 consists of students in the study who were eighth-graders in the spring of 2005.

[a]This sample includes special education students who can be taught in the regular classroom setting. Special education students classified by the DOE as requiring collaborative team teaching services or self-contained classes are not part of the sample.

[b]Lottery participants are classified as "overage for eighth grade" if they were 14 or older on September 1 of the eighth-grade school year.

[c]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams. Due to missing test scores, the sum of levels 1-4 may not add to 100 percent.

Appendix D

Imputing Outcomes for Students Who Are Lost Through Attrition

As noted in Chapter 2, estimated effects of small schools of choice (SSCs) are based on administrative data from the New York City Department of Education (DOE). These data are only available for students who enroll in a New York City public school. They are not available for students who move out of the city, transfer to a private or parochial school, or drop out of school. In the present analysis, the percentage of student observations with follow-up data declines from a high of almost 90 percent in the first year of high school to a low of just under 70 percent in the fourth year.

Without follow-up data for all students, SSC effects for the full study sample cannot be estimated. However, it is standard procedure to consider how missing data for some students might affect results for the full sample. Typically, this is done by assuming values for the missing data ("imputing" these values) and repeating the analysis with the assumed values. While there are numerous approaches for such imputation, they vary markedly in their complexity, transparency, and assumptions, and no consensus exists about which is most appropriate. Thus, in the absence of a compelling reason to use a particular approach, the analysis in this report uses two simple approaches to illustrate what SSC enrollment effects might possibly be for the full study sample.

The first approach, presented in Appendix Table D.1, makes the relatively conservative assumption that any student with missing data for an outcome was unsuccessful on that outcome. For example, it is assumed that any student who is missing graduation data has not graduated. This assumption implies no difference in mean outcomes for SSC lottery winners and control group members, which in turn implies zero effect of SSC enrollment. To be more conservative would require assuming that SSCs have a negative effect on graduation rates for students with missing graduation data. Given the sizable positive SSC enrollment effects in earlier grades reported in Chapter 3 for the overall sample and many sample subgroups, it seems unrealistically conservative to assume negative effects on subsequent graduation rates for a large subgroup such as that comprising students with missing graduation data.

The second approach to imputing missing outcome data uses information from DOE records on student discharge codes to distinguish between students with missing data who are indicated as having dropped out of school and all other students for whom data are missing (because they left the New York City school district).[1] Table D.2 illustrates the distribution of discharge codes across dropouts and other categories; the data are shown separately for SSC lottery winners and control group members for the fourth year of high school of the first student cohort in this study (the only cohort for which four years of high school data are available). Note first that differences in all rates of discharge for SSC lottery winners and control group members are small and are not statistically significant. Note next that roughly 15 percent of students in the

[1]Information on student discharge codes was not used as part of the primary estimation approach for the present analysis because this type of information is typically unreliable.

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Appendix Table D.1

Estimated Effects of SSC Enrollment, Imputing Zeros for Students with Missing Follow-up Data for Course Credits: Cohorts 1 to 4

Outcome	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Year 1 of high school (cohorts 1 to 4)					
Total credits earned toward graduation[a]	10.2	9.4	0.8 **	0.19 **	0.000
Total number of student observations = 30,959					
Year 2 of high school (cohorts 1 to 3)					
Total credits earned toward graduation[a]	18.5	16.4	2.1 **	0.26 **	0.002
Total number of student observations = 26,685					
Year 3 of high school (cohorts 1 and 2)					
Total credits earned toward graduation[a]	24.5	22.7	1.8 **	0.17 **	0.003
Total number of student observations = 17,984					
Year 4 of high school (cohort 1)					
Graduated from high school	46.9	42.5	4.4 *		0.015
Total number of student observations = 8,283					

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in the 2004-2005 to 2007-2008 school years, as well as data from New York City Department of Education attendance, course credits, Regents exam, transactional, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size for each measure is calculated as a proportion of the standard deviation of the outcome for control group counterparts.

Cohort 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

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Appendix Table D.2

Estimated Effects of Winning an SSC Lottery on DOE-Defined Categories of Discharge Status: Fourth Year of High School, Cohort 1

Outcome	SSC Lottery Winners	Control Group Members	Estimated Effect	P-Value for Estimated Effect
Students missing outcome data in 4th year				
Dropped out	14.6	15.6	-1.0	0.556
Transferred to an alternative program	10.5	11.8	-1.3	0.395
Other[a]	7.3	7.5	-0.2	0.838
Students not missing outcome data in 4th year	68.3	69.4	-1.1	0.398
Total number of student observations = 8,283				

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in the 2004-2005 to 2007-2008 school years, as well as data from New York City Department of Education (DOE) course credits, transactional, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Estimated differences between SSC lottery winners and control group members are regression-adjusted as described by Equation A.1 in Appendix A. Variables in the regression are measured as deviations from their lottery mean in order to account for the lottery for each sample point. This approach is equivalent to directly accounting for each lottery by adding a 0/1 indicator variable for it (Wooldridge, 2000). Values in the column labeled "SSC Lottery Winners" are observed means for lottery winners assigned by HSAPS to an SSC. Values in the column labeled "Control Group Members" are regression-adjusted means that match the distribution of SSC lottery winners across lotteries.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Cohort 1 consists of students in the study who were eighth-graders in the spring of 2008.

[a]The "Other" category consists of students who transfer to a school outside the DOE system, enter into an early college program, or are reported as deceased. For accountability purposes, these students are are not included in the publicly reported graduation cohort.

first study cohort are coded as dropouts by the time they reach their fourth year of high school. The remaining approximately 18 percent of students are coded as having missing data for some other reason.

