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# Thirty Years of Charter Schools: What Does Lottery-Based Research Tell Us?

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## ABSTRACT

Charter schools can serve as “laboratories of innovation,” generating evidence about effective educational practices via their random admissions lotteries. This paper synthesizes findings from charter school lottery-based studies and identifies future research priorities. Evidence shows charter schools can boost academic achievement and long-term outcomes, especially for lower-performing, nonwhite, low-income students and those with disabilities. However, these findings are limited to over-subscribed schools in urban areas. Future research should expand geographic coverage, update K-12 academic outcomes, and explore non-test-score outcomes, college, and earnings. Addressing these areas would strengthen evidence and inform education policymaking in the charter sector and beyond.


## KEYWORDS

charter schools; natural experiments; school choice

## Introduction

Charter schools educate a growing number of students nationwide. First established in Minnesota in 1991, they now operate in 43 states and educate 3.7 million students, or 7% of the K-12 student population (NCES, 2021). In some urban areas, such as New Orleans, San Antonio, Washington, D.C., and Detroit, they enroll more than 40% of students (Xu, 2022). But the impact of charter schools extends beyond the students who attend them. As “laboratories of innovation,” they present the opportunity to try out new educational practices that traditional public schools could replicate. Additionally, because they often use lotteries to assign spots, charter schools provide a setting for rigorous research about effectiveness. Therefore, charter schools hold the potential to inform our understanding of what educational practices drive student success. To ensure that charter schools serve this purpose, it is important to study them rigorously, highlight key takeaways, and identify limitations of existing research. This paper summarizes the existing lottery-based evidence on the impacts of charter schools and outlines areas for future inquiry.

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Charter schools are independently run public schools. Like traditional public schools, charters are taxpayer-funded, cannot charge tuition or turn students away unless at capacity, and must adhere to traditional accountability standards such as administering and reporting the results of state standardized tests. However, they have more freedom to define curriculum, hire (and fire), and experiment with new programs and practices than traditional schools. Charter schools are also schools of choice. When they have more applicants than capacity, charter schools assign seats via lottery. In addition to allocating seats equitably among applicants, lotteries allow researchers to rigorously evaluate the impact of charter schools on student outcomes.

Lottery studies, which are naturally occurring experiments, are the most credible methodology available for determining the impacts of oversubscribed charter schools. A charter school lottery mimics an experiment by randomly assigning students to a charter school (treatment condition) or not (control condition). Randomly selecting which students receive a charter school offer ensures that lottery winners and lottery losers have the same expected outcomes *before* attending a charter school. Researchers can then compare outcomes of lottery winners with those of lottery losers, accounting for differences in attendance at charter schools, to estimate causal charter school effects. By contrast, non-lottery studies compare outcomes of students who *opt into* charter schools with those of students who do not. However, students who opt to attend charter schools may be different from students who opt to attend traditional public schools; differences in outcomes between these two groups may be the result of baseline differences in students who elect to enroll in either type of school, rather than of attendance at a charter school. Lottery studies offer the most trustworthy evidence about the causal impact of charter schools on student outcomes by ensuring comparisons are made between similar groups of students. However, lottery studies also have limitations, as they can only be conducted in charter schools with oversubscription and historical records. This may limit the external validity of such studies, especially if oversubscription is correlated with school performance. Additionally, lottery studies do not shed light on the “black box” of what goes on inside charter schools, since they generate impact estimates representative of participation in the charter school as a whole and cannot establish causality for particular charter school practices or characteristics.

This paper summarizes the existing evidence on the impacts of charter schools, using research that leverages charter school lotteries. We attempt to gather all lottery-based studies of charter schools that have been released since 2000, including peer-reviewed studies, white papers, policy reports, and working papers. As we describe below, the corpus of research shows that charter schools can have large positive effects on academic achievement, including among lower-performing students, low-income students, nonwhite students, English language learners, and students with disabilities. Several studies



Charter sector growth, the adoption of centralized school assignment mechanisms that streamline the lottery process, and the passage of time since charter schools were founded create new opportunities to address these limitations. Future lottery-based charter school research should expand the geographic scope; update evidence on K-12 academic outcomes in light of changes to the charter sector and public education system writ large since COVID-19 (Kane & Reardon, 2023); explore effective charter school practices and models; study non-test score outcomes; and examine long-term effects on college outcomes and earnings. More research on these topics would strengthen the evidence base for future education policymaking, both within the charter sector and beyond.

The remainder of the paper is organized as follows. [Section 2](#) provides background on charter schools, including common arguments for and against them. [Section 3](#) describes how charter school lotteries work and the methods underlying lottery-based studies. [Section 4](#) summarizes existing evidence on the impact of charter schools on academic achievement, behavior, health, and post-secondary outcomes, as well as differential effects for student subgroups. [Section 5](#) explains sources of variation in the charter school sector and what lottery-based studies can tell us about what works (and what doesn't). [Section 6](#) concludes.

## **Charter schools**

### ***Charter school features***

Charter schools are independently run public schools that are granted greater flexibility than traditional public schools in exchange for stricter accountability. For instance, charter schools have more autonomy over curriculum, textbooks, instructional methods, time in school, and class schedules than do traditional public schools. Teachers at charter schools are not subject to the same licensing requirements as at traditional public schools. Charter schools are exempt from school district collective bargaining agreements, though the staffs of individual charter schools may organize unions to negotiate with management. To maintain or renew their charters, charter schools must demonstrate performance in terms of student achievement, organizational stability, and financial viability.

Charter schools vary considerably (see Angrist et al., 2013; Dobbie & Fryer, 2013), but have some defining features that characterize their governance structures, accountability mechanisms, admissions procedures, and funding sources. Charter authorizers govern charter schools through contracts that set performance expectations and timelines, and are typically reviewed every five years. These performance standards are set by the school and the authorizer. If a charter school does not meet these expectations, the authorizer can revoke the charter and shut down the school (National Association of Charter School Authorizers, 2009). By contrast, traditional public schools are typically overseen by local school boards and

must adhere to state-wide laws and regulations that apply to all public schools within a given state. The teeth of this accountability feature can be seen in contrasting closure rates between charter and traditional public schools. Harris and Martinez-Pabon (2023) report an annual closure rate of 5% for charter schools compared to 0.9% for traditional public schools. They also find that closure for charter schools is more frequently due to poor academic performance than due to low enrollment (which would imply financial difficulties).

