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The Causal Impact of Attending High Tech High's High Schools on Postsecondary Enrollment

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A Thesis Presented to the Faculty

of the Graduate School of Education of Harvard University

in Partial Fulfillment of the Requirements

for the Degree of Doctor of Education

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I dedicate my dissertation to my grandfather, William J. Beauregard, who taught me of the value of hard work and integrity, the power of optimism and setting one's sights high, and the utmost importance and joy of friends and family.

Acknowledgments

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Abstract

In recent years, a small but growing number of empirical studies have examined the causal impact of attending charter schools on academic achievement (Betts and Tang, 2011). In assessing achievement, researchers have focused on short-term, educational outcomes such as student results on state-mandated exams. To date, little research has examined how charter schools impact educational outcomes over the medium- and long-term.

I examine the causal impact of attending High Tech High (HTH), a well-established charter school network of 12 schools based in San Diego, California, on postsecondary enrollment. I find that attending HTH in high school increases the likelihood of enrollment in a four-year college by 10.9 percentage points and decreases the likelihood of enrollment in a two-year college by 11.2 percentage points. This observed shift suggests that HTH effectively prepares its students to apply, gain admission, and/or ultimately attend four-year colleges over two-year colleges.

My study also speaks to the question of who applies to charter schools. I find that the postsecondary enrollment rate among those who apply but are not admitted to HTH is roughly 12 percentage points higher than the overall rate among graduates of high schools managed by the San Diego Unified School District (SDUSD). This observation suggests that the composition of students and families who apply to HTH in high school

and those who attend district-managed high schools in SDUSD differ in ways that likely influence their propensity of enroll in postsecondary education.

The Causal Impact of Attending High Tech High's High Schools on Postsecondary Enrollment

Introduction

With the number of students attending charter schools in the United States increasing eight-fold over the past fifteen years, it has become ever more important to identify promising charter school models (National Alliance for Public Charter Schools, 2014). However, the identification of promising models has proven difficult. The difficulty is partly due to the large variation in the estimated effects across studies examining charter school effectiveness. It is also due to the lack of rigorous research methods applied in a vast majority of studies. Specifically, the methods applied in many studies do not fully take into account differences between the backgrounds of students attending charter schools and those attending traditional public schools (Betts and Tang, 2011).

In recent years, a small but growing number of studies has accounted for differences in student background when examining charter school effectiveness by exploiting data from admissions lotteries. The researchers of these studies have done so by taking advantage of the requirement that charter schools, which are public schools and thus cannot be selective in their admissions process, are required to hold lotteries for admitting students when they are oversubscribed (Angrist et al., 2013; Angrist et al., 2012; Abdulkadiroglu et al., 2011; Curto and Fryer, 2011; Dobbie and Fryer, 2013; Dobbie and Fryer, 2011; Gleason et al., 2010; Hoxby et al., 2009; Hoxby and Rockoff, 2005; McClure et al., 2005). Because admission by lottery is dictated by chance, students who are admitted and not admitted form ideal treatment and control groups in which the causal impact of being admitted to a charter school may be assessed. Moreover, by using the exogenous lottery results as an instrumental variable for enrollment, researchers have been able to estimate the impact of attending oversubscribed charter schools.

These lottery-based studies have contributed meaningfully to the research base on charter school effectiveness, particularly in identifying models that demonstrate a positive effect on students' academic achievement. However, even with the addition of these studies, the current research base has suffered from at least two limitations. First, the research base focuses mainly on short-term outcome measures, such as student results on state-mandated exams, which are only modestly related to long-term success (Currie and Duncan, 2001). To date, the research base includes only a few recent studies that examine the impact of attending a charter school on postsecondary outcomes (Angrist et al., 2013; Dobbie and Fryer, 2013).[1]

Second, lottery-based studies cover only a modest percentage of charter schools in operation – approximately 2% according to a 2012 review conducted by Betts and Atkinson. Of these schools, researchers have largely focused on a particular charter school model known as the "No Excuses" approach, which features "a longer school day, an extended school year, selective teacher hiring, strict behavior norms, and emphasizes traditional math and reading skills" (Angrist et al., 2012). Given this singular focus and in light of the existing heterogeneity in the estimated effectiveness of charter schools, it is important to expand the evidence base by examining different models and approaches to educating children in charter schools.

[1] In addition, Zimmer et al. (2009) and The Knowledge is Power Program's (KIPP) 2011 College Completion Report for observational studies that examine the association between charter school attendance and postsecondary outcomes.

I contribute to the research base on charter school effectiveness by using lottery results to examine the causal impact of attending a charter school on postsecondary enrollment. Moreover, the particular model that I examine offers contrasting features to the charter school models on which prior lottery-based studies have focused.

High Tech High (HTH) is a well-established network of charter schools based in San Diego, California. Touted as both innovative and nontraditional in design, the network's progressive school model features a combination of project-based learning, the integration of technology in its liberal arts curriculum, and a focus on rigorous 21st-century skills (Mehta and Fine, 2012). Like all charter schools, HTH has more autonomy over its structure and curriculum than traditional public schools. However, it incorporates design elements that contrast with those of "No Excuses" charter schools and, more generally, with those of most traditional American schools. Since HTH's inception as a single high school in 2000, it has grown into a network of 12 schools on three different campuses that span grades K-12. More than 2,000 students have graduated from its schools with a majority of its graduates continuing on to college.[2] The network admits students via lottery as it receives approximately twice as many applications each year as there are openings. Collectively, these attributes – the availability of sufficient postsecondary data, the uniqueness of its model, and the admission of students via lottery – provide a rare opportunity to assess the causal impact of a charter school model that has yet to be examined and do so based on longer-term educational outcomes.

In examining the impact of attending one of HTH's two high schools on its Point Loma campus, I observe a shift toward enrollment in four-year colleges and away from

[2] Retrieved from http://www.hightechhigh.org/about/results.php

enrollment in two-year colleges. I find that attending HTH in high school increases the likelihood of enrollment in a four-year college by 10.9 percentage points and decreases the likelihood of enrollment in a two-year college by 11.2 percentage points. This observed shift suggests that HTH is especially effective in preparing it students to apply, gain admission, and/or ultimately attend four-year colleges over two-year colleges. Given the added challenges of earning a four-year degree after starting at a two-year institution (Long & Kurlaender, 2009), this shift that HTH promotes likely benefits students' postsecondary outcomes, including the attainment of a bachelor's degree.

In addition to finding a differential impact on the likelihood of enrolling in a four-year college in lieu of a two-year college, I also observe that the immediate college enrollment rate among those who apply and are not admitted to HTH is 12 percentage points higher than the overall rate among graduates of high schools managed by the San Diego Unified School District (SDUSD). While it is uncertain why this difference in the likelihood of enrolling in college exists, my observation suggests that the composition of students and families who apply to HTH in high school and those who attend district-managed high schools in SDUSD differ in their motivation and/or capacity to enroll in postsecondary education. This observation applies to all ninth-grade applicants of HTH's Point Loma campus and is distinct from the differential impact I find when comparing postsecondary enrollment among those who are admitted and attend HTH with those who are not admitted and do not attend HTH.

I begin by describing the background and context for studying HTH's impact on college enrollment outcomes. I then provide an overview of the prior lottery-based studies examining the impact of charter schools on student academic outcomes. This overview is followed by a description of my data and research design. I conclude by discussing my findings and offering guidance on future research based on my analysis.

Background and Context

San Diego Unified School District

As the second largest school district in California, the San Diego Unified School District (SDUSD) serves approximately 131,250 students as of the spring of 2014. The district includes 177 schools: 108 elementary schools, nine K-8 schools, 25 middle schools serving grades 5-8, 24 senior high schools, eleven non-traditional schools, nine alternative schools, and 49 charter schools with different grade-level configurations.[3] It serves a racially/ethnically diverse student population that is 46.5 percent Hispanic, 23.4 percent white, 10.2 percent African-American, and 13.6 percent Asian. Based on district-level data, approximately 59.4 percent of SDUSD's students are eligible for free or reduced price lunch, 26.5 percent are classified as English language learners, 11.1 percent receive special education services, and approximately 20.5 percent of students participate in the district's Gifted and Talented Education program.[4]

Academically, SDUSD has shown increases in achievement in the last five years in all subject areas based on the California Standards Tests. In 2013, 50.9 percent of students in grades 2-11 met state standards (i.e., scoring at proficiency or advanced levels) in mathematics. Sixty percent of the district's students in grades 2-11 met

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[3] SDUSD's non-traditional schools include a virtual school, a school for adult learning, and other schools focused on specific areas and interests such as the performing arts and world languages. Its alternative schools include a school for alternative learning for behavior and learning, a school for students with special needs, and other schools providing alternative settings for students to complete their schooling.