Using the information about school dropouts, the second approach imputes a value of zero for outcomes for students who are coded as high school dropouts. For the remaining students with missing data, values are imputed based on the distribution of values observed for students whose data are not missing. This is accomplished by taking the mean and standard deviation of the outcome for control group members with data and assuming a normal

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Appendix Table D.3

Estimated Effects of SSC Enrollment, Imputing Zeros for Dropouts and Values in Accord with Control Group Distribution for All Other Students with Missing Follow-up Data for Course Credits: Cohorts 1 to 4

Outcome	Target SSC Enrollees	Control Group Counterparts	Estimated Effect	Effect Size (Standard Deviation)	P-Value for Estimated Effect
Year 1 of high school (cohorts 1 to 4)					
Total credits earned toward graduation[a]	10.6	9.7	0.9 **	0.21 **	0.000
Total number of student observations = 30,959					
Year 2 of high school (cohorts 1 to 3)					
Total credits earned toward graduation[a]	20.2	18.1	2.1 **	0.25 **	0.001
Total number of student observations = 26,685					
Year 3 of high school (cohorts 1 and 2)					
Total credits earned toward graduation[a]	27.4	25.4	2.0 **	0.18 **	0.003
Total number of student observations = 17,984					
Year 4 of high school (cohort 1)					
Graduated from high school	55.8	51.2	4.6 *		0.012
Total number of student observations = 8,283					

SOURCES: MDRC's calculations use High School Application Processing System data from eighth-graders in the 2004-2005 to 2007-2008 school years, as well as data from New York City Department of Education attendance, course credits, Regents exam, transactional, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: Appendix A describes how values in the column labeled "Target SSC Enrollees" are estimated. Appendix A also describes how values in the column labeled "Estimated Effect" are estimated. Values in the column labeled "Control Group Counterparts" are differences between corresponding values in the first and third columns.

A two-tailed t-test was applied to the estimated effect. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The estimated effect size for each measure is calculated as a proportion of the standard deviation of the outcome for control group counterparts.

Cohort 1, 2, 3, and 4 consist of students in the study who were eighth-graders in the spring of 2005, 2006, 2007, and 2008, respectively.

[a]The "total credits earned toward graduation" measure is the aggregate number of course credits earned toward fulfilling the New York State graduation requirements. The credit requirements are as follows: 31 core subject credits, including 8 credits each of English and social studies; 6 credits each of math and science; 2 credits of arts; 1 credit of health; and 13 additional credits, including 4 credits of physical education, 2 credits of a foreign language, and 7 credits of electives.

distribution of these values. This part of the imputation (like the first imputation approach) makes the relatively conservative assumption that SSCs had no effect on graduation rates for students with missing follow-up data (because it imputes the same mean value of the outcome for SSC lottery winners and control group members who are not dropouts but have missing data).

Table D.3 presents results using the second imputation approach corresponding to those in Table D.1 for the first imputation approach. As expected, estimated SSC enrollment effects in Table D.3 are essentially the same as those in Table D.1.

Appendix E

Sources and Description of Data Collected for the Study

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Appendix Table E.1

Sources and Description of Data Collected for the Study

Data Source	Sample	School Years Used	Description of Data
High School Application Processing System (HSAPS)	Data are available for all eighth-grade students who completed their application to the High School Application Processing System.	2004-2005 to 2007-2008	These files contain information about the school choices and rankings made by each student, as well as a student's geographic priority and "known" status for each school. The files also contain the program/school to which each student was assigned by the HSAPS algorithm as well as their eighth-grade demographic characteristics.
New York City Department of Education (DOE) October enrollment data	Data are available for 6th- to 12th-graders enrolled in public schools. This file contains all students enrolled in grades 6-12 as of October of each school year.	2005-2006 to 2008-2009	The October enrollment files contain demographic and identification characteristics for each student. These data are used to determine where each student enrolls at the beginning of the school year.
DOE June enrollment data	Data are available for 6th- to 12th-graders enrolled in public schools. This file contains all students who have enrolled in grades 6-12 at any point during the school year.	2005-2006 to 2008-2009	The June enrollment files contain demographic and identification information for each student as of the end of the school year. These data also provide detailed information about each student's disposition at the end of the year.
DOE Regents exam data	Data are available for all students who attempted a Regents exam. Data are collected at each Regents exam testing date, and compiled by school year.	2005-2006 to 2008-2009	These data contain information on test subject, test date, and total score for each Regents exam taken in the school year.
DOE attendance data	Data are available for all students enrolled in the New York City public school system. Data are collected at the end of each school year.	2005-2006 to 2008-2009	The attendance files contain measures of days present, days absent, and days enrolled in the New York City public school system. This information was used to construct the attendance rate measures.