As schools of choice, charter schools cannot count on guaranteed enrollment based on residential boundaries.<sup>1</sup> Instead, they must find ways to attract applicants. Because they are public schools, charter schools cannot turn students away if they have space. Once they reach capacity, charter schools generally use lotteries to allocate seats among applicants. Local bargaining contracts with teachers typically do not apply to charter schools, which means they have greater flexibility to hire and fire. Like traditional public schools, charters are taxpayer-funded based on the number of enrolled students. They cannot charge tuition, but often supplement their budgets with grants and private donations.

### *Variation among charter schools*

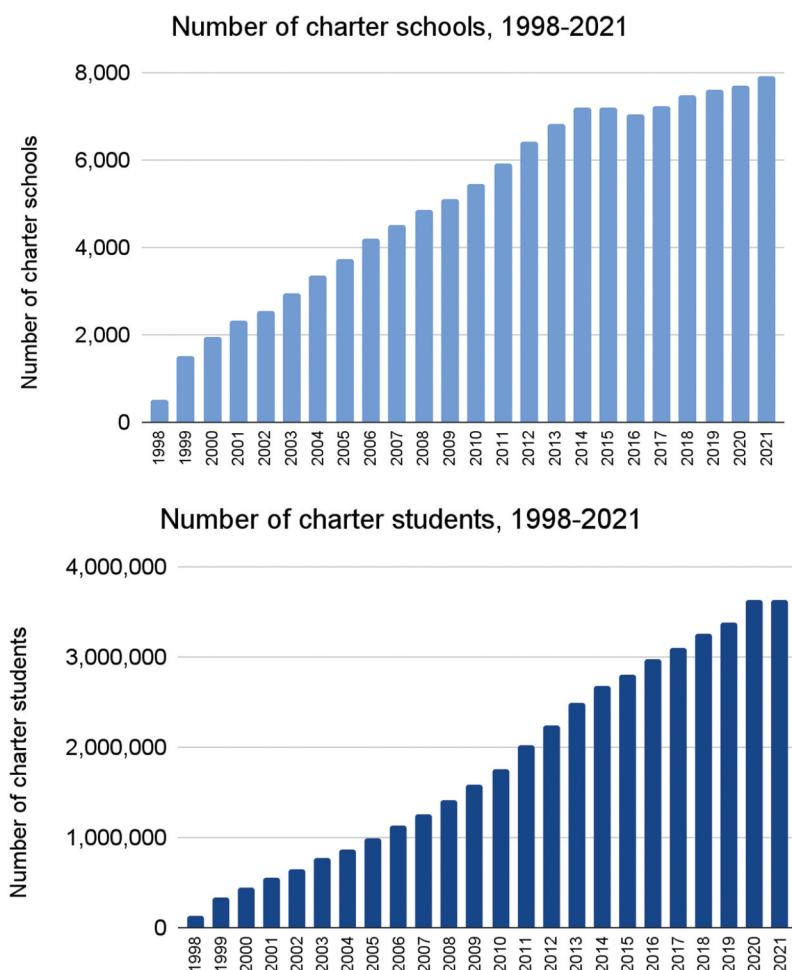
State laws account for some of the variation in charter schools. States decide which entities can authorize charter schools, such as state or local boards of education, universities, or other organizations including nonprofits foundations on community service organizations. Further, states may determine performance criteria, funding, and caps on the number of charter schools. Some states, such as Florida, Ohio, and Michigan, permit for-profit charter schools, while others do not.

Charter schools also vary in who operates them. Some are independently managed, while others belong to a charter management organization (CMO). CMOs are nonprofit groups of schools that share such features as core mission, curriculum, theme, policies, and practices. CMOs may operate in a specific region, like Success Academy schools in New York City, or nationally, as in the case of the Knowledge Is Power Program (KIPP). Roughly a quarter of charter schools belong to a CMO (White & Xu, 2022). The for-profit equivalents of CMOs are Education Management Organizations (EMOs). EMOs operate 9% of the nation's charter schools (White & Xu, 2022). The way charter schools deliver instruction varies, too. While most charters are brick-and-mortar schools, charters that operate primarily or entirely online serve 9% of charter school students (Common Core of Data, 2022).

Charter schools further vary by theme and model. Some charter schools emphasize themes such as civics, college preparation, or STEM. A charter school's model refers to its broader approach. One charter school in Denver, for example, specializes in "expeditionary learning," which focuses on "learning expeditions, case studies, projects, fieldwork, and service learning projects" in and outside of the classroom (Grigg & Borman, 2014). A common charter

approach that we will refer to throughout the paper is the “No Excuses” model. Such charter schools emphasize high academic expectations, strict disciplinary practices, and extended time in class (Golann & Torres, 2020). Many charter schools that previously identified as No Excuses schools now prefer to be described as “High Expectations, High Support,” though we will refer to No Excuses schools throughout this paper to align with the language used by the studies we summarize.

The charter school sector has grown considerably since it was first established in 1991. Figure 2 shows this growth in terms of schools and students. As of 2021, 7% of K-12 students attend charter schools, though many urban areas