[4] Retrieved from http://www.sandi.net/page/21

standards in English language arts (ELA).[5] Comparatively, the percentage of students meeting state standards in mathematics and ELA ranked third and first among large urban school districts in the state and slightly higher than the overall statewide percentages. The 4-year adjusted cohort graduation rate for the district's class of 2013-2014 was 79.6 percent, which ranked fourth among large districts in the state and was slightly lower than the state's overall rate of 80.8 percent. Alternatively, the 4-year adjusted cohort dropout rate for the class of 2012-13 was 9.7 percent, which was the lowest dropout rate among large districts and compared favorably to the statewide rate of 11.6 percent.[6]

High Tech High: A Brief History

HTH was first conceived by a group of local civic and technology industry leaders in San Diego in the mid-late 1990s. Concerned with the scarcity of qualified individuals entering the technology field, and particularly the low numbers of women and ethnic minority group members with backgrounds in mathematics, science, and technology, the group agreed to open a technology-based charter school in late 1998.[7] HTH's first school opened its doors to its inaugural ninth and tenth grade classes in the

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[5] Retrieved from http://www.sandi.net/cms/lib/CA01001235/Centricity/Domain/121/R_R/Reports/CST/2013/cst5yr/cst0913.rm.all.pdf

[6] Retrieved from http://dq.cde.ca.gov/dataquest/CohortRates/GradRates.aspx?Agg=D&Topic=Graduates&TheYear=2012-13&cds=37103710000000&RC=District&SubGroup=Ethnic/Racial. According to the Data Reporting Office of the California Department of Education, the 4-year adjusted cohort graduation rate is calculated by dividing the number of students in the 4-year adjusted cohort who graduate in four years or less with either a traditional high school diploma, an adult education high school diploma, or have passed the California High School Proficiency Exam (CHSPE) by the number of students who form the adjusted cohort for that graduating class. The cohort is adjusted by: adding students who later transfer into the cohort during grade nine (year 1), grade 10 (year 2), grade 11 (year 3), and grade 12 (year 4); and subtracting students who transfer out, emigrate to another county, or die during the 4-year period. The 4-year adjusted cohort dropout rate is the rate of students that leave the 9-12 instructional system without a high school diploma, GED, or special education certificate of completion and do not remain enrolled after the end of the 4th year.

[7] Retrieved from http://www.hightechhigh.org/about/index.php

subsequent fall. Three years later in 2003, the school graduated its first class of 50 students. In the same year, HTH opened High Tech Middle School adjacent to the high school, thus becoming a network of schools and creating its Liberty Station campus situated in the Point Loma community of San Diego.

The HTH network continued its expansion in the San Diego area in 2004 with the opening of HTH International, HTH Media Arts, and High Tech Middle Media Arts on its Liberty Station campus. In 2007, the network expanded beyond Liberty Station by opening HTH Chula Vista in Chula Vista and HTH North County in San Marcos with each school opening its doors to 150 ninth-grade students. In 2009, High Tech Middle North County opened on its San Marcos campus to serve students in grades 6-8. Finally, the network opened elementary and middle schools on its Chula Vista campus in 2011, and in 2013, it opened an elementary school in San Marcos.

High Tech High's Mission, Goals, and Design Principles

HTH's mission is "to develop and support innovative public schools where all students develop the academic, workplace, and citizenship skills for postsecondary success."[8] Along with its mission, the network has established a common set of goals for each of its schools. These goals include: (i) serving a student body that mirrors the local community ethnically and socioeconomically; (ii) integrating technical and academic education to prepare students for postsecondary education in both high tech and liberal arts fields; (iii) increasing the number of educationally disadvantaged students who specialize in mathematics and engineering in high school and postsecondary education; and (iv) graduating students who will be thoughtful, engaged citizens.

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[8] Retrieved from: http://www.hightechhigh.org/about/

To achieve these goals, each HTH school embraces four design principles: (i) personalization, (ii) adult-world connection, (iii) common intellectual mission, and (iv) teacher-as-designer. Collectively, these principles and the ways in which they are acted upon distinguish HTH's education program from other schools.

The network's principle of personalization is reflected in each school's advisory system. Each student has an advisor who monitors the student's personal and academic development. It is also reflected in the tasks in which students regularly engage. These tasks include students participating in open-ended, self-directed activities, holding individual student exhibitions, and managing digital portfolios in which students compile and present their work.

Such tasks, in conjunction with the network's emphasis on project-based learning, integration of college-prep/technical education (in which there is no student tracking and assessment is performance-based), and the requirement that all students complete community-based internships in high school, reflect its common intellectual mission and adult-world connection principles.

Finally, the network's teacher-as-designer principle is reflected in the provision of ample planning time during the workday for interdisciplinary teacher teams to develop curricula, including integrated projects and rubrics for assessment. It is also reflected in the network's selective hiring policies and systems for preparing aspiring teachers to assume teaching roles within its schools. Its two-year Teacher Induction Program and Graduate School of Education, for example, provide aspiring teachers with training and hands-on experience to work in its schools.

In addition to the network boasting a high rate of students matriculating in college, approximately 77 percent of its graduates have finished or are currently enrolled in postsecondary education. This includes 69 percent of students who were the first in their family to go to college and 67 percent of students who qualify for free or reduced-price lunch (FRPL) based on data provided to the network by National Student Clearinghouse (NSC), a national administrative database of postsecondary enrollment (as cited in Mehta and Fine, 2012, p. 32). Given these results, the network receives thousands of applications each year for relatively few slots. As of the first semester of the 2014-2015 school year, the network's waiting list included approximately 7,000 students.

Previous Research Examining the Impact of Attending Charter Schools on Student Achievement

In a recent review of the literature on charter school effectiveness, Betts and Tang (2014) find considerable heterogeneity in the estimated effects across studies. The researchers also find that roughly 75 percent of studies do not employ methods that fully account for differences between the background of students attending charter schools and those attending traditional public schools. A majority of studies are thus exposed to selection biases, which may distort their findings.

Of the minority of studies that rely on more rigorous methods, Betts and Tang find that only a handful use a lottery-based approach. Of these studies, two of the studies examine charter schools in major U.S. cities, four center on individual schools or networks located in urban settings, and one examines charter schools at the national level. Four of the studies focus on charter schools that researchers describe as subscribing to aspects of the "No Excuses" approach.

Overall, the lottery-based studies base student performance almost exclusively on annual, state-mandated exams in ELA and mathematics. The results of the studies show that applicants attending these charter schools outperform or perform at the same level as applicants attending traditional public schools with the estimated difference varying by grade level and geographic area.

In their study of twelve oversubscribed charter middle and high schools in Boston that incorporate aspects of the "No Excuses" approach, Abdulkadiroglu et al. (2011) find that students who are admitted and attend the schools outperform those who are not admitted and instead attend traditional public schools by 0.27 standard deviations in ELA and 0.36 standard deviations in mathematics for each year of attendance. Angrist et al. (2012) find similar large differences in their impact evaluation of a single KIPP charter middle school in Lynn, Massachusetts – a network described by the researchers as emblematic of "No Excuses" schools. In an impact evaluation of the Harlem Children Zone's Promise Academies (PAs), which combine aspects of the "No Excuses" approach with a host of community services, Dobbie and Fryer (2011) find large and positive differences in achievement between applicants attending and not attending the PAs at the elementary and middle school levels. Finally, in a recent lottery-based study of the SEED schools, the nation's only urban public (charter) boarding schools serving students in grades 6-12, Curto and Fryer (2011) find that applicants attending the schools outperform non-attendees by 0.20 standard deviations in ELA and 0.23 standard deviations in mathematics.[9]

Other lottery-based studies report more modest or insubstantial differences. Hoxby

[9] The researchers describe the SEED schools as "combin[ing] a 'No Excuses' charter model with a five-day-a-week boarding program."

et al. (2009), in their study of more than forty oversubscribed charter schools of varying missions, policies, and practices in New York City, find smaller albeit significant differences on the order of 0.04 standard deviations in ELA and 0.09 standard deviations in mathematics. Hoxby and Rockoff (2005) find similar, modest differences in ELA and mathematics for students who apply to a single network of charter schools in Chicago in grades K-5 and then enroll and attend a school within the network for at least two years. Finally, in the only lottery-based study conducted at the national level, including 36 oversubscribed, charter middle schools across 15 states, Gleason et al. (2010) find that impact on achievement varies significantly across schools In ELA, the researchers find that the magnitude ranges from -0.43 to +0.33 standard deviations. In math, the magnitude ranges from -0.78 to +0.065 standard deviations. The researchers also find that charter schools located in urban areas and serving higher proportions of disadvantaged students are most successful in boosting performance.