(continued)

Appendix Table E.1 (continued)

Data Source	Sample	School Years Used	Description of Data
DOE course credits data	Data are available for all high school students in the New York City public school system. Data are collected at the end of each school year, and include credits accumulated during summer school.	2005-2006 to 2008-2009	The course credits files contain the number of credits attempted, passed, and failed in each of the nine DOE classified subject areas: English, math, social studies, science, foreign language, business/technology, arts, physical education, and miscellaneous.
DOE student transactional file	Data are available for all high school students in the New York City public school system. Data are collected throughout the school year.	2005-2006 to 2008-2009	The transactional file records each movement a student makes into or out of a school in the DOE system. The final transaction a student made on this file was used to construct the graduation measures for this study.
DOE state test data	Data are available for all students in grades 3-8 who took the New York State reading or math tests.	2003-2004 to 2008-2009	The state test files contain the scale score and performance level for each student who took the New York State mathematics and reading tests.
New York State Report Card	Data collected from the New York State Education Department (NYSED) for all New York City high schools.	2002-2003 to 2007-2008	Data include characteristics of the school, such as student body demographics, school location, student enrollment, and teacher experience and tenure.
Administrative records provided by the Gates Foundation and intermediaries	Data are available for all new small schools that started after the 2002-2003 school year and received funding from the Bill & Melinda Gates Foundation.	2002-2003 to 2008-2009	These school-level data contain information on whether a new small school was started with funding from the Bill & Melinda Gates Foundation.
DOE school-level administrative records	Data on new small schools, new small learning communities, and new career and technical education academies opened as of the 2002-2003 school year were provided by the New York City DOE.	2002-2003 to 2008-2009	These school-level data contain information on new small school characteristics, small learning community characteristics, and career and technical education academy characteristics. Examples of these characteristics include school/program name, location, school opening date, and expected grade configuration.

Appendix F

Variation in the Fourth-Year Effects

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Appendix Table F.1

Variation in Effects of SSC Enrollment on Graduation, by Student Characteristic: Fourth Year of High School, Cohort 1

Student Characteristic	Estimated Effect	P-Value for Estimated Effect
8th-grade reading proficiency[a]		
Did not meet standards (level 1)	-9.8	0.413
Partially met standards (level 2)	9.4 **	0.002
Fully met standards (level 3)	9.8	0.062
Met standards with distinction (level 4)	--	--
8th-grade math proficiency[a]		
Did not meet standards (level 1)	9.0	0.131
Partially met standards (level 2)	7.2 *	0.046
Fully met standards (level 3)	6.2	0.156
Met standards with distinction (level 4)	--	--
Low-income status		
Eligible for free/reduced-price lunch	7.0 *	0.032
Not eligible for free/reduced-price lunch	4.7	0.235
Race/ethnicity, by gender		
Black male	6.9	0.198
Hispanic male	0.4	0.938
Other male	10.9	0.358
Black female	2.3	0.604
Hispanic female	2.4	0.669
Other female	6.4	0.603
Choice level (of 12) at which enrollee participated in lottery		
1st choice	7.0 *	0.038
2nd-3rd choices	8.3	0.055
All other choices	8.3	0.160

(continued)

Appendix Table F.1 (continued)

SOURCES: MDRC's calculations use High School Application Processing System and New York City Department of Education (DOE) state test data from eighth-graders in 2004-2005, as well as data from DOE course credits, transactional, and enrollment files from the 2005-2006 to 2008-2009 school years.

NOTES: This table presents the estimated effects for students who have follow-up course credits data. Each panel in this table divides students into subgroups based on a given characteristic. Within each subgroup a two-tailed t-test was applied to the estimated effect, with statistical significance levels indicated as: ** = 1 percent; * = 5 percent. An F-test was used to assess the statistical significance between subgroups; none of the subgroup differences in this table is statistically significant.

Cohort 1 consists of students in the study who were eighth-graders in the spring of 2005.

Estimated effects on level 4 math and reading proficiency are not estimable due to small sample sizes.

[a]Students scoring at proficiency levels 1 and 2 are not considered to be performing at grade level for state math and reading exams.

Appendix G

Small Schools of Choice in This Study

This report provides findings on the effects of New York City's "small schools of choice" (SSCs). SSCs are technically defined as:

- High schools (as opposed to middle/high schools or other school types), which are intended to serve only grades 9 through 12 at capacity[1]
- Schools that were founded in 2002 or later[2]
- Schools that employed the "limited unscreened" selection method in the High School Application Processing System (HSAPS)[3]

Additionally, because this study utilizes naturally occurring lotteries that take place within HSAPS when an SSC has more available applicants than seats, only those SSCs that were also *oversubscribed* serve as the SSCs that generate the study sample.[4] The 105 study SSCs are listed below by borough.

All schools meeting the aforementioned criteria are additionally *small* — serving 550 students or fewer.

Brooklyn

Academy for Environmental Leadership
Academy for Young Writers
Academy of Hospitality and Tourism
Academy of Urban Planning
Arts and Media Preparatory Academy
Brooklyn Academy for Science and the Environment
Brooklyn Community High School of Communication, Arts and Media
Brooklyn Preparatory High School
Bushwick Leaders' High School for Academic Excellence

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[1]Three of the schools in the study sample, while founded as high schools, began serving sixth- to eighth-graders during the study period.

[2]The study period includes academic years 2005-2006 through 2008-2009. Thus, only schools that were founded as of September 2008 are characterized as SSCs.

[3]Limited unscreened schools do not impose academic requirements but instead give preference to students who live within a certain geographic area and have attended a school's open house or the school's booth at a school fair, or who are otherwise "known" to the school.

[4]Appendix A provides a detailed description of how HSAPS generates lotteries. In order to be oversubscribed for lottery purposes, an SSC must have more *available* applicants (who have not already been matched to one of their prior school choices) than seats. Thus, some schools that appear to have been oversubscribed (for example, a school described in the New York City Department of Education High School Handbook as having had 500 "total applicants" for 108 "program seats") may not have actually been oversubscribed for the purposes of generating a lottery.