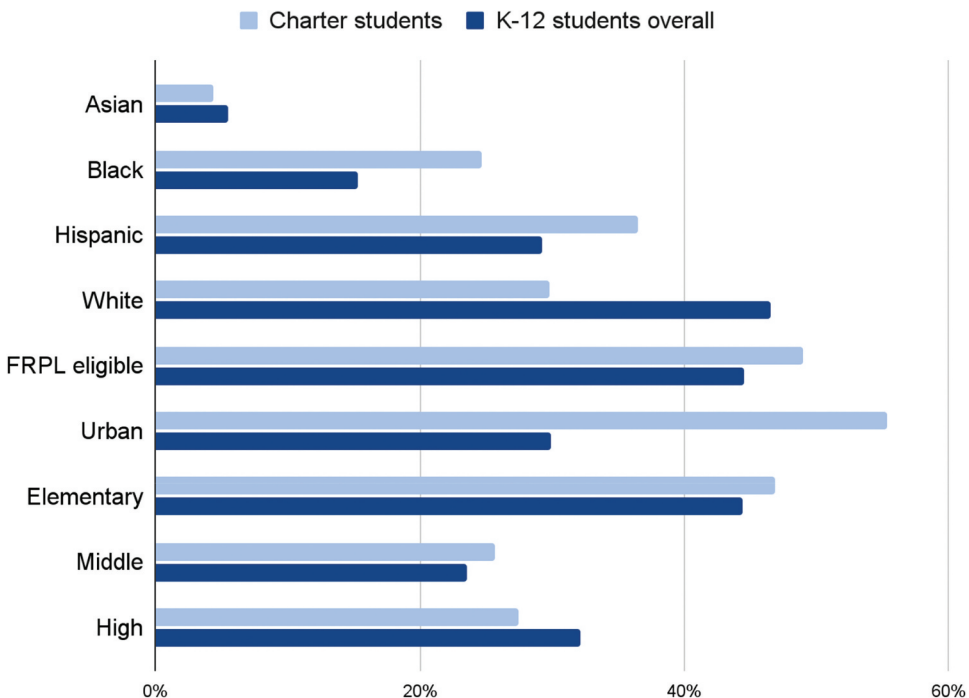
**Figure 2.** Charter schools and charter school enrollment over time. *Notes:* This figure shows the number of charter schools (top) and the number of students enrolled in charter schools (bottom) in the United States since 1998, when the indicator for charter schools first appeared in Public Elementary/Secondary School Universe Survey collected by the National Center for Education Statistics. Both the number of charter schools and enrollment in charters has increased steadily since the late 1990s.

have much higher charter enrollment (NCES, 2021). Charter schools are disproportionately located in urban areas, and they tend to serve a lower-income population and a higher proportion of nonwhite students than traditional public schools, as shown in Figure 3.

### **Potential benefits of charter schools**

Proponents highlight several potential benefits of charter schools. First, charter schools may offer families with poor-performing neighborhood schools alternative schooling options. Indeed, charter schools are disproportionately located in urban areas (Figure 3), which tend to have lower-performing traditional public schools. Charter schools may also simply provide *different* schooling options that families prefer. Because charter schools have more autonomy than traditional public schools, they may offer educational experiences unavailable elsewhere. For instance, some charter schools offer longer school days or specific curricula that families may like.

Another advantage of charter schools is their potential to serve as “laboratories of innovation” for the public education system writ large (Lubienski, 2003).



**Figure 3.** Characteristics of charter students relative to K-12 students. *Notes:* This table reports characteristics of charter school students and the K-12 public school student population overall in all 50 states and the District of Columbia based on the 2021–22 Public Elementary/Secondary School Universe Survey. Percentages reflect the portion of students in the specified population (charter school students or K-12 public school students) associated with the specified category.



Because charter schools are exempt from many of the laws that govern other public schools, they can experiment with curricula, textbooks, and instructional methods. In theory, traditional public schools could adopt and scale up practices that prove successful in the charter school setting. In practice, charter management organizations implement many of the same practices across multiple schools. It is an open question whether traditional public schools have benefited from innovations in the charter school setting. There is one experiment that demonstrates that charter school practices adopted in traditional public schools boosts student achievement (Fryer, 2014).

A third argument for charter schools is that competition among schools for students could drive improvement, both within the charter sector and beyond (Chubb & Moe, 1990; Friedman, 1955). This theory emphasizes the fact that charters face an incentive to outperform traditional public schools in order to attract and maintain enrollment. Traditional public schools face a similar incentive to improve in order to avoid losing students and associated funding to charters. Families can “vote with their feet” by opting to attend whichever school they prefer, creating competitive pressure that rewards continued improvement in both charter and traditional public schools.<sup>2</sup>

### ***Potential drawbacks of charter schools***

Common criticisms of charter schools include concerns that they stratify the public school system, drain resources from traditional public schools, over-emphasize tested subjects, and rely on a less-experienced workforce. Concerns that charter schools shape their student bodies and do not serve the full public come from several factors (Mommandi & Welner, 2021). Because students must opt into charter schools, less-informed families may be deterred by the administrative and procedural barriers to enrollment (Cohodes et al., 2022; Corcoran et al., 2018; Gross et al., 2015). The opt-in nature of charter schools can contribute to school segregation by race/ethnicity (Monarrez et al., 2022). Charter schools may themselves may seek out high-performing students who would reflect well on the school and make it easier to meet state standards. “Cream-skimming” high-performing students could concentrate the most disadvantaged and low-performing students in traditional public schools. Furthermore, some charter schools do not “backfill” spots in their schools after students leave, letting seats go empty if students leave the school or move out of the area. This means that those most committed to the school are the ones who are in the classroom the longest, a post-hoc selection issue. A few states restrict this practice (Cambell & Quirk, 2019; Hill & Maas, 2015), but we are not aware of a comprehensive data source to assess the extent to which charter schools backfill or not (Cambell & Quirk, 2019).

A second, related criticism is that charter schools drain regular public schools of financial and other resources (Ladd, 2022). As school systems typically allocate money based on enrollment, traditional schools may lose funding when students switch to charters (Epple et al., 2016). Some states, like Massachusetts, have laws that ensure that funding at traditional public schools does not drop in the short run with enrollment. However, this compensatory provision is phased out over time. Additionally, if charter enrollment increases, such guarantees may not continue. Funding shifts would be of particular concern if charters indeed “cream skim,” attracting “easier to educate” students while leaving traditional schools with a larger share of students who have more challenging and costly learning needs. Recent research shows that this financial concern may be less of a threat than previously thought, as Weber (2021) finds that larger charter shares do not diminish funding for traditional public schools on a per pupil basis, though district schools can still face unpredictability even if per pupil funding remains stable or increases.

Critics also fault charters for overemphasizing tested topics (Koretz, 2017). In many states, charter schools need to meet performance standards as measured by standardized tests in math and English language arts (ELA) as part of their contracts. Some argue that such standards induce charter schools to devote disproportionate classroom time to subjects that are tested or “teach to the test” at the expense of providing a well-rounded education. This is an empirical question that could be answered with additional research that examines the non-test score and long-term outcomes of charter school students. We discuss the limited research on this below, and these issues are considered in particular in Cohodes (2016).