Most recently, two of the studies described above have extended their analysis to examining the impact of various charter schools on medium-term educational outcomes, including high school graduation and postsecondary enrollment. In expanding on their examination of the effects of attending a select sample of Boston's charter high schools, Angrist et al. (2013) are unable to detect an effect on either high school graduation or college enrollment. They do, however, find that charter attendance induces a shift from two- to four-year institutions. The researchers attribute the shift to gains in college readiness among the schools in their sample, as evidenced by higher, on average, Advanced Placement participation and increased SAT scores. Dobbie and Fryer (2013), in their extended study of the impact of attending HCZ's Promise Academies, find that attending the Promise Academies in middle school and high school increases the probability of enrolling in college. Like Angrist et al. (2013), they also find attending the Promise Academies increases the probability of attending a four-year college while decreasing the probability of attending a two-year college. They attribute their findings to the Promise Academies inducing some of its students to enroll in four-year colleges instead of two-year colleges.

High Tech High's Lottery Process for Admission

Before presenting my research design, it is important to first discuss how HTH's lottery process for admission works. My ability to assess the causal impact of attending HTH on college enrollment is contingent on modeling HTH's lottery process accurately. All admission lotteries have details, such as sibling preferences, that affect either the relevant sample to include in the analysis and/or the specification of the model used to estimate the impact of either an offer of admission or actual enrollment. A detailed understanding of the nuances of HTH's lottery process is thus critical.

Each spring, HTH conducts individual lotteries for admission at each grade level for each of its three campuses. When applying, applicants rank the three campuses by preference. HTH then includes each applicant in the grade-level lottery of the campus representing the applicant's first choice. In conducting its annual lotteries for the schools on its Point Loma campus, HTH seeks to create a student body at each grade level that is representative of the total youth population in San Diego[10]. To accomplish representative student bodies at each grade level, HTH assigns statistical advantage to applicants who fit

[10] HTH's Point Loma campus includes two high schools and two middle schools.

select criteria when conducting its annual admissions lottery. Statistical advantage is assigned according to two criteria:

1. the geographic region in which applicants reside at the time of applying;[11]
2. the applicant's FRPL status.

HTH relies on a ballot or "ticket" system when assigning statistical advantage to individual applicants based on these two criteria. The more tickets an applicant is assigned, the greater the chance that he or she is offered admission. The number of tickets assigned to each applicant based on geographic region is dependent on two factors:

1. the percentage of the total youth population in San Diego that comprises each geographic region based on the most recent U.S. Census data available for youth of ages 5 to 17[12];
2. the number of returning HTH students at each grade level who reside in each region.

Similarly, the number of tickets assigned to applicants based on FRPL status is based on three factors:

1. information provided by families about their eligibility for FRPL when completing an application for admission;
2. the network's specified goal of having approximately forty percent of its student population from each geographic region qualify for FRPL[13];

[11] Specifically, HTH places applicants in one of nine geographic regions based on the zip code of their primary residence. The regions are as follows: Downtown, Coastal, East, Mid-city, North, North of 8, North Central, Northern Inland and Other. Applicants whose primary residence does not fall within one of the first eight regions listed are places in the ninth category, Other.

[12] My sample includes lottery data from the spring of 2007, 2008, 2009, and 2010. During these years, HTH used U.S. Census data from 2000 in establishing its statistical advantages by geographic region.

3. the number of returning HTH students at each grade level who are eligible for FRPL.

In conducting annual admissions lotteries for its Point Loma campus and assigning statistical advantage to select applicants, HTH relies on a computer algorithm. The algorithm first places each applicant into one of nine geographic regions. It then subdivides applicants of each region into two subcategories. One subcategory comprises of those applicants from the region who are eligible for FRPL. The second subcategory consists of applicants from the region who are not eligible for FRPL. In all, there are 18 subcategories or individual lotteries per grade level each year.[14]

In determining the number of applicants from each individual lottery to which HTH seeks to offer admission, the algorithm first identifies the desired percentage of applicants from each lottery that HTH would like to offer admission. The algorithm identifies these percentages by first considering the percentage of the city's youth population who reside in each region based on the most recent U.S. Census. It then factors in its desired percentage of applicants from each region who are eligible for FRPL, which is 40 percent. Finally, the algorithm considers the number of returning HTH students at each grade level who reside within each region and are eligible for FRPL. After deducting the number of seats taken by returning students at each grade level from the number, the algorithm arrives at the desired number of students from each region that are eligible and not eligible for FRPL. Statistical advantages as represented

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[13] The 40 percent threshold is based on HTH's goals at the time of writing its charter application with the state of California in which approximately 40 percent of SDUSD middle school and high school students were eligible for FRPL.

[14] With four years of ninth-grade application data for HTH's Point Loma campus, this equates to 72 individual lotteries. I describe this in greater detail below.

by the number of tickets allocated to each applicant are then awarded. All applicants of the same lottery are awarded the same number of tickets.

As an example, assume that HTH seeks to enroll a ninth-grade cohort of 200 students in a given year. Also, assume that 25 percent of the cohort (that is, 50 students) reside in the Mid-City region based on the most recent U.S. Census. If HTH has 40 eighth-grade students who reside in Mid-City and plan to return to HTH as ninth graders, HTH will seek to admit ten new ninth-grade applicants from Mid-City. Moreover, if 15 of the 40 returning eighth-grade students are eligible for FRPL and the network seeks to have 40 percent of its ninth-grade cohort from Mid-City to be eligible for FRPL, then it will seek to admit five new ninth-grade applicants from Mid-City who are eligible for FRPL. To accomplish this outcome, if HTH seeks to enroll 60 additional students in total into its ninth-grade cohort after confirming that 140 of its current eighth grade students are continuing to ninth grade at HTH, the algorithm will assign ten tickets to each applicant who reside in Mid-City and are eligible for FRPL (60*.25*.4=10). This allotment of tickets is directly proportional to its statistical preferences, which, in turn, influences the probability of these applicants being offered admission.

Alternatively, using the example above, suppose that 20 of the 40 returning students who reside in Mid-City are eligible for FRPL (as opposed to 15 students). Under this scenario, HTH will not seek to admit any additional applicants from Mid-City who are eligible for FRPL. It thus assigns zero tickets to FRPL-eligible applicants residing in Mid-City. By assigning zero tickets to these applicants, the applicants have a probability of zero of being offered admission.

As a third and final scenario, and using the example above, suppose instead that 25 of the returning 40 students who reside in Mid-City are eligible for FRPL. Under this scenario, there are more students enrolled in HTH who reside in Mid-City and are eligible for FRPL than HTH desires based on its interest in mirroring the total youth population in San Diego from geographic and socioeconomic perspectives. The algorithm addresses this scenario by assigning zero tickets to FRPL-eligible applicants residing in Mid-City and then randomly spreading the impact of the oversubscription of FRPL-eligible students from Mid-City across other geographic regions. More specifically, it would randomly reduce the number of desired seats allocated to the FRPL-eligible students in other regions by the number of oversubscribed seats allocated to HTH returners who are eligible for FRPL in Mid-City.

Research Design

In conducting my analysis, I take advantage of the fact that HTH typically has many more students apply for admission each year than there are openings and thus offers admission through a lottery system. By offering admission via lottery, students of a given grade level from geographic region who are eligible or not eligible for FRPL are either offered or not offered admission randomly, thereby creating two exogenously-assigned groups within each of its lotteries – students who are "lotteried-in" and those who are "lotteried-out." These groups within each individual lottery do not differ in their motivation to attend the school and, more generally, are equal in expectation across unobserved characteristics.

Students comprising each lotteried-out group form my control group and provide an estimate of the counterfactual, that is, what the outcome would have been for applicants of each lotteried-in group (or treatment group) had the applicants not been offered admission. The mean difference in the outcome of interest between these two groups is known as the "Intent-to-Treat" (ITT) effect. It assesses the impact of an offer of admission to HTH. I rely on ordinary least squares (OLS) regression analysis in estimating this difference in models that include a fixed effect for each lottery.

Unlike the offer of admission to HTH, which is exogenously assigned via lottery, applicants choose the school in which they ultimately enroll and attend. These choices depend not only on whether applicants are admitted to HTH via lottery but also on unobservable characteristics that may also impact educational outcomes. Consequently, using OLS regression analysis to investigate the relationship between educational outcomes and attending HTH would likely produce biased estimates of any causal effect. To attain unbiased estimates for the causal impact of attending HTH, commonly referred to as the "Treatment on the Treated" (TOT) effect, I employ instrumental variables estimation (IVE). In applying IVE, I use the random and exogenous admission offer as an instrument for the potentially endogenous act of attending HTH. This provides an estimate of the TOT effect for "compliers." Compliers represent those applicants who adhere to the treatment to which the instrumental variable has assigned them. In my analysis, the compliers are those who are admitted and enroll in HTH or are not admitted and enroll in a school other than HTH.