Bushwick School for Social Justice
Expeditionary Learning School for Community Leaders
FDNY High School for Fire and Life Safety
Foundations Academy
Frederick Douglass Academy VII
Green School
High School for Civil Rights
High School for Global Citizenship
High School for Service and Learning
High School for Youth and Community Development
High School of Sports Management
International Arts Business School
It Takes A Village Academy
New York Harbor School
Performing Arts and Technology High School
Rachel Carson High School of Coastal Studies
Urban Assembly School for Law and Justice
Urban Assembly School of Music and Art
Victory Collegiate High School
Williamsburg High School for Architecture and Design
Williamsburg Preparatory School
World Academy for Total Community Health

Manhattan

Essex Street Academy
Facing History School
Food and Finance High School
Henry Street School for International Studies
High School for Arts, Imagination, and Inquiry
High School of Hospitality Management
James Baldwin School
Lower Manhattan Arts Academy
Manhattan Theatre Lab
Mott Hall High School
Pace High School
Urban Assembly Academy of Government and Law
Urban Assembly School for Media Studies
Urban Assembly School for the Performing Arts

Urban Assembly School of Business for Young Women
Urban Assembly School of Design and Construction

Queens

Academy of Finance and Enterprise
Cypress Hills Collegiate Preparatory School
East-West School of International Studies
Excelsior Preparatory High School
Frederick Douglass Academy VI
High School of Applied Communication
Pan American International High School
Queens Preparatory Academy

Staten Island

College of Staten Island High School for International Studies

Bronx

Academy for Language and Technology
Astor Collegiate Academy
Bronx Academy of Health Careers
Bronx Academy of Letters
Bronx Aerospace Academy
Bronx Center for Science and Mathematics
Bronx Engineering and Technology Academy
Bronx Expeditionary Learning High School
Bronx Guild
Bronx Health Sciences High School
Bronx High School for the Visual Arts
Bronx High School for Writing and Communication Arts
Bronx High School of Performance and Stagecraft
Bronx Lab School
Bronx Leadership Academy II
Bronx School of Law and Finance
Bronx Theatre High School
Collegiate Institute for Math and Science

Community School for Social Justice
Discovery High School
Dreamyard Preparatory School
Eagle Academy for Young Men
Explorations Academy
Felisa Rincon De Gautier Institute
Gateway School of Environmental Research and Technology
Global Enterprise Academy
High School for Contemporary Arts
High School for Teaching and the Professions
High School for Violin and Dance
High School of Computers and Technology
Holocombe L. Rucker School of Community Research
Knowledge and Power Preparatory Academy International High School
Leadership Institute
Metropolitan High School
Millennium Art Academy
Morris Academy for Collaborative Studies
Mott Hall Bronx High School
Mott Haven Village Preparatory High School
New Explorers High School
Pablo Neruda Academy for Architecture and World Studies
Peace and Diversity Academy
Pelham Preparatory Academy
Renaissance High School of Musical Theater and Technology
School for Community Research and Learning
School for Excellence
Sports Professions High School
Urban Assembly Academy for Careers in Sports
Urban Assembly Academy for History and Citizenship for Young Men
Validus Preparatory Academy School for Excellence

Appendix H

New York City Department of Education's New Secondary School Application, 2008

New York City Department of Education

NEW SECONDARY SCHOOL APPLICATION 2008 EDITION

APPLICATION FOR GRADES 6-8, 6-12 OR 9-12

Office of Portfolio Development
52 Chambers Street
New York, New York 10007
Telephone: 212.374.2371; Facsimile: 212.374.5581

INTRODUCTION

The New York City Department of Education (DOE) Office of Portfolio Development (OPD) is pleased to present the new school application process for opening DOE schools in September 2008. The development of excellent new small schools is a key component of the Department of Education's second term *Children First* reform agenda and an important strategy for focusing attention on the vision of the future through demonstrating what is possible in public education. The Office of Portfolio Development seeks to develop a diverse portfolio of new schools that incorporate knowledge from research and from expert practice about the critical elements of what makes an effective school.

Completing this application is a rigorous process that will require applicants to form planning teams, work together closely over time, and develop and revise a portfolio of documents. The documents that each planning team creates are meant to be ones that could be used in the new school and should reflect the planning team's fundamental beliefs about education.

To support the efforts of the planning team, the Office of Portfolio Development has designed a series of professional development workshops. These sessions will review all the major aspects of creating a school and provide technical assistance as applicants develop the most thoughtful and effective plans possible for starting a school. The calendar below is a tentative list of professional development workshops. Please check our website http://schools.nyc.gov/NewSchools to confirm workshop dates, times, and locations.

The Application Process	Description
Spring/Summer: Introductions, Coalition-Building, and Getting Started • Open House for 2008 New Schools *Thursday April 26* • Information Sessions *May 10 – charter schools* *May 17 – transfer schools* *May 24 – ELL focused schools* *May 31 – CTE focused schools* • Summer Professional Development Workshops *July 10, 12,17, 19*	Individuals, including potential principal and teachers, intermediaries, community based organizations, and other groups interested in developing new schools come together to share ideas and explore possible collaborations. New school development workshops on curriculum & assessment design, school culture & personalization, differentiated instruction and staffing and scheduling. Times and location TBD – see website for details: http://schools.nyc.gov/NewSchools
Fall: Professional Development, Executive Summary and Final Application Submissions • Fall New School Kick-Off *Wednesday September 26* • Executive Summary due *October 19, 2007* • Professional Development Workshops *October 3, 10, 17, 27 November 7, 14 December 5* • Final New School Application due *November 28, 2007*	Professional development workshops will support planning teams as they work on the core issues of school creation, ranging from curriculum and assessment to graduation criteria, school culture to hiring. All teams are encouraged to attend. See website for details: http://schools.nyc.gov/NewSchools The executive summary and final application should draw from these sessions.