Concern about the emphasis on rote learning and testing is paired with criticism of harsh disciplinary practices (Goodman, 2013). Urban charter schools often have higher suspension rates than their traditional counterparts (Angrist et al., 2013; Felix, 2020; Losen et al., 2016). No Excuses charter schools, in particular, rely on strict disciplinary practices, though some of these schools have been moving away from this label and its associated policies in recent years (Torres, 2022).

A final critique of charter schools relates to the teacher workforce. Because local bargaining contracts between teachers and school districts often do not apply to charter schools, teachers are less likely to be unionized, tend to be less experienced, report working longer hours, and have higher turnover rates than their counterparts in traditional schools (Barrett et al., 2022; Bruhn et al., 2022; Carruthers, 2012; Cowen & Winters, 2013; Stuit & Smith, 2010; National Center for Education Statistics, 2023).

Throughout the rest of this paper, we will discuss what lottery-based studies reveal about the benefits and critiques of the charter school sector. We will also

highlight areas that currently lack empirical evidence and suggest opportunities for future research.

## Why lottery studies?

### *The selection bias problem*

Parents, education practitioners, policymakers, and researchers want to know the causal impact that charter schools have on students. Yet, simple comparisons of outcomes between students who attend charter schools and those who do not may be misleading. This is due to “selection bias,” which occurs when the individuals who opt into a treatment are different from those who do not. Charter students are, on average, more likely to live in urban settings in lower-income households, be nonwhite, and have lower baseline achievement scores than is the case for the K-12 population overall (Figure 3). Even within a given city, the students who opt to attend charter schools may be different from those who enroll in their local public schools. Therefore, differing outcomes of charter school students and traditional public school students may be due to baseline differences in students, not the relative effectiveness of either type of school.

While researchers can account for observable differences in students (like baseline test scores or demographic characteristics) that drive selection bias statistically, they cannot account for unobservable differences. For example, administrative data does not measure the academic and emotional support students receive at home. Such unobservable characteristics may affect both whether students enroll in charter schools and their academic or other outcomes. Selection into treatment (e.g., charter schools) based on unobservable characteristics is a fundamental challenge in research.

In medical and natural sciences, selection bias is often solved by conducting randomized controlled trials (RCTs). RCTs randomly assign participants in a study to either a treatment condition or a control condition. Random assignment ensures that, all else equal, we would expect the outcomes for the two groups to be the same. We can therefore attribute any differences in ultimate outcomes to the treatment itself. In the social sciences, randomly assigning a treatment or control condition is often not possible for ethical or feasibility reasons. As a result, reliably estimating the *causal* impact of policies or programs (“treatments”) can be a challenge.

The use of lotteries in the charter school sector creates a “natural experiment,” mimicking the random assignment used in RCTs and empowering researchers to rigorously evaluate the causal impact of charter schools on student outcomes. We expect winners and losers of charter school lotteries to be the same, on average, in terms of observable and unobservable characteristics at baseline because of the random nature of the lottery. Therefore,

any differences in outcomes between these groups later on must be the result of differences in enrollment rates in charter schools between lottery winners and losers.

### ***Lotteries in practice***

Charter schools use lotteries to allocate available seats when they are “over-subscribed,” i.e., when more students apply than there are spots available.<sup>3</sup> If a student loses the lottery and does not receive a charter school offer, she may be placed on a waitlist to receive an offer later if a seat becomes available. Because families can apply to multiple schools, it is common for seats to open up. Many charter schools run their own lotteries, though some districts have centralized assignment systems or common applications. Such systems allow families to submit a single list of rank-ordered school preferences to a central office instead of applying to individual schools, increasing efficiency and fairness. School seats are allocated in a manner that reflects student preferences and school priorities (e.g., keeping siblings in the same school) using an algorithm (e.g., the deferred acceptance algorithm).

### ***Estimating causal charter effects***

Researchers leverage charter lotteries to estimate the causal impact of charter attendance by comparing the outcomes of students who received an offer to enroll in a charter school with those who did not. Not all students who receive an offer eventually enroll in a charter school, so researchers adjust the winner vs. loser comparison to account for such situations. The most common method to do this comparison and adjustment uses an instrumental variables framework known as two-stage least squares (2SLS).

2SLS addresses selection bias in who enrolls in charter schools by using the random assignment of the charter offer to predict the likelihood of eventually enrolling in a charter school. The “first-stage” estimates how receiving a charter offer changes the likelihood that a student will enroll in a charter school. This is the difference in charter attendance rates between the students who are offered a seat during the lottery and those who are not. The “second-stage” estimates the effect of charter school attendance, as predicted by the first-stage, on a student-level outcome. The estimates from a 2SLS model represent the causal effect of attendance at a charter school on a given student-level outcome for “compliers” – students who would enroll in a charter school if they get an offer and would not enroll in a charter school if they do not. The 2SLS estimate is also known as the local average treatment effect (LATE), or the effect for students who were induced to attend charter schools due to receiving a lottery offer (Angrist et al., 1996).

The first-stage model is:

$$D_i = \gamma + \pi Z_i + \mu_i$$

where  $D_i$  indicates whether a student enrolls in the charter school, and  $Z_i$  indicates whether a student received a lottery offer.  $Z_i$  is known as an instrumental variable. The coefficient  $\pi$  measures the effect of winning the lottery on charter attendance.<sup>4</sup> The second-stage is:

$$Y_i = \phi + \rho \hat{D}_i + \epsilon_i$$

where the effect of interest,  $\rho$ , measures the impact of charter school attendance on a student-level outcome,  $Y_i$ , for compliers. To generate a causal estimate, the outcome,  $Y_i$ , must be present at similar rates for those offered a seat in the lottery and those not offered a seat in the lottery, that is, a lack of differential attrition. However, researchers have some methods to address differential attrition should it exist.