Datasets

The student-level data that I analyze come from HTH and SDUSD. Data provided by HTH include annual applicant records for the ninth grade to its Point Loma campus from the spring of 2007 to spring of 2010. While HTH has three campuses, I have lottery data for its Point Loma applicants only.[15] I thus focus my analysis on students who apply to HTH's Point Loma campus only. Records include applicants' first and last names, date of birth, gender, grade level and school attended at the time of the application, race/ethnicity, free and reduced lunch (FRPL) eligibility, home addresses and zip codes at the time of application, and an indicator of which applicants were offered admission and which lotteried-in applicants accepted the offer to enroll and attend HTH. From 2007 to 2010, HTH's Point Loma campus received 2,852 applications for admission to ninth grade. In Table 1, I summarize the raw lottery data provided by HTH.

Data from SDUSD include demographic characteristics, baseline state exam scores in ELA as of eighth grade, and college enrollment data for SDUSD-eligible applicants of HTH from the winter of 2007 to the fall of 2014. Demographic data include students' first and last names, grade-level by year, student identification numbers, town of residence by year, date of birth, gender, race/ethnicity, and limited English proficiency status by year. Secondary-level academic achievement information includes results on the annual California Standards Tests (CST) as of eighth grade. Finally, postsecondary enrollment data for HTH applicants include the name and type of the college (two-year vs. four-year) in which they were enrolled for each subsequent fall through the fall of 2014. Postsecondary enrollment outcomes are based on whether a student is enrolled in a postsecondary institution in the semester immediately following the student's projected, on-time, high school graduation. Postsecondary enrollment data for all HTH applicants

[15] I focus my analysis solely on HTH's Point Loma campus because I obtain demographic and postsecondary data from SDUSD and the Point Loma campus is located in SDUSD. I thus have access to demographic and postsecondary data for a vast majority of applicants who apply to HTH's Point Loma campus. I do not have access to demographic and postsecondary data for applicants of HTH'S other two campuses, which are located outside of SDUSD in neighboring districts.

are made available through SDUSD's contract with NSC.[16]

Sample

In Table 1, I summarize the ninth-grade lottery records provided by HTH as well as the restrictions I place on the data provided to arrive at my analytic sample.

[INSERT TABLE 1 HERE]

In the first row, I provide the total number of ninth-grade admission records for HTH's Point Loma campus from 2007-2010. The total number, 2,852, includes students who attended HTH in eighth grade and will continue their enrollment in HTH in ninth grade. HTH includes its returning students in its application records because it factors returning students into the statistical advantages it assigns to select applicants as described above. In the second row, I eliminate repeat applications submitted by an applicant. Also excluded in the second row are applicants who are siblings of current HTH students. In the third row, I exclude students who attended HTH in eighth grade and whose families have indicated to HTH that they will continue to attend HTH in ninth grade. I exclude siblings and continuing students from the analytic sample because they are automatically offered admission without participating in a lottery. HTH received 1,853 applications from non-returning, non-repeating, non-sibling students for admission to ninth grade in 2007-2010. In the fourth row, I exclude applicants in which SDUSD has

[16] Through its subscription with NSC, SDUSD has access to the postsecondary data of students who attended SDUSD high schools. Access includes graduates of SDUSD as well as students who transferred from SDUSD at some point during their high school tenure. NSC maintains enrollment information on more than 3,500 colleges and universities, which enroll 98 percent of students attending public and private nonprofit postsecondary institutions. Attrition is thus limited only to colleges in which NSC does not have postsecondary education records.

no baseline demographic data as of eighth grade. I exclude these applicants because I only have access to postsecondary enrollment data for applicants for which I have baseline data from the district.

Finally, I exclude applicants from lotteries in which there are either zero applicants who were offered admission or zero applicants who were not offered admission. I exclude applicants from these lotteries because my analysis requires that for each lottery, I have at least one applicant who is lotteried-out and thus forms my control group for that lottery. Moreover, I must have at least on applicant who is lotteried-in so that I have a treatment group represented within each lottery. Of the 72 lotteries included in my dataset (based on four years of data in which there are 18 lotteries per year), 22 lotteries do not include at least one applicant who is offered admission and at least one applicant who is not offered admission. I thus exclude applicants included in these 22 lotteries. As a result of each of the restrictions described, my final sample consists of 919 ninth-grade applicants to HTH's Point Loma campus.[17]

In matching demographic and secondary/postsecondary data from SDUSD with HTH's lottery and enrollment data, I rely on applicants' first and last names, date of birth, and gender as my merging variables. Observations in these two data sources do not share a unique and reliable identification field. I thus utilize a user-created record linkage command, "reclink," in Stata to match observations between my datasets. The reclink command provides scores that represent the probability of a match based on the given matching variables. I examine the matches resulting from the command and confirm that all matches with a probability score of 0.75 or above are valid. Upon reviewing matches

[17] Of my final restricted sample of 919 applicants, approximately 55.6 percent were offered admission to HTH. Of those, roughly 79.8 percent accepted the offer and enrolled in HTH's ninth grade.

with scores just below 0.75, I accept a number of cases in which misspellings and inconsistencies could be identified and corrected. In the event that I cannot conclude that a proposed match is correct and the score is below 0.75, I decline the proposed match.

[INSERT TABLE 2 HERE]

As shown in column 5 of Table 2, I successfully match 63.7 percent of all ninth-grade applicants to HTH's Point Loma campus. While this overall match rate is lower than the match rates of recent comparable studies, the lower rate is likely due to HTH drawing applications from a wide geographic landscape in which a larger percentage of its applicants attend public schools in districts other than SDUSD or private schools.[18] SDUSD, which is my only source of baseline demographic data, does not have data on applicants who have never enrolled in a SDUSD school, which negatively impacts the match rate.

The match rate for applicants who were offered admission is 74.7 percent (column 5). The match rate for applicants who were not offered admission is 53.7 percent (column 6). While the difference between these match rates is statistically significant, it is not likely due to incomplete or flawed data. Rather, the difference is likely attributed to HTH's statistical preferences in which it admits students more heavily from several geographic regions within SDUSD. SDUSD is thus more likely to have baseline data for these students. Conversely, HTH admits fewer applicants from regions outside of

[18] Dobbie and Fryer (2013) report match rates of Promise Academy lottery data the New York City administrative of 95.1 to 95.8 percent. Angrist et al. (2013) report an overall match rate of 94.0 percent. Finally, Angrist et al. (2012) report an overall match rate of 91.1 percent with a differential match rate of 12 percentage points between those offered admission and not offered admission, respectively.

SDUSD for which I have baseline data for fewer students through SDUSD.

To investigate the degree to which the differential in my rates in matching applicants who were offered admission and not offered admission to their corresponding SDUSD demographic data is attributed to statistical preferences embedded within HTH's admissions practices and not due to flawed or incomplete data, I examine the match rate of applicants residing in the Mid-city region only. This region is geographically located at the center of the district. It is also the region with the highest percentage of FRPL applicants, which could indicate that relatively more applicants from this region attend public schools versus private schools. I find that the differential in match rates between lotteried-in and lotteried-out applicants of this region who are eligible for FRPL is approximately 5 percentage points, which is substantially smaller than the 20 percentage point differential for my sample overall. For applicants of Mid-city who are ineligible for FRPL, the differential is 8 percentage points. These observations within the Mid-city region give me confidence that HTH's statistical preferences with admissions are largely responsible for the wide match differential I observe and not due to flawed or incomplete data.

[INSERT TABLE 3 HERE]

In Table 3, I present a summary of the postsecondary data included in my analysis. Of the 919 applicants in my sample, NSC had postsecondary records for 653 applicants (71.1 percent). For those applicants in which NSC did not have records, I assume that these applicants do not enroll in a postsecondary institution in the fall immediately following their projected high school graduation. The difference in the NSC match rates for applicants who were offered admission (68.8 percent) and not offered admission (73.9 percent) is not statistically significant.

In column 2 of Table 4, I present descriptive statistics for baseline characteristics of my lottery sample. Specifically, I report eighth grade means for ninth-grade lottery applicants to HTH'S Point Loma campus from 2007 to 2010. To provide context for the population of applicants that HTH attracts on its Point Loma campus for the ninth grade, I also report sample means for all SDUSD students who were enrolled in the ninth grade in the fall of 2007 to 2010 (column 1).