There are three distinct stages to the 2008 new school application process:

Stage 1 *Executive Summary*. This first step is a short but critical step in the application process. All applicants must submit an Executive Summary. All applicants may continue on to submit the application portfolio – no feedback on the Executive Summary will be provided. The Executive Summary will include biographical information, a vision statement, and resumes of planning team members. This must be emailed to: NewSchoolsTeam@schools.nyc.gov by close of business October 19, 2007 .

Stage 2 *Final Application Portfolio.* Based on the "Elements of Effective Schools" (listed herein), application proposals should reflect the essence of what each planning team believes will lead to the development of a successful school.
Email completed Application Portfolio to: NewSchoolsTeam@schools.nyc.gov by close of business Wednesday November 28, 2007.

Stage 3 *Interviews* will be conducted during the week of December 10-14, 2007. Only teams with the most developed application portfolios will be invited to interview with a panel assembled by the Office of Portfolio Development. The interview will provide the planning team with an opportunity to answer questions about the application and demonstrate its quality.

Chancellor approval of new schools opening in September 2008 will take place in late January 2008.

For leaders of approved schools, the New York City Leadership Academy sponsors the *New School Intensive* from February through August 2008, and then through the first year of the school's implementation.

STAGE 1: THE EXECUTIVE SUMMARY, DUE OCTOBER 19, 2007

PART A: APPLICANT INFORMATION

1. Name of Proposed School
2. Desired Location of Proposed School (Please note that schools are located where there is capacity and demonstrated educational need. The first priority is to replace schools selected to close due to historical under-performance. New school applications that reflect the intersection of capacity and need will be prioritized.)
3. Name of Proposed School Leader
    - Mailing address
    - Telephone number(s) – specify work, home, cell
    - Facsimile number
    - E-mail address
    - Leadership Program (if applicable, ex. New Leaders for New Schools, NYC Leadership Academy, etc.)
4. Name of Intermediary Organization/Lead Partner, if applicable
    - Mailing address
    - Contact person
    - Telephone number(s) of contact person
    - E-mail address of contact person
5. Proposed grade level(s) to be served in the first year
6. Proposed grade levels to be served at scale (full capacity)
7. List members of the planning team. Include their affiliations and/or potential roles at the school. The planning team should include teachers, parents, students, intermediary representatives (if applicable), community-based partner representatives (if applicable) and the designated leadership.
8. School Theme. Check one (if applicable):

☐ Architecture & Urban Planning ☐ Business, Finance, & Entrepreneurship
☐ Health & Medicine ☐ Humanities & Classical Studies
☐ Literature, Writing, & Communication ☐ Multicultural/Multilingual Education
☐ Performing & Visual Arts ☐ Science, Math, & Technology
☐ Service, Leadership, Law & Justice ☐ Other:

PART B: EXECUTIVE SUMMARY (No More Than Four Pages)

Articulate the overarching mission of the proposed school and the components of the school design and support structures that are most essential to achieving that mission. Briefly state the reasons for opening this school in the community identified (if applicable) and the ways in which the school will benefit students. Include a description of the unique educational experiences of students in the proposed new school. To demonstrate the school's mission, include a one page task that students will be expected to complete by the end of the first year.

PART C: EVIDENCE OF CAPACITY

Please submit the resumes and partnership agreements to the fullest extent possible as part of the Executive Summary.

1. Planning Team Capacity: Write a one page overview of the strengths of the planning team that serves as an introduction to the resumes. Provide a resume for each member of the planning team, including his/her educational and employment history. The resume and/or cover letter should describe the leadership capacity of the key personnel, including *evidence of expertise and a strong track record* in the following areas:

    a. Instructional leadership, including
        - Organizing toward high student achievement
        - Professional development
        - Curriculum development
        - Youth development

    b. Urban school development and operation
    c. Parent and community engagement
    d. Financial management
    e. Creation of strategic partnerships

2. Institutional Partnerships:

    a. If the proposed school anticipates partnering with an outside entity (i.e. an intermediary and/or community-based organization), provide evidence of the organization's track record in terms of a. – e. above.
    b. Describe the role that the partner(s) would play in the school's educational plan and operation.

3. Leadership Capacity:
    a. Attach a copy of the proposed school leader's SAS/SBL or SDA/SDL certificate or proof of enrollment in a New York State principal certification program, indicating license date.
    b. Attach the names, positions and contact information of three potential referees who will testify to the integrity and leadership qualities of the proposed school leader.

STAGE 2: THE APPLICATION PORTFOLIO, DUE NOVEMBER 28, 2007

The New School Application is a portfolio of documents that form the core of a school's vision. Each document is an authentic component toward building a school, and taken together they will be used to assess the viability of the plan. The portfolio is a window into the school's design and is not intended to be a comprehensive blueprint. View each document as part of the whole. *Please adhere to the 30 page limit* for Part A & Part B (excluding resumes). Being succinct is critical for the audiences of each component of the application. Each part of the portfolio will demonstrate the team's capacity to execute the school's mission.

The Office of Portfolio Development will evaluate new school applications using research-based evidence of the following *Elements of Effective Schools*:

1. Strong leadership and a mission that teachers, administrators, and students know and support.

2. A structure, including elements such as reduced teacher load that ensures that students will be known well by their teachers and other school staff.