Here,  $\hat{D}_i$  is the predicted enrollment in a charter school from the first-stage. In addition to the 2SLS estimate, researchers sometimes estimate a “reduced-form” or intent-to-treat (ITT) effect. The ITT is the causal effect of an *offer* to a charter school on a given student outcome. This estimate is an average treatment effect for all applicants and is not restricted to compliers in the same way the LATE is. The ITT model takes the following form:

$$Y_i = \alpha + \beta Z_i + v_i$$

The 2SLS and ITT estimators are closely related: The 2SLS is the reduced-form effect scaled by the first-stage estimate of how a lottery offer changes the charter attendance rate, on average. Some researchers prefer the ITT because it reveals a policy-relevant treatment effect of an *offer* of charter school admission. The LATE, on the other hand, describes the average causal effect for students who actually *attend* charter schools. The relationship between the 2SLS and reduced-form is:

$$2SLS(LATE) = \frac{ReducedForm(ITT)}{FirstStage}$$

When there is perfect compliance – meaning that every student who received an offer of admission to a charter school enrolls – and no non-offered student enrolls, the 2SLS and reduced form coincide. In practice, this is rarely the case.

The simple models described above are often augmented to account for applications to multiple schools with the inclusion of risk sets (lottery fixed effects); to increase precision with the inclusion of covariates; and to estimate effects for multiple types of charter schools. Econometric methods that leverage lotteries have improved as a growing number of school districts use centralized assignment systems. Such systems generate many natural

experiments that can illuminate the causal effects of attendance at any of the schools in the centralized system at once.

A common way to estimate 2SLS in a setting with centralized school assignment is to include risk set fixed effects in the estimation strategy. Risk sets are defined as groups of students who applied to the exact same set of schools and ranked them in the same order. Within each risk set, students face the same likelihood of receiving a lottery offer. Therefore, including risk set fixed effects compares outcomes between students who applied to the same schools and faced the same likelihood of receiving a lottery offer. This approach allows lottery estimates to be generated for a group of charter schools that have varying numbers of applications and seats (and therefore a differential likelihood of an offer) at the same time.

Abdulkadiroğlu et al. (2017) develop empirical methods that extend this study design to fully exploit the random assignment embedded in centralized assignment mechanisms. Specifically, they show that conditioning on the probability of random assignment to treatment (“propensity score”) for participating students recovers a more representative average causal effect with more efficiency than the risk set fixed effects approach. For a more detailed explanation of lottery methods, see Angrist et al. (2023).

### ***Limitations of lottery studies***

By removing selection bias, lottery-based estimates of charter school effectiveness attain strong *internal validity*. That is, they convincingly identify the true causal impact of charter schools within the setting being studied. Still, such studies have their limitations. First and foremost, lottery studies can only evaluate oversubscribed schools. This limits their *external validity*, i.e., the extent to which their findings can be generalized to other settings. Even within a single district, oversubscribed charters may not be representative of all charter schools in the area. Oversubscription rates in the charter sector are not well documented. However, one data point from the 2006–07 school year suggested that only 26% of charter middle schools had more applicants than available seats (Clark Tuttle et al., 2012). The schools that have the most demand – oversubscribed charters – may also be those that families consider to be the highest quality. Outcomes at these oversubscribed schools, therefore, may not be indicative of those at nearby undersubscribed schools. This has been shown empirically in two studies (Abdulkadiroğlu et al., 2011; Ackerman & Egalite, 2017) which both show that undersubscribed schools also underperform oversubscribed schools.

More broadly, lottery estimates offer credible localized results but do not necessarily capture national trends. To the extent that oversubscribed charter schools are not evenly distributed across the country, lottery-based estimates may not reflect the charter sector as a whole. Another impediment to

generalizing from existing studies relates to the selection bias phenomenon described earlier. The students who opt to apply to charter schools may be different from students in the rest of the district. Therefore, if non-charter students were to switch to charter schools, they would not necessarily achieve the same outcomes as estimated in lottery-based studies.

Lottery studies are further limited in the way that treatment can be defined. Because students receive an offer (or not) to a school, treatment is defined by all the features that comprise a given school. For instance, No Excuses charter schools are characterized by longer school days, longer school years, high expectations for student performance, strict disciplinary practices, and contracts between families and the school. While many studies estimate the overall causal effect of No Excuses charter schools, lottery-based studies cannot causally identify which specific aspects of the No Excuses model drive the observed impact. At best, lottery studies can offer correlational evidence about features of schools that tend to have the largest causal effects, as some existing studies do (Angrist et al., 2013; Dobbie & Fryer, 2013).

Finally, on the logistical side, the validity of lottery studies depends on accurate and comprehensive record-keeping. For some of the first lottery studies, researchers had to match lottery records by hand with administrative records of students. Without clear records, identifying treatment and control students could be a challenge. Further, if not all schools are equally meticulous in their record-keeping, the results may be particular to charter schools that have better records. As schools and districts increasingly use digital platforms to run their lotteries and maintain records, these quality issues are subsiding. Still, changing technology platforms used for admissions and staff turnover can result in the loss of records that are necessary to leverage lotteries and implement methods to recover credible causal estimates. Students who leave the public school system entirely present a different type of validity challenge, leading to attrition from the study sample and outcomes that are unobserved altogether.

Alternative econometric methods that draw on observational administrative data can complement lottery studies. Many studies estimate charter school impacts using quasi-experimental methods. Regression, matching, and difference-in-differences techniques can shed light on some of the questions that lottery-based studies cannot, but such methods may not fully eliminate selection bias as described above. In this paper, we chose to focus on lottery-based studies because we believe they offer the most credible causal estimates of the impact of charter schools. For an overview of quasi-experimental studies of charter school effectiveness, see Cohodes and Parham (2021).



## What do lottery studies tell us?

### *Papers included in this review*

We aimed to identify all studies that met our inclusion criteria, which we defined as studies that: (i) estimate the impact of charter school programs on academic, behavioral, health, civic, or labor market outcomes; (ii) use lottery methods or other forms of random assignment; (iii) are published in peer-reviewed journals, working papers, government publications, or independently published white papers after 2000 and until Fall 2023; and (iv) are located in the United States and enroll students in grades K-12. We began by compiling a list of papers from the references of the most recently published review of rigorous studies of charter school effectiveness (Cohodes & Parham, 2021). We identified all the papers cited in Cohodes and Parham (2021) that fit our inclusion criteria or were themselves review papers. We combed the bibliographies of the papers in this list to find additional papers that fit the inclusion criteria. We also searched for forward citations of the review papers we identified. Separately, we conducted a search of databases of peer-reviewed journal articles, dissertations, research reports, and working papers. Our sources included Harvard's library (Hollis), MIT's online libraries, the National Bureau of Economic Research (NBER), and the National Education Working Paper Series (EdWorkingPapers) compiled by the Annenberg Institute. We used combinations of four search terms: (i) charter school, (ii) lottery, (iii) random assignment, and (iv) school choice.