[INSERT TABLE 4 HERE]

When comparing the means of ninth-grade applicants to HTH's Point Loma campus and the district overall, I observe that HTH receives a slightly greater percentage of applications from applicants who are classified as white, black or Hispanic.[19] I also observe that HTH's Point Loma applicants for the ninth grade score marginally higher, on average, on the eighth grade ELA assessments than do SDUSD ninth-grade students. These differences, however, are not statistically significant.[20]

In columns 3 and 4, I report estimates for differences in eighth-grade demographics

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[19] While not presented in my table, I find that the percentage of HTH applicants who are classified as Asian is approximately five percentage points lower than the percentage of Asian students who attended a SDUSD school as of ninth grade in the fall of 2007 to 2010.

[20] Of the 919 applicants in my final sample, SDUSD has ELA state exam results as of the eighth grade for 661 applicants. Students who attend private schools and schools outside of California in eighth grade are not required to take California's state exams. SDUSD thus does not have eighth grade state exam results for these students. I do not include mathematics state assessment results in my analysis because students in eighth grade take different exams based on what mathematics course they take. Alternatively, all students in the eighth grade take the same ELA exam, thus allowing for the common measure of baseline proficiency.

between applicants who are offered admission and not offered admission. Because admission is offered to applicants via lottery and thus offered randomly across applicants, my expectation is that the differences should be modest. In column 3, I report the differences in coefficients from regressions of a dichotomous variable equal to one if the applicant was offered admission via lottery on an outcome variable corresponding with the demographic characteristic indicated in each row. Regressions include dummies for interactions between lottery year, regional cluster, and FRPL status. Collectively, these dummies represent each lottery held by HTH for admission to its Point Loma campus from 2007 to 2010. I do not include dummies representing my reference lottery and the 22 lotteries in which there is not at least one applicant who is offered admission and at least one applicant who is not offered admission.

I observe that all but two differences in the observed characteristics between applicants who are offered admission and not offered admission are statistically indistinguishable from zero. Applicants who were offered admission are 7.5 percent less likely to be female and 6.8 percent more likely to be white than those who are not offered admission. In examining these two imbalances at the individual lottery level, I find that the imbalance overall in female stems mainly from two of the 50 lotteries in which a larger concentration of students who were admitted are male. Moreover, the imbalance in white stems mainly from five of the 50 lotteries.

In column 4, I add all of the demographic controls to the regressions for baseline ELA exam scores. Through a joint test of balance for all observable characteristics, including demographic controls, I fail to reject the null hypothesis that the coefficients are simultaneously equal to zero. As shown in column 4, the F-statistic for this test from produces a p-value of 0.31.[21]

Measures

My outcome measures, *outcome*, include five dichotomous variables representing postsecondary enrollment as reported by NSC. These outcomes are assessed in the fall immediately following a student's projected, on-time high school graduation.[22]

1. Any college
2. Two-year college
3. Four-year college
4. Four-year college rated as "very competitive" or above by Barron's Profiles of American Colleges[23]

For my main question predictors, I create the dummy variable, *lotteried_in*, which indicates whether an applicant was admitted to HTH via lottery (where $lotteried\_in_i$=1 for those who are offered admission and $lotteried\_in_i$=0 for those who are not offered admission). I also create the dichotomous variable, *attended*, which indicates whether an applicant ever attended HTH.

To increase the precision of my impact estimates, I include a vector of pre-determined control predictors, including dummy variables for gender and race/ethnicity.

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21 While the results of this joint test provide reassurance that the imbalance does not obstruct my ability to draw causal findings, I address the issue further by fitting alternative models in which applicants included in the imbalanced lotteries are excluded from my sample. I find that excluding these lotteries does not influence my results.

22 To provide an example, if a student applied to the ninth grade of HTH's Point Loma campus in 2007, the student's projected on-time graduation is the spring of 2011 and immediate postsecondary enrollment would be assessed as of the fall of 2011.

23 My construction of this variable, which represents "admissions-competitiveness," is adapted from Deming et al. (2011). I set the variable equal to "1" if Barron's rates the college as of 2011 as "very competitive," "highly competitiveness," or "most competitiveness." I set the variable equal to "0" if Barron's rates the college as "competitive," "less competitive," "noncompetitive," or "special." I also code colleges that are unrated by Barron's as 0. This includes two-year colleges. Finally, I code students who do not attend college as determined by NSC as 0.

I also include continuous covariates for eighth grade test scores on state-mandated ELA exams.[24]

Data Analysis

The ITT effect in my analysis is estimated using the following linear regression model, which I estimate using OLS:

$$outcome_{ijt} = \alpha_1 lotteried\_in_{ijt} + \alpha_2 X'_i + \alpha_3 I_j^{lottery} + \zeta_{ijt}$$

for student *i* in lottery *j* at time *t*. Variable X'_i represents a vector set of pre-determined control predictors. Parameter α_3 represents the fixed effects for lottery. Coefficient ζ_{ijt} is an error term that reflects random fluctuation in the outcome measure.[25] The estimate of parameter α_1 represents the coefficient of interest within this hypothesized model – it is interpreted as the causal effect of being offered admission to HTH.

The TOT effect in my analysis is the estimated mean difference in outcomes between lotteried-in students who actually enroll in and attend a school and those in the control group who would have enrolled if they had been offered admission. I estimate its effect through a two-stage, least squares (2SLS) regression of student outcomes ($outcome_{ijt}$) on an indicator variable for having ever attended HTH ($attended_{ijt}$) with lottery status ($lotteried\_in_{ijt}$) as an instrumental variable for enrollment. My first- and second-stage statistical models are as follows:

$$1st\text{: } attended_{ijt} = \delta_1 lotteried\_in_{ijt} + \delta_2 X'_i + \delta_3 I_j^{lottery} + \nu_{ijt}$$

$$2nd\text{: } outcome_{ijt} = \gamma_1 \widehat{attended}_{ijt} + \gamma_2 X'_i + \gamma_3 I_j^{lottery} + \varepsilon_{ijt}$$

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[24] As described above, students in eighth grade take different mathematics exams based on what mathematics course they take. I thus do not include a covariate for eighth grade test scores on state-mandated ELA exams. Alternatively, all students in the eighth grade take the same ELA exam, thus allowing for the common measure of baseline proficiency.

[25] Standard errors are clustered at the district (SDUSD) sending school level.

where parameter γ_1 is the principal coefficient of interest and is interpreted as the (average) causal effect of attending HTH for compliers. While I estimate both TOT and ITT effects, my tables and discussion focus on the TOT estimates as the impact of attending HTH is of greater interest among education policy makers and school leaders and operators.[26]

Results

Overall Effects on Postsecondary Enrollment

I begin by examining my first stage estimates, which, as specified in my model above, represent the impact of being offered admission via lottery on enrolling in and attending HTH.[27] In column 1 of Table 5, I report my estimates. I find that being offered admission increases the probability of enrolling by approximately 50.0 percentage points. This estimate is stable to the inclusion in the model of baseline demographics and ELA scores. [28]

[26] To determine the probability of detecting an effect of enrolling in HTH on immediate college enrollment, I conduct statistical power analysis using the software program, Optimal Design Plus Empirical (ODPE). HTH applicants are nested within 50 individual lotteries based on the geographic region of their primary home address and their FRPL status. I thus select the multi-site, randomized trial option in ODPE for my analysis. In addition, I accept a Type II and Type I error of 20 percent and 5 percent, respectively. I also assume that approximately 10 percent of the variation in my outcome is explained by my covariates. This assumption is based on fitting the ITT model described above in which immediate college enrollment of any type is my outcome variable and I control for individual lotteries and baseline demographics. To obtain statistical power of 0.80, I conclude that each site must comprise of approximately 18 applicants in order to detect an effect size of 0.20 standard deviations. My final sample consists of 919 applicants where applicants are not evenly distributed across lotteries. The average number of applicants per lottery, however, is between 18 and 19. Assuming that the uneven distribution of applicants across lotteries does not negatively affect my statistical power, I conclude that I have sufficient power to detect an effect size is 0.20 standard deviations. In the event that the effect size is 0.15 standard deviations, I would require an average of 37 applicants per lottery. Under this scenario, my analysis would be significantly underpowered, thereby limiting my ability to detect an effect if an average effect exists.
[27] My decision to fit linear probability models as opposed to logistical regression models is informed by Angrist & Pischke (2009).
[28] I utilize a variation of "Cohen Missing-Data Strategy" to address the issue of not having baseline ELA scores for all applicants in my sample. This strategy involves filling any missing values for scores with an

[INSERT TABLE 5 HERE]

I report my reduced-form estimates in column 2 of Table 5. These estimates represent the effect of being offered admission via lottery on enrolling in college. In column 3, I report my 2SLS estimates, which represent the effect of attending HTH's Point Loma high schools on enrolling in college among compliers. As reported in the top section of Table 5, I detect no impact on the probability of enrollment in college of any type, which includes two-year and four-year colleges, for my aggregate sample. My estimates are consistent when including baseline demographics and ELA scores.