3. A small team of qualified teachers responsible for a manageable number of students for at least a full school year that has the autonomy necessary to determine what students learn and how and what they need to make regular progress towards graduation.

4. High expectations for all students and a standards-based, academically rigorous curriculum that connects what students learn with college and career goals.

5. Performance-based assessments for students and teachers and a culture of continuous improvement and accountability for student success.

6. A structure that fosters the development of authentic, sustained, caring, and respectful relationships between teachers and students and among staff members. Advisories of 10-15 students are one strategy to achieve this goal.
7. A school schedule that includes longer instructional blocks that promote interdisciplinary work, teacher collaboration, and reduced student loads. This schedule should be coupled with collaborative team planning and professional development time within the regular school schedule so that teachers can form a professional community.

8. A well-defined plan to service the learning needs of the full range of students in the community, including special education students and English Language Learners.

9. Connections between what students learn in school to their lives and communities through internships, mentoring experiences, and service learning opportunities.

10. Partnerships with students, parents, and community organizations and institutions as key collaborators and stakeholders.

As part of *Children First*, new schools created in 2008 are designed specifically to meet the needs of under-served communities. Applications should clearly state how all students, including those who are performing below grade level, students entitled to special education services, and English language learners will be successful in this new school design. The following data is a potential snapshot of the partial incoming class – applicants are advised to specifically refer to this data while designing their new school.

The following hypothetical data table reflects a sample of the students who might attend the new school. The data set is selected from previous school year reports. Use this sample data to inform the new school application.

Student ID	Sex	ELL	SETSS	SC or CTT	Title 1 Eligible	Days Absent	ELA Score	Math Score
1	M	Y			Y	15	1	1
2	M					0	3	2
3	M	Y	Y		Y	7	2	1
4	M					16	2	1
5	M				Y	33	2	1
6	M					1	1	2
7	M				Y	8	2	2
8	M					7	2	1
9	F		Y			8	2	2
10	F				Y	28	4	4
11	F				Y	4	1	1
12	M					14	2	2
13	M				Y	0	4	3
14	M					10	1	2
15	F					49	2	3
16	F			Y	Y	2	2	1
17	F				Y	20	2	3
18	F				Y	15	3	2
19	F			Y	Y	2	1	2
20	F				Y	16	2	2
21	F				Y	22	3	4
22	M					19	1	2
23	M				Y	4	2	1
24	F	Y			Y	0	1	1
25	F				Y	12	2	2
26	M				Y	17	2	2
27	M				Y	20	2	3
28	M				Y	0	3	2
29	M			Y		9	2	1
30	F	Y			Y	14	1	2

PART A: APPLICANT INFORMATION

1. Name of Proposed School
2. Desired Location of Proposed School (Please note that schools are located where there is capacity and demonstrated educational need. The first priority is to replace schools selected to close due to historical under-performance. New school applications that reflect the intersection of capacity and need will be prioritized.)
3. Name of Proposed School Leader
    - Mailing address
    - Telephone number(s) – specify work, home, cell
    - Facsimile number
    - E-mail address
    - Leadership Program (if applicable, ex. New Leaders for New Schools, NYC Leadership Academy, etc.)

4. Name of Intermediary Organization/Lead Partner, if applicable
    - Mailing address
    - Contact person
    - Telephone number(s) of contact person
    - E-mail address of contact person

5. Proposed grade level(s) to be served in the first year
6. Proposed grade levels to be served at scale (full capacity)
7. List members of the planning team. Include their affiliations and/or potential roles at the school. The planning team should include teachers, parents, students, intermediary representatives (if applicable), community-based partner representatives (if applicable) and the designated leadership.
8. School theme. Check one (if applicable):

☐ Architecture & Urban Planning	☐ Business, Finance, & Entrepreneurship
☐ Health & Medicine	☐ Humanities & Classical Studies
☐ Literature, Writing, & Communication	☐ Multicultural/Multilingual Education
☐ Performing & Visual Arts	☐ Science, Math, & Technology
☐ Service, Leadership, Law & Justice	☐ Other:

PART B: VISION & VALUES

1. **Introduce the application portfolio with a one page cover letter that sets the documents in context and frames the school's vision. A possible way to frame the introduction is to address these questions:**
   - What are your school's core values?
   - How are these values reflected in the elements of this portfolio?
   - How have these values been reflected in the team's process of developing this new school proposal?

2. **The second set of documents orients prospective students and their families to the vision and values of the new school. These include:**

   a. **School Directory Page**. As a component of the school admissions process, complete the attached page – labeled as Attachment 2A (page 15). 'In Your Own Words' presents an opportunity to explain the key features of this school to parents and students – it must be only one paragraph, free of educational jargon. The other parts of the page provide a snapshot of the school program in its first year.

   b. **Introductory letter.** A welcome letter to parents and accepted students can include the vision of the school as well as how this will become reality. It should include discussion of the specific role of Intermediary or community based partner. If necessary, this letter should specifically welcome the target student population your school is designed to serve (for example, English language learners.)

   c. **Sample outreach**. An example of how you will attract students to your new school. Please note that all work in this application should reflect your understanding of the students in your school, including under-prepared and low-performing students. At full capacity, new schools may also serve 15% students entitled to special education services and 20% English language learners.

   As you recruit students and parents, communicate your vision and describe the new culture in one sample outreach material you might provide: a brochure to distribute at recruitment fairs, talking points at a Community Education Council meeting, a 3 minute DVD that shows the daily life of a student in the school, etc.