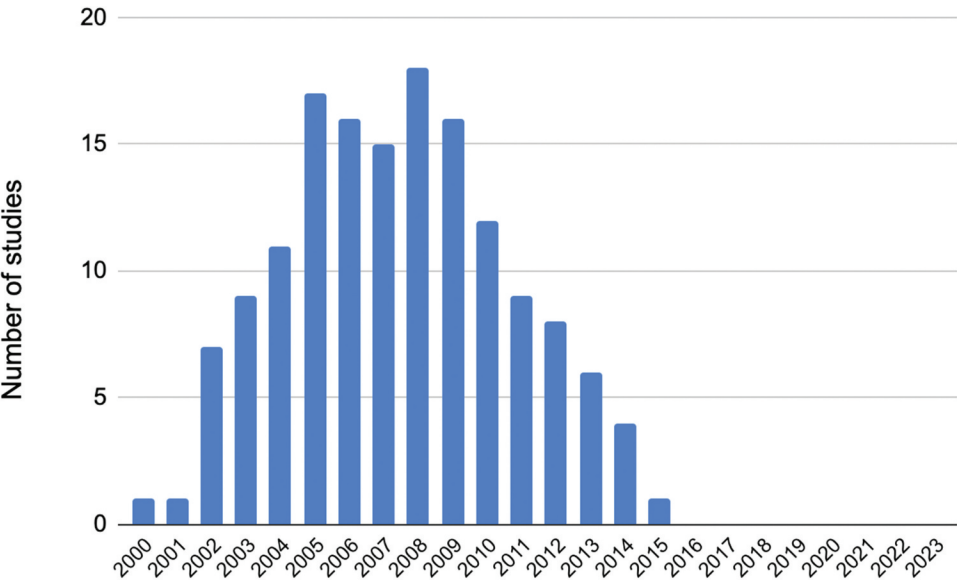
We identified 40 lottery-based studies of charter schools. Some of these papers have been released as both draft working papers and peer-reviewed journal articles. In cases when the analysis or sample differed substantively, we included both versions. Otherwise, we included the peer-reviewed, published version of the study. We also reviewed meta-analyses and systematic reviews of the literature on charter school impacts. Table 2 summarizes the studies by the outcome that they report. Thirty-one studies analyze standardized test scores, 12 analyze other K-12 outcomes, and 10 analyze post-secondary outcomes. While lottery studies of charter schools have been done in many settings, they are more likely to take place in urban areas in a few states, use lottery data from 2015 and before, and focus on middle and high schools. These factors should be kept in mind before making generalizations based on the results summarized in this paper.

Although charter schools operate in 43 states, lottery studies included in this paper report findings for only 14 states that we could identify.<sup>5</sup> Figure 1 depicts the uneven geographic distribution of charter schools and charter lottery studies. Table 1 shows the number of studies that use lottery data from each state.<sup>6</sup> Most lottery-based studies use data from Massachusetts (19 studies) and New York (nine studies). Within these states, studies often take place in large urban centers like Boston and New York City. For instance, 12 of



the Massachusetts studies use data from Boston’s charter schools. Charter schools in much of the country, particularly in suburban and rural areas, have not received as much scrutiny. This gap in the research is significant given the large variability in charter school laws across states, as well as in programs and practices of different types of charter schools.

Evidence on charter school effectiveness for the past 5 to 10 years is not well-documented by lottery methods. [Figure 4](#) shows the number of studies that use lottery data from each year between 2000 and 2023. The evaluations use lottery data from between 2000 and 2015, with no studies using lottery data from 2016 and onwards. Outcome data for these studies could (and often does) come from later years. Estimating charter school impacts on long-term outcomes like enrollment in and persistence through college necessitates data from earlier years: Students finishing college this year, in 2023, would have participated in a middle school charter lottery in 2012 (or earlier, if they did not go straight through high school and college). However, researchers could use more recent lottery data to estimate impacts on K-12 academic, behavioral, and health outcomes.



**Figure 4.** Number of studies using lottery data from each year, 2000–2023. *Notes:* This figure shows a histogram of the years of lottery data used in each study included in this review. Years of treatment typically overlap or immediately follow lottery data years (e.g., if lottery data from 2005 was used for a study of middle schools, treatment years might be 2005–2008). Outcome data years may vary depending on the outcome. For instance, outcome data for studies that focus on math/ELA scores overlap or come soon after lottery data, whereas studies that focus on longer term outcomes like college enrollment experience a lag between when the lottery data was generated and when the outcome data became available.

**Table 1.** Location of lottery-based charter studies.

State	# of studies
Massachusetts	19
New York	10
Washington, DC	5
California	6
Georgia	4
Texas	4
Colorado	3
Illinois	3
Louisiana	1
Maryland	1
Michigan	1
New Jersey	1
North Carolina	1
Pennsylvania	1

*Notes:* This table shows the number of studies reviewed in this paper, by state. Studies do not need to include all charter schools in a state to be listed here. Some studies use data from multiple states so the number of studies column sums to more than the total number of lottery-based studies included in this review (40). Some studies, including several of the studies in Massachusetts, use data from the same years and same schools. Two studies report taking place in multiple states, but do not specify which states the data came from. These are therefore excluded from the state count reported in this table.

**Table 2.** Outcomes analyzed in lottery-based charter studies.

Outcome	# studies	Notes on outcome
<i>Outcomes observed during K-12</i>		
Math/ELA test scores	31	Standardized test scores, state tests
Other K-12 academic	12	Graduation, grade-level, SAT, AP test taking/scores, merit scholarship eligibility
Behavior	9	Absences, effort, suspensions, risky behaviors like drinking, drugs, pregnancy
Health	4	Student well-being, attitudes, mental health, physical health
<i>Outcomes observed post-K-12 education</i>		
Post-secondary	10	Enrollment, 2-year vs. 4-year, persistence, quality of post-secondary institution
Civic	2	Voter registration, voting
Labor market	0	Employment, wages

*Notes:* This table shows the number of studies that analyze outcomes that fit into seven broad categories. Individual studies may include outcomes in multiple different outcome categories, so the total number of studies adds up to more than the total number of lottery-based studies included in this review (40).