When examining the effect of attending HTH on the probability of enrolling in a two-year college, I observe signs of an overall negative impact. While the estimates are just beyond the bounds of the traditional ten percent level of statistical significance (p = 0.107), my 2SLS point estimates indicate a decreased probability of 11.2 percentage points of enrolling in a two-year college when controlling for baseline demographics and ELA scores. When examining the effect of attending HTH on the probability of four-year college enrollment, I observe an overall positive impact. I find that attending HTH's Point Loma high schools increases the probability of enrolling in a four-year college by 10.9 percentage points, a statistically significant finding.

Finally, I detect no effect on the probability of enrollment in a four-year college

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arbitrary constant number and including a missing-data dummy within my statistical models. Chetty et al. (2014) apply a similar strategy in their examination of the impact of teacher value-added and student outcomes in adulthood.

rated as very competitive or above by Barron's Profile of American Colleges. My estimates are consistent when including baseline demographics and ELA scores.

In addition to examining effects on my aggregate sample, I also examine the impact of attending HTH's Point Loma's high schools on various subgroups, including male and female students, and students who are classified as black or Hispanic.[29] Specifically, I include in my analytical model interaction terms for each subgroup and a dummy variable that represents whether an admitted applicant enrolls in HTH. For each subgroup of interest, I fail to reject the null hypothesis that the coefficients representing each subgroup jointly equal to zero. In conclusion, I find no differential impact on the probability of enrolling in postsecondary education of any type among the subgroups that I examine.

Additional Results

Comparison of College Enrollment Rates

When examining the impact of being admitted and attending HTH's Point Loma high schools on postsecondary enrollment, I observe a relatively high rate of immediate college enrollment among HTH applicants. In Table 6, I compare postsecondary enrollment rates of my sample with the rates of graduates of SDUSD-managed high schools as well as the rates nationally. In column 1, I report that 71.1 percent of HTH applicants in my sample were enrolled in college of some form in the fall immediately following the spring of their projected year of high school graduation. Among applicants

[29] I do not include as a part of my subgroup analysis whether an applicant was eligible for FRPL at the time of applying because an applicant's FRPL status determines the lottery in which they participate. For a given subcategory or lottery, all applicants within the lottery are either eligible for FRPL or not eligible for FRPL.

who were admitted to HTH's Point Loma campus as of ninth grade, the rate of college enrollment was 68.8 percent. The rate was higher for those who were not admitted at 73.9 percent. This rate is slightly higher than the national rate in the United States as of the same period and is markedly higher than the rate of college enrollment among students of SDUSD-managed schools.[30] According to SDUSD, the postsecondary enrollment rate among high school graduates of SDUSD-managed schools for the classes 2010-2013 was 62.7 percent. Such differences suggest that the composition of students and families who apply to HTH in high school and those who attend district-managed high schools in SDUSD differ in ways that likely influence the likelihood of enrolling in postsecondary education.[31]

[INSERT TABLE 6 HERE]

While I do not have access to immediate college enrollment rates of select subgroups of students who graduate from SDUSD-managed schools, I find that the immediate college enrollment rates of various subgroups within my sample are similar to students of the same subgroup nationally. In columns 2-7, I report postsecondary

[30] According to U.S. National Center of Education Statistics, the percentage of "recent high school completers" as of 2009 was 70.0 percent. This percentage includes graduates between 16 and 24 years old who graduated from high school in the preceding 12 months. Note that the percentage includes persons receiving their GEDs.

[31] I also compare these rates with the postsecondary enrollment rates presented in recent, comparable studies that examine the impact of charter schools on medium-term outcomes. I find that the rates observed in comparable studies are substantially lower than what I observe among those applying to HTH's Point Loma high schools. Angrist et al. (2013) observe an immediate college enrollment rate of 48.4 percent in their study of charters schools in Boston. Dobbie & Fryer (2013) report college enrollment rates of 28.8 percent and 42.9 percent for those who are admitted and not admitted to the Promise Academies of the Harlem Children's Zone.

enrollment rates for select subgroups. I observe that the immediate college enrollment rate of subgroup applicants who are not admitted are higher than the national rates. Of particular note are non-admitted Hispanic applicants of HTH whose rate of immediate college enrollment is 16.3 percentage points higher than the national rate. Assuming that the differences in college enrollment rates between graduates of SDUSD-managed high schools and graduates at the national level hold and given that applicants of HTH who were not admitted display rates that are consistently higher than national levels, it appears that select subgroups of HTH applicants, including applicants classified as male, female, black, and Hispanic, exhibit substantially higher levels of postsecondary enrollment than those graduating from SDUSD-managed high schools.[32]

Conclusion

In conducting my thesis research, I expand the research base on charter school effectiveness. I do so by examining the causal impact of attending a charter school on medium-term outcomes, which few researchers, to date, have been able to do. In addition, I focus on a particular charter school network that features characteristics that are different from the "No Excuses" model that has been the focus of the studies from which my

[32] To further explore the relatively higher rates of postsecondary enrollment among HTH applicants, I narrow my observations to the Mid-city region, which, as mentioned above, is geographically located at the center of the district and is also the region with the highest percentage of FRPL applicants. I find that 71.4 percent of applicants from Mid-city who were not offered admission to HTH enrolled in college in the fall immediately following their projected spring graduation. While I do not have access to the postsecondary enrollment rate of students from Mid-city who graduate from a SDUSD-managed high school, the percent of college-enrolled applicants from Mid-city who are not offered admission to HTH is substantially higher than the district's overall rate of college enrollment. This observation reinforces the notion that students and families who apply to HTH in high school are especially motivated and/or have a higher capacity to enroll in postsecondary education in comparison to their peers who attend district-managed high schools in SDUSD.

research builds.

Through my analysis, I observe a shift away from enrolling in two-year colleges and toward enrolling in four-year colleges, which is consistent with the findings of comparable studies. The researchers of these studies attribute the shift they observe to gains in college readiness and to college counseling in which students are encouraged to enroll in four-year colleges. While the schools of focus for these studies differ from HTH in their characteristics, the claims presented by the researchers of these studies are plausible in explaining the same shift that I observe among HTH attendees.

In addition, I observe that the rate of college enrollment among HTH applicants is relatively high. For the four ninth-grade cohorts that I observe in my analysis, I find that roughly 71 percent of applicants enroll in postsecondary education in the fall immediately following their projected high school graduation. This rate is similar to the national rate as of the same period and is strikingly higher than the rate of college enrollment among students of SDUSD-managed high schools. I observe similar differences when comparing the rates of select subgroups. Overall, I conclude that the composition of students and families who apply to HTH's Point Loma campus in high school are especially motivated and/or have a higher capacity to enroll in postsecondary education in comparison to their peers who attend district-managed high schools in SDUSD. Those who applied and were not offered admission likely found other promising high school options. In doing so, these students and their families best positioned themselves to enroll in postsecondary education at the same high levels as students attending HTH. As a result, I detect no differential impact in attending HTH in overall college enrollment among those apply to the network and were either admitted or not admitted as of ninth grade.

In encouraging others to expand on my study, I identify three specific limitations of my analysis that are worth addressing. Addressing these limitations could inform the growing discussion on charter school effectiveness on both medium- and long-term outcomes. The first limitation is that I examine the impact of attending HTH's schools in grades 9-12 only. I do not assess the impact of attending HTH's middle schools or elementary schools in conjunction with one of its high schools. In Dobbie & Fryer's (2013) study of the impact of being admitted to HCZ's Promise Academies, in which they report detecting a positive effect on college enrollment, they focus their examination on a cohort of students who attended a Promise Academy in middle school and high school. Given HTH's current design as a K-12 model, it is plausible that its students who attend HTH's elementary and/or middle schools before attending one of its high schools (and thus experience its full educational offerings) yield medium-term outcomes that are more positive than students attending HTH's high schools only. Due to not having reliable admissions data at the middle school level, I am currently unable to examine these effects.