3. **The third set of documents orients students and their families to the culture of the school. These include:**

   a. The introduction to the student handbook that frames the culture of your school

   b. A sample document that will explain the rules and consequences for students – or a portion of the rules

   c. A sample of a student's weekly and daily schedule

   d. An explanation - written for students - of the performance expectations (qualitative and quantitative) for students graduating from the school, beyond the state mandated examinations

4. **The fourth set of documents orients teachers to the Curriculum and Instruction model, and includes the following:**

   a. **Curriculum Scope and Sequence**: Show the scope and sequence of subject courses that defines the curriculum across all the grades the school will serve at full capacity. Present this in chart form by course title only. Include courses that highlight the unique theme and mission of the school. It is not necessary to describe the courses.

   b. **Curriculum Map**: Identify one subject or course area and briefly describe the curriculum scope and sequence for each grade level of the school at full capacity. Pick the subject area which is central to the theme of the school. For each year, include a 2-3 sentence description of critical components of the curriculum and indicate briefly what the students will know and be able to do at the end of each year. This curriculum map may include, but is not limited to: Essential Questions, Skills and Content Knowledge, Major Projects. This should be presented in the form of a chart.

   c. **Sample Unit and Lesson Plan**: Provide a sample unit and a sample daily lesson plan from the first year curriculum described in the Curriculum Map above. The sample unit and lesson plan should represent the kind of teaching and learning you would like to see in the school. Be explicit in the unit and lesson plan as to what supports will be provided for students entitled to special education services, English language learners and/or students who scored Level 1 or 2 on promotional tests. For schools proposing grades 6-12 at full capacity, include a sample unit and lesson plan from both the 6th and 9th grades.

   d. **Second Sample Unit and Lesson Plan:** Provide a second sample unit and a lesson or project plan from another subject area in the same year described above. This second sample should demonstrate how literacy or numeracy is taught across the curriculum. Be explicit in the unit and lesson plan as to what supports will be provided for students entitled to special education services, English language learners and/or students who scored Level 1 or 2 on promotional tests. For schools proposing grades 6-12 at full capacity, include a second sample unit and lesson plan from both the 6th and 9th grades.

   e. **Assessment**: Design an assessment (major project, test, performance, etc) and a rubric that will show students' level of mastery on the task described in the Sample Unit (c) above. The assessment should be reflective of the kind of task that is central to the theme or approach to learning in the school. Be explicit as to how the assessment may be modified to measure the progress of students entitled to special education services, English language learners and/or students who scored Level 1 or 2 on promotional tests.

   f. **Professional Development**: Design a professional development session that enables teachers to become better skilled at implementing the kind of lesson and teaching strategies described in the Sample Unit (c) above.

5. The fifth set of documents focus on the school's vision and values with regard to teacher performance:

a. **Hiring Criteria**: Write a job description for a teacher in the school and the criteria that a fully qualified candidate should meet

b. **Weekly Teacher Schedule:** Provide a sample for any one subject area teacher

c. **Professional Development Plans**: Prioritize *two* topics for professional development during the summer and first year for teachers in the new school. For each, provide a sample of a professional development lesson plan that is in-house and designed by the instructional leader. Topics may include, but are <u>not</u> limited to:

- Developing curriculum
- Developing school culture
- Serving the needs of low-performing students, students entitled to special education services, English language learners
- Using data to build a culture of continuous learning
- Rules, regulations, and discipline code
- Parent and community engagement

d. **Using data to build a culture of continuous learning**. Using the sample data listed on page 6:

- How will you use this data as a diagnostic over the summer?
- How will you work with teachers over the summer to enable them to make sense of the data? Design a professional development session for teachers using this data.

5. The sixth set of documents describes the leadership and accountability systems of the school:

a. **Accountability**: Describe one or two systems the school will put in place to evaluate results from periodic and formative assessments, and to approach the Quality Review benchmarks, as well as parent, teacher, and student satisfaction surveys.

b. **Governance**: Beyond the mandated School Leadership Team and Parent Association, what is one critical committee you plan to create in the school's first year? Who will be on this committee? How will the committee members be selected? What decisions will members have the authority to make? Explain your choice in one page.

c. **Budget & Staffing Plan**: Using the budget model provided in Appendix 6C (page 16), show the school's first year staffing plan, including teachers and educational support staff. Provide license requirements and roles for each of the staff members you provide in your plan. In one paragraph explain how your staffing plan reflects your educational priorities.

d. **Staff Handbook**: When the school is at full capacity, you may choose to develop a handbook for staff, parents, and community partners that describes the governance

structure of the school. Write an extract (one page) from such a handbook that explains one critical aspect of the governance structure of the school.

PART C: EVIDENCE OF CAPACITY

Please submit the resumes and partnership agreements to the fullest extent possible.

1. Planning Team Capacity: Write a one page overview of the strengths of the planning team that serves as an introduction to the resumes. Provide a resume for each member of the planning team, including his/her educational and employment history. The resume and/or cover letter should describe the leadership capacity of the key personnel, including *evidence of expertise and a strong track record* in the following areas:

a. Instructional leadership, including
- Organizing toward high student achievement
- Professional development
- Curriculum development
- Youth development

b. Urban school development and operation
c. Parent and community engagement
d. Financial management
e. Creation of strategic partnerships

2. Institutional Partnerships:

a. If the proposed school anticipates partnering with an outside entity (i.e. an intermediary and/or community-based organization), provide evidence of the organization's track record in terms of a. – g. above.
b. Describe the role that the partner(s) would play in the school's educational plan and operation.