Charter lottery studies disproportionately evaluate middle schools. Overall, 11 studies evaluate elementary schools, 32 evaluate middle schools, and 19 evaluate high schools (see Supplementary table S1). This sampling does not reflect the actual composition of charter schools. Charter elementary school students outnumber charter middle and high school students, as shown in [Figure 3](#). Some studies evaluate the combined impacts of elementary and middle schools or middle and high schools, and in a few cases, K-12 schools. Some charter lottery studies focus on a specific model like No Excuses schools (26 studies) or a charter management organization like KIPP (18 studies examine CMO charter schools, eight have a focus on KIPP specifically; see Supplementary table S2). These studies can shed light onto what practices may

contribute to the causal impacts of charter schools but cannot offer definitive evidence about whether the model or CMO affiliation in itself drives results.

Finally, the studies included in this paper vary in their sample sizes. In some cases, researchers focus on a single charter school, while others analyze entire charter systems or use data from entire states. For instance, three of the nine studies that took place in New York City estimate the impact of specific schools: Promise Academy in the Harlem Children's Zone (Dobbie & Fryer, 2011, 2015) and Democracy Prep (Gill et al., 2020). To put this figure in perspective, New York City is home to more than 250 charter schools (New York State Education Department, 2023).

### ***Charter school impacts on test scores in math and ELA***

Lottery-based studies tend to find that, on average, charter schools have a large positive impact on standardized test scores in both math and ELA, with larger effects in math (Abdulkadiroğlu et al., 2017; Angrist et al., 2016, 2023; Cohodes et al., 2021; Hoxby et al., 2009; Reber et al., 2023). Table 3 summarizes the results of the 31 studies that estimate the impact of charter schools on standardized test scores. The “main” impact estimate from each paper is in Supplementary Table S3. Most lottery studies report impacts on math and ELA because these scores are readily available in administrative data for both traditional and charter school students and are predictive of longer-term outcomes (Chetty et al., 2014; Goldhaber & Özek, 2019).

Large, positive effects of charter schools on math and ELA achievement often come from studies of urban, No Excuses charter schools. For example, an early study of Boston's charter schools found score gains of 0.42 standard deviations (SD) in math and 0.25 SD in English per year at the middle school level and slightly smaller but similar results at the high school level (Abdulkadiroğlu et al., 2011). These effect sizes are typical of other estimates from Boston's charter schools (Angrist et al., 2011, 2013; Cohodes et al., 2013). No Excuses charter schools in New York City, Newark, Chicago, and Los Angeles also deliver achievement gains relative to non-charter schools (Angrist et al., 2023; Dobbie & Fryer, 2013; Reber et al., 2023; Unterman, 2017; Winters, 2020).

Several exceptions emerged to the broadly positive findings about the impacts of charter schools on standardized test scores. Two national studies find that charter schools have a negligible or negative impact on student test scores (Clark et al., 2015; Gleason et al., 2010). However, these top-line results varied considerably across schools and students. Two studies that have more restricted geographic samples report null impacts of charter schools on test scores (Grigg & Borman, 2014; Ridley & Terrier, 2018). Grigg and Borman (2014) is a small study of two schools, while Ridley and Terrier (2018), which uses data from across Massachusetts, notes heterogeneity across student

**Table 3.** Lottery-based impacts of charter schools on math and ELA scores.

Paper	Location	Math	ELA	Notes/exceptions
Hoxby & Rockoff (2005)	Chicago, IL	↑	↑	
Abdulkadiroglu et al. (2009)	Boston, MA	↑	↑	
Hoxby et al. (2009)	New York, NY	↑	↑	
Angrist et al. (2010)	Lynn, MA	↑	↑	
Gleason et al. (2010)	15 states	↓	↓	Null results mask heterogeneity
Abdulkadiroglu et al. (2011)	Boston, MA	↑	↑	
Angrist et al. (2011)	Massachusetts	↑	↑	MS ELA effect is null
Dobbie & Fryer (2011)	New York, NY	↑	↑	
Angrist et al. (2012)	Lynn, MA	↑	↑	
Angrist et al. (2013)	Boston, MA	↑	↑	Negative effects in non-urban schools
Clark Tuttle et al. (2013)	6 states	↑	↑	
Cohodes et al. (2013)	Boston, MA	↑	↑	
Dobbie & Fryer (2013)	New York, NY	↑	↑	HS ELA effect is null
Curto & Fryer (2014)	Washington, D.C.	↑	↑	
Grigg & Borman (2014)	Denver, CO	↓	↓	
Clark et al. (2015)	13 states	↓	↓	Heterogeneity across schools/students
Cohodes (2016)	Boston, MA	↑	↑	
Abdulkadiroglu et al. (2016)	2 states: LA, MA	↑	↑	
Abdulkadiroglu et al. (2017)	Denver, CO	↑	↑	
Unterman (2017)	New York, NY	↑	↑	
Dynarski et al. (2018)	Michigan	↑	↑	
Frandsen & Lefgren (2018)	Lynn, MA	↑		
Ridley & Terrier (2018)	Massachusetts	—	—	Urban: ↑; Suburban: math ↓, ELA null
Walters (2018)	Boston, MA	↑	↑	
Winters (2020)	Newark, NJ	↑	↑	
Cohodes et al. (2021)	Boston, MA	↑	↑	
Setren (2021)	Boston, MA	↑	↑	
Cohodes & Feigenbaum (2023)	Boston, MA	↑	↑	
Grissmer et al. (2023)	Colorado	↑	↑	
Angrist, Pathak, & Zarate (2023)	Chicago, IL	↑	↑	
Reber et al. (2023)	Los Angeles, CA	↑	↑	

*Notes:* This table displays direction and significance of the main effects in the 31 lottery-based studies that estimate impacts on math and ELA. Results shaded in green are significant at  $p < .05$ . Not statistically significant results are denoted with an uncolored arrow. Dashes indicate that aggregate results were not reported. In many cases, studies do heterogeneity analyses that show different results for different groups. The results summarized here only pertain to the main results of each paper. Notes on heterogeneity are included in the last column.

<b>Legend</b>			
↑	Positive effect, statistically significant	↓	Negative effect, not statistically significant
↑	Positive effect, not statistically significant	↓	Negative effect, statistically significant

populations, similar to the national studies. Three factors could explain the varying results: different students, different counterfactuals, and different school practices.

Charter schools in suburban or rural areas are more likely to have no impact or a negative impact on student achievement than are urban charters (Angrist et al., 2011, 2013; Clark et al., 2015; Gleason et al., 2010; Grissmer et al., 2023). In a large nationwide lottery-based evaluation of charter schools, researchers estimate the impact of 33 charter middle schools in 13 states and find slightly negative but insignificant effects on student achievement (Clark et al., 2015).

This is one of a few studies where a significant portion of the school sample (22 schools, or 67%) came from non-urban charter schools. The sample also differed from that of other charter school studies and charter schools nationally: Students were more likely to be white and less likely to receive free or reduced-price lunch (FRPL), and they had higher baseline achievement scores. While its student and school sample is less representative of the charter school sector overall, the study offers an important insight: Results from urban charters do not necessarily generalize to other settings. Within the study population, results varied considerably across schools and students, with positive impacts for schools in urban areas and those serving more disadvantaged populations and smaller or negative impacts for schools in non-urban areas and serving more advantaged student populations (Clark et al., 2015). But this, too, is not always the case: A for-profit charter school network in Michigan benefited non-poor students outside urban areas more than it did low-income students in urban areas (Dynarski et al., 2018). This finding stands in contrast to most other lottery-based charter school research.

Charter schools in Massachusetts follow a similar pattern to the national study described above. Urban charters in Massachusetts produce large, statistically significant impacts on math and ELA achievement, while charter schools in suburban areas negatively affect student achievement (Angrist et al., 2013; Ridley & Terrier, 2018). Angrist et al. (2013) try to disentangle whether this is the case because urban charter schools themselves are particularly effective, or whether the students who attend urban charter schools are more susceptible to experiencing gains from attending any charter school (urban or not). Indeed, the student populations served by schools in these settings differ: Students in non-urban charter schools have higher baseline scores, on average, than students in urban charter schools (Angrist et al., 2013). The authors find that while the particular population served by urban charters partly explains the large gains seen in urban charter schools, the urban schools are more effective at educating low-income, nonwhite students and students with low baseline test scores than non-urban charters. In other words, the difference in student populations served by urban and non-urban charters does not fully account for the overall difference in effectiveness of these schools (Angrist et al., 2013).

The quality of non-charter school options in urban and non-urban settings could explain, in part, the larger effect sizes of urban charters relative to non-urban charters. For instance, the non-charter options in urban settings may be weaker than those available to suburban students. In Chicago, estimated treatment effects depend on where students would be expected to attend if they did not get an offer at a top-choice school (Angrist et al., 2023). In this setting, exam schools (not charter schools), which are widely considered to be high-performing schools, appear to *negatively* impact student achievement. This negative effect of the exam schools is driven by students who would

otherwise attend high-performing charter schools in Chicago. These findings show that the *counterfactual* school can play an important role in the estimated treatment effect of a charter school. This point applies more generally to other studies: Charter schools have the largest impact on students whose alternative school options are low-performing (Chabrier et al., 2016).

In some charter lottery studies, the counterfactual is not clear or may be other charter schools. For instance, SEED charter school, a No Excuses boarding school in Washington, D.C., positively affects student achievement (Curto & Fryer, 2014). However, students who do not receive an offer at SEED may end up attending a different charter school in the Washington area. Similarly, Promise Academy charter schools in the Harlem Children's Zone (HCZ) in New York City positively affect math and ELA scores at the elementary school level and math scores at the middle school level (Dobbie & Fryer, 2011). However, the counterfactual schools for the elementary student sample include other charter schools in New York. Therefore, the effects at the elementary level are specific to Promise Academy relative to other charter schools *and* traditional public schools, not to traditional public schools only.

The positive and significant gains of charter students in math and ELA are encouraging given that educational interventions at the high school level may be considered “too late” to be effective. Even more notably, charter schools can significantly improve achievement for students with lower baseline achievement (Walters, 2018). Furthermore, where we have evidence over time, charter schools show sustained positive effects even as the sector has expanded, suggesting that these results may not be driven only by differences in unobservable characteristics of early adopters (Cohodes et al., 2013, 2021).

### **Other academic outcomes**

Studies have shown charter schools to improve academic outcomes in areas beyond math and ELA scores, including higher performance on science exams and high school exit exams (which often involve subjects other than math and ELA); increased participation in college-prep courses and improvements on associated exams (including AP and SAT); and enhanced chances for merit aid (Angrist et al., 2016, 2023; Cohodes & Feigenbaum, 2023; Dobbie & Fryer, 2015, 2011; Dynarski et al., 2018; Grissmer et al., 2023; Setren, 2021). These results are limited to a few studies primarily in urban areas where there is also evidence of test score gains in math and ELA. One exception to these positive results comes from Los Angeles, where recent evidence shows that No Excuses charter high schools have no effect on AP course-taking or high school GPA, but do increase the likelihood of students taking a calculus class (Reber et al., 2023). Table 4 summarizes results from studies of academic outcomes other than math and ELA scores. We thus conclude that urban charter schools boost

**Table 4.** Lottery-based impacts of charter schools on other K-12 academic outcomes.

Paper	Location	Science	Take SAT	SAT score	ACT score	Take AP	AP score	# AP exams	GPA	Grade progression	Exit exam	On-time graduation
Dobbie & Fryer (2011)	New York, NY									↓		
Dobbie & Fryer (2015)	New York, NY											↑
Cohodes (2016)	Boston, MA	↑										
Angrist et al. (2016)	Boston, MA		↑	↑		↑	↑	↑	↓	↓	↑	↓
Dynarski (2018)	Michigan									—		
Setren (2021)	Boston, MA		↑	↑		↑	↑	↑				
Cohodes & Feigenbaum (2023)	Boston, MA		↑	↑		↑	↑	↑	↓	↓		↓
Grissmer et al. (2023)	Denver, CO	↑										
Angrist, Pathak, & Zarate (2023)	Chicago, IL				↑							↓
Clark Tuttle et al. (2013)	6 states	↑										↑
Reber et al. (2023)	Los Angeles, CA					↑			↑			

*Notes:* This table shows the direction and significance of