In addition to not having data that extend back to the middle school or elementary school levels, a second limitation relates to not being able to examine medium-term and long-term outcomes beyond postsecondary enrollment. HTH's model and its design principles, including the principles of personalization and adult connection, are theoretically conducive to preparing students for success in college and success professionally. Such principles, while beneficial, may be less direct in promoting college enrollment, which is most heavily reliant on academic success in high school, including grade point averages, SAT scores, and extra-curricular interests. In future years, data beyond college enrollment, including measures of college persistence, labor market outcomes, and measures of civic engagement, are likely to be more readily available. Researchers will thus be equipped with the information necessary to examine the impact of attending HTH on additional medium-term and long-term outcomes.

Finally, much of the broader debate on charter school effectiveness both in cities and nationwide compares the academic performance of students who attend charter schools with students who attend district-managed schools. One key assumption underlying this comparison is that charter schools and district-managed schools that serve the same communities necessarily serve the same population of families and students within the communities. My observation of vastly different postsecondary enrollment rates between applicants who are not admitted to HTH and those who attend SDUSD-managed schools challenges this assumption. Even with an admissions lottery system as sophisticated as HTH's with its built-in statistical preferences based on residence and socioeconomic status in order that it may serve a population of students that is representative of the total youth population of San Diego, I observe likely differences in motivation and/or capacity among applicants and non-applicants that influence postsecondary enrollment. It is plausible that such differences also affect other educational outcomes, including state exam results, which are most often cited in the broader debate on charter school effectiveness. Ascertaining whether such differences exist beyond HTH's high schools and the degree to which they exist are important open questions for future research to examine.

References

Abdulkadiroglu, A., Angrist, J. D., Dynarski, S. M., Kane, T. J. & Pathak, P. A. (2011). Accountability and flexibility in public schools: Evidence from Boston's charters and pilots. *Quarterly Journal of Economics*, 126(2), 699–748.

About High Tech High. (n.d.). Retrieved from http://www.hightechhigh.org/about/

Angrist, J. D., Cohodes, S. R., Dynarski, S. M., Pathak, P. A. & Walters, C. R. (2013). *Stand and deliver: Effects of Boston's charter high schools on college preparation, entry, and choice.* NBER Working Paper no. 19275. Cambridge, MA: National Bureau of Economic Research.

Angrist, J. D., Dynarski, S. M., Kane, T. J., Pathak, P. A. & Walters, C. R. (2012). Who Benefits from KIPP? *Journal of Policy Analysis and Management*, 00(0), 1-24.

Angrist, J. D., Pischke, S. (2009) Mostly harmless econometrics: an empiricist's companion, Princeton, NJ: Princeton University Press.

Betts, J. R. & Atkinson, R. C. (2012). Better research needed on the impact of charter schools. *Science*, 335, 171-172.

Betts, J. R. & Tang, Y. E. (2014). *A meta-analysis of the literature on the effect of charter schools on student achievement..* National Charter School Research Project. Seattle, WA: Center on Reinventing Public Education

Black, D. A. & Smith, J. A. (2004). How robust is the evidence on the effects of college equality? Evidence from matching. *Journal of Econometrics,* 121, 99-124.

Carter, S. C. (2000). *No excuses: Lessons from 21 high-performing, high-poverty schools.* Washington, DC: Heritage Foundation.

Chetty, R., Friedman, J. R. & Rockoff, J. E. (2014). Measuring the impacts of teachers II: teacher value-added and student outcomes in adulthood. *American Economic Review*, 104(9), 2633-2679.

Conley, D. T. (2007). *Redefining College Readiness.* Eugene, OR: Educational Policy Improvement Center. Retrieved from http://www.aypf.org/documents/RedefiningCollegeReadiness.pdf

Currie, J. & Thomas, D. (2001). Early test scores, school quality and SES: long run effects of wage and employment outcomes. In S. W. Polachek (Ed.), *Worker wellbeing in a changing labor market* (pp. 103-32). Amsterdam: Elsevier Science.

Curto, V. & Fryer, R. G. (2011). *Estimating the returns to urban boarding schools: Evidence from SEED.* NBER Working Paper no. 16746. Cambridge, MA: National Bureau of Economic Research.

Deming, D. J., Hastings, J. S., Kane, T. J. & Staiger, D. O. (2011). School choice, school quality and postsecondary attainment. NBER Working Paper no. 17438. Cambridge, MA: National Bureau of Economic Research.

Dobbie, W., & Fryer, R. G. (2013). The médium-term impacts of high-achieving charter schools on non-test score outcomes. NBER Working Paper no. 19581. Cambridge, MA: National Bureau of Economic Research.

Dobbie, W. & Fryer, R. G. (2011). Are high-quality schools enough to increase achievement among the poor? Evidence from the Harlem Children's Zone. *American Economic Journal: Applied Economics*, 3, 158–187.

Gleason, P., Clark, M., Tuttle, C. C. & Dwoyer, E. (2010). *The evaluation of charter school impacts: Final report.* National Center for Education Evaluation and Regional Assistance. Washington DC: Institute of Education Sciences, U.S. Department of Education.

Hamilton, L. & Stecher, B. M. (2010). Expanding what counts when evaluating charter school effectiveness. In J. R. Betts & P. T. Hill (Eds.), *Taking measure of charter schools: Better assessments, better policymaking, better schools* (pp. 33-54). United Kingdom: Rowman & Littlefield Education.

Hoxby, C. M., Murarka, S. & Kang, J. (2009). *Charter schools in New York City: Who enrolls and how they affect student achievement.* NBER working paper no. 14852. Cambridge, MA: National Bureau of Economic Research.

Jacob, B. A. (2005). Accountability, incentives and behavior: the impact of high-stakes testing in the Chicago Public Schools. *Journal of Public Economics,* 89(5-6), 761-796.

KIPP. (2011). *The promise of college completion: KIPP's early successes and challenges.* Retrieved from http://www.kipp.org/files/dmfile/CollegeCompletionReport.pdf

Kohn, A. (2000). *The case against standardized testing: raising the scores, ruining the schools.* Portsmouth, NH: Heinemann.

Koretz, D. M. (2008). *Measuring Up: What educational testing really tells us.* Cambridge, MA: Harvard University Press.

McClure, L., Strick, B., Jacob-Almeida, R. & Reicher, C. (2005). *The Preuss School at UCSD: School characteristics and students' achievement.* The Center for

Research on Educational Equity, Assessment and Teaching Excellence. University of California, San Diego, CA. Retrieved from http://create.ucsd.edu/Research_Evaluation/ PreussReportDecember2005.pdf

Mehta, J. & Fine, S. (2012). Teaching differently, learning deeply. *Phi Delta Kappan*, 94(2). 31-35.

Moon, T. R., Callahan, C. M. & Tomlinson, C. A. (2003). Effects of state testing programs on elementary schools with high concentrations of student poverty-good news or bad news? *Current Issues in Education*, 6(8). Retrieved from http://cie.ed.asu.edu/volume6/number8/

Murnane, R. J. & Willett, J. B. (2010). *Methods matter: improving causal inference in educational and social science research.* New York, NY: Oxford University Press.

National Alliance of Public Charter Schools. (2012). The public charter schools dashboard: a comprehensive data resource from the National Alliance of Public Charter Schools. Retrieved from http://dashboard.publiccharters.org/dashboard/schools/year/2012

National Science Foundation. (2015). Women, minorities, and persons with disabilities in science and engineering: 2015 Retrieved from http://www.nsf.gov/statistics/wmpd

Ravitch, D. (2010). *The death and life of the great American school system: how testing and choice are undermining education.* New York, NY: Basic Books.

Long, B. & Kurlaender, M. Do community colleges provide a viable pathway to a baccalaureate degree? *Educational Evaluation and Policy Analysis,* 31 (1), 30-53.

Thernstrom, A. & Thernstrom, S. (2003). *No excuses: Closing the racial gap in learning.* New York, NY: Simon & Schuster.

Whitman, D. (2008). *Sweating the small stuff: Inner-city schools and the new paternalism.* Washington, DC: The Fordham Institute.

Zimmer, R., Gill, B., Booker, K., Lavertu, S., Sass, T.R. & Witte, J. (2009). *Charter schools in eight states: effects on achievement, attainment, integration, and competition.* Santa Monica, CA: RAND Corporation. Retrieved from http://www.rand.org/pubs/monographs/2009/RAND_MG869.pdf

Table 1. HTH Lottery Records for Students Applying to HTH's Point Loma Schools in Ninth Grade

	Lottery cohort				
	2007-2008	**2008-2009**	**2009-2010**	**2010-2011**	**All lotteries**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Total number of records (ninth grade)	674	740	730	708	2,852
Excluding repeat applicants and siblings	631	670	690	566	2,557
Excluding returning HTH students	432	474	493	454	1,853
Excluding applicants without baseline demographics	269	327	321	295	1,212
Excluding applicants of lotteries in which there are either no applicants who have been offered admission or no applicants who were not offered admission	198	220	276	225	919

Notes: In the first row, I provide the total number of records for ninth-grade applicants to HTH's Point Loma campus. In each successive row, I list my sample restrictions. In the second row, I eliminate the records of all repeat applicants (or applications submitted beyond the first application submitted by an applicant), siblings and children of HTH. In the third row, I exclude the records of returning HTH students. In the fourth row, I eliminate applicants for which SDUSD has no records in the fourth row. In the fifth row, I exclude applicants of lotteries in which there are either no applicants who have been offered admission or no applicants who were not offered admission. This table is adapted from Angrist et al. (2012).