3. Leadership Capacity:
a. Attach a copy of the proposed school leader's SAS/SBL or SDA/SDL certificate or proof of enrollment in a New York State principal certification program, indicating license date.
b. Attach the names, positions and contact information of three potential referees who will testify to the integrity and leadership qualities of the proposed school leader.

PART D: CONNECTION TO COMMUNITY

Provide letters of commitment from institutional and/or community based partners that will support the school. These letters must be on official letterhead and should explain the specific roles of each partner in the school. Fiduciary and governance structures should also be explained.

STAGE 3: THE INTERVIEW, DECEMBER 10-14, 2007

Planning teams with the most developed applications will be invited to interview with representatives of the New City Department of Education during the week of December 10-14, 2007. Separate notification and explanation of the interview format will be sent.

SIGNATURES

I certify that the work in this application portfolio is the collaborative work of the planning team for _____
Name of School

Attach this page to the original application portfolio and submit to the Office of New Schools by 5pm on November 28, 2007

_____

Print/Type Name of Proposed School Leader Signature Date

_____

Print/Type Name of Intermediary Organization Executive Director Signature Date

_____

Print/Type Name of Leadership Program Advisor who will certify that Principal Candidate will meet all license requirements by July 1, 2008 **OR** Attach copy of SDA/SDL or SAS/SBL certification

ATTACHMENT 2A: SCHOOL DIRECTORY PAGE

Important Admissions Information

Eligibility: (Choose One)

☐ Limited Unscreened: Priority to students who attend an information session, then to all New York City Residents
☐ Other:

School Overview

In Their Own Words: (500 Characters Maximum)

Special Education Services (Check all the apply):

☒ SETTS
☐ Self-contained
☐ Collaborative Team Teaching
☐ Special Class for Hearing Impaired

Partnerships

- Intermediary:
- Community-based Organizations:
- Hospital Outreach:
- Cultural/Arts Organizations:
- Not-For-Profit:
- Corporate:
- Financial Institutions:
- Other:

ELL Programs (Check all that apply):

☒ ESL
☐ Bilingual Programs:
☐ Dual Language Programs:

Courses & Program Highlights

Programs:

Languages:

Advanced Placement Courses:

Enrollment:

Total Students per grade:

Grades Served in 2008-2009:

Grades Served at Scale:

Extracurricular Activities:

Leadership & Support:
Academic:
Artistic:
Clubs:
School Sports:

ATTACHMENT 6C: STAFFING PLAN GUIDE

Use the following hypothetical numbers as a guide to create a staffing plan that will enable the school to execute its mission. Provide the specific license and role of the staff member in the school.

Important: *These figures are provided only as a guide and should not create an expectation for the 2008 budget. The purpose of this application question is to create a staffing plan, and so this budget does not include start-up allocation, OTPS expenditures, etc. Official school budgets, released in the spring of 2008, will provide more specific allocations.*

SALARY ASSUMPTIONS	
Please use the following in your budget	
Principal	$107,000
School Secretary	$43,300
Social Worker	$65,000
Guidance Counselor	$76,000
Teacher	$55,000
½ Time F Status Teacher	$27,500
Paraprofessional	$33,500
School Aide	$23,500

ALLOCATIONS: Use these hypothetical allocations to create school's first year staffing plan				
	9-12 beginning with 108 Students	**6-12 beginning with 81 Students**	**6-12 beginning with 162 Students**	**6-8 beginning with 108 Students**
Overall Allocation	$615,000	$615,000	$837,000	$615,000

NOTE:
The Overall Allocation for the purposes of this application includes overhead and instructional allocations and can be used to fund any of the following positions: principal, secretary, guidance counselor, social worker, school aide, paraprofessional, and teacher. It is not necessary to provide budget for OTPS.

Bibliography

An extensive body of literature is available about the small schools that have been created in New York City, beginning with case study work on the early schools that served as models for much of the subsequent small school creation nationwide, continuing with a variety of observational studies of the cohort of schools created in the mid-1990s, and culminating with a set of studies about the schools created after 2000 through the New Century High Schools Initiative and as part of the Children First reforms that the New York City Department of Education implemented. While it is beyond the scope of this report to summarize the literature, this bibliography is provided to help readers understand the context and commentary related to New York City's small schools.

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EARLIER PUBLICATIONS ON NEW YORK CITY SMALL SCHOOLS OF CHOICE

Approaches of Bill & Melinda Gates Foundation-Funded Intermediary Organizations to Structuring and Supporting Small High Schools in New York City
2010. Eileen Foley with Erickson Arcaira, Stephen Coleman, Elizabeth Reisner, Troy Scott, Tandra Turner, Yvonne Woods. Prepared by Policy Studies Associates, Inc.

New York City's Changing High School Landscape
High Schools and Their Characteristics, 2002-2008
2010. Janet C. Quint, Janell K. Smith, Rebecca Unterman, Alma E. Moedano. Prepared by MDRC.

Small High Schools at Work
A Case Study of Six Gates-Funded Schools in New York City
A Report to the Bill & Melinda Gates Foundation
2010. Prepared by the Academy for Educational Development (AED) Center for School and Community Services.

NOTE: All the publications listed above are available for free download at www.mdrc.org.

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- Improving Public Education
- Promoting Successful Transitions to Adulthood
- Supporting Low-Wage Workers and Communities
- Overcoming Barriers to Employment

Working in almost every state, all of the nation's largest cities, and Canada and the United Kingdom, MDRC conducts its projects in partnership with national, state, and local governments, public school systems, community organizations, and numerous private philanthropies.