Table 2. Match of SDUSD Demographic Data to Ninth-Grade Applicants to HTH's Point Loma Campus

					Fraction of applicants matched with SDUSD in active lotteries only		
Lottery cohort	Total number of applicants (1)	Number of applicants in active lotteries only (2)	Number of applicants matched with SDUSD (3)	Number of applicants matched with SDUSD in active lotteries only (4)	Total (5)	Offered admission (6)	Not offered admission (7)
2007-2008	432	329	269	198	0.602	0.761	0.492
2008-2009	474	329	327	220	0.690	0.767	0.602
2009-2010	493	424	321	276	0.651	0.712	0.585
2010-2011	454	361	295	225	0.650	0.761	0.450
All cohorts	1,853	1,443	1,212	919	0.637	0.747	0.537
All applicants of Mid-city only who are eligible for FRPL	386	386	311	311	0.806	0.824	0.771
All applicants of Mid-city only who are ineligible for FRPL	128	128	94	94	0.734	0.765	0.681

Notes: In column (1), I provide the total number of ninth-grade applicants to HTH's Point Loma campus by year who were not returning HTH students, repeat applicants, or applicants who are siblings of enrolled students. In column (2), I report the total number of ninth-grade applicants from lotteries in which there is at least one SDUSD-matched applicant who has been offered admission and at least one SDUSD-matched applicant who was not offered admission. In column (3), I report the total number of ninth-grade applicants to HTH's Point Loma campus from any lottery with which I was successfully able to match SDUSD demographic data. In column (4), I provide the number of SDUSD-matched, ninth-grade applicants from lotteries in which there is at least one applicant who has been offered admission and at least one applicant who was not offered admission. I report match statistics for these applicants in columns (5) through (7). This table is adapted from Angrist et al. (2012).

Table 3. Match of NSC Records to Ninth-Grade Applicants of HTH's Point Loma Campus

			Fraction with NSC records		
Lottery Cohort	**Number of applicants in lottery sample (1)**	**Number with NSC records (2)**	**Total (3)**	**Offered admission (4)**	**Not offered admission (5)**
2007-2008	198	154	0.778	0.745	0.813
2008-2009	220	152	0.691	0.637	0.737
2009-2010	276	208	0.754	0.782	0.717
2010-2011	225	139	0.618	0.588	0.681
All cohorts	919	653	0.711	0.688	0.739

Notes: In column (1), I provide the number of applicants in my final sample by lottery cohort. In column (2), I provide the number of applicants in my final sample for which NSC has postsecondary records. In columns (3) through (5), I report the percentage of the total number of ninth-grade applicants with NSC records as well as the percentage of applicants with NSC records who were offered and not offered ninth-grade admission to HTH's Point Loma campus.

Table 4. Descriptive Statistics of 2007-2010 Lottery Sample as of Eighth Grade

	Means		Balance regressions	
	SDUSD (1)	HTH (2)	Lottery controls only (3)	Lottery and demographic controls (4)
Female	0.497	0.496	-0.071*	
			(0.038)	
White	0.279	0.293	0.068**	
			(0.027)	
Student of color	0.531	0.573	-0.014	
			(0.030)	
Eighth grade ELA score	0.267	0.316	-0.094	-0.080
			(0.090)	(0.089)
F-value from joint test			3.620	1.190
p-value from F-test			0.013**	0.314
N for demographics	32,034	919	919	
N for baseline ELA	29,667	661	661	661

Notes: In column (1), I report eighth-grade means for students who attended ninth grade in SDUSD in the fall of 2007 to 2010. In column (2), I report eighth-grade means for ninth-grade applicants to HTH's Point Loma campus between 2007 and 2010 who were not returning HTH students, repeat applicants, or applicants who are siblings of enrolled students. In columns (3) and (4), I report coefficients from regressions of a dichotomous variable equal to one if the applicant was offered admission via lottery on an outcome variable corresponding with the demographic characteristic indicated in each row. Regressions include dummies for interactions between lottery year, regional cluster, and FRPL status. In column (4), I add all of the demographic controls to the regressions for baseline ELA scores. F-tests are for the null hypothesis that the coefficients on being lotteried-in in all regressions are equal to 0. These tests are calculated for the subsample that has nonmissing values in all regression variables tested. ***, **, and * indicates statistically significant differences between those who were offered admission and those who were not with 99%, 95%, 90% confidence, respectively. Robust standard errors are in parentheses in columns (3) and (4). This table is adapted from Angrist et al. (2012).

Table 5. Impact Estimates of Being Offered Admission to HTH's Point Loma Campus via Lottery and of Attending HTH on Postsecondary Enrollment

		Ninth-grade applicants to HTH's Point Loma Campus		
		First stage	Reduced form	2SLS
Type of postsecondary enrollment	Controls	(1)	(2)	(3)
Any college	Basic	0.509***	-0.018	-0.034
		(0.031)	(0.034)	(0.063)
		919	919	919
	Demographics	0.513***	-0.010	-0.020
		(0.038)	(0.034)	(0.064)
		919	919	919
	Demographics and baseline scores	0.500***	-0.004	-0.008
		(0.317)	(0.034)	(0.064)
		919	919	919
Two-year college	Basic	-	-0.052	-0.101
		-	(0.036)	(0.067)
		-	919	919
	Demographics	-	-0.052	-0.102
		-	(0.036)	(0.068)
		-	919	919
	Demographics and baseline scores	-	-0.056	-0.112
		-	(0.036)	(0.070)
		-	919	919
Four-year college	Basic	-	0.037	0.072
		-	(0.035)	(0.066)
		-	919	919
	Demographics	-	0.042	0.086
		-	(0.035)	(0.067)
		-	919	919
	Demographics and baseline scores	-	0.054	0.109*
		-	(0.034)	(0.066)
		-	919	919
Barron's "very competitive" college or above	Basic	-	0.002	0.004
		-	(0.024)	(0.046)
		-	919	919
	Demographics	-	0.002	0.007
		-	(0.024)	(0.047)
		-	919	919
	Demographics and baseline scores	-	0.008	0.016
		-	(0.023)	(0.047)
		-	919	919

Notes: My sample includes students who applied to attend a high school on HTH's Point Loma campus as of ninth grade between the spring of 2007 and 2010. I exclude from my sample returning students, repeat applicants, and applicants who are siblings of enrolled students. All regressions include dummies for interactions between lottery years, regional clusters, and FRPL status. Regression results listed as "Demographics" under the Controls column incorporate demographic controls including dummies for female, white, student of color, and other race/ethnicity. In columns (1) - (3), I report coefficients for my first stage, reduced form and 2SLS models from instrumenting whether an applicant enrolls at HTH as of ninth grade using a dummy for admission via lottery. Robust standard errors (clustered at the student level) are reported in parentheses. Cell sizes are listed below standard errors. *Significant at 10 percent; **significant at 5 percent; *** significant at 1 percent.

Table 6. Comparison of Immediate Postsecondary Enrollment

		Select subgroups				
	Overall	**Female**	**Male**	**White**	**Black**	**Hispanic**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Final sample (n=919)	0.711	0.763	0.659	0.751	0.735	0.676
Offered admission	0.688	0.766	0.613	0.746	0.747	0.627
Not offered admission	0.739	0.760	0.718	0.756	0.719	0.753
Graduates of SDUSD-managed high schools	0.627	NA	NA	NA	NA	NA
National statistics	0.700	0.740	0.660	0.710	0.700	0.590

Notes: In this table, I report immediate postsecondary enrollment rates for my final sample, those in my sample who are offered admission, those in my sample who are not offered admission, and students who graduate from SDUSD managed high schools. I also report college enrollment rates at the national level. While the national rate is not "immediate" in timing but rather based on a window of 12 months preceding the time in the reported year in which enrollment is measured, it serves as a sound basis of comparison. In column (1), I provide overall rates of immediate postsecondary enrollment. In columns (2) through (6), I provide immediate college enrollment rates of select subgroups.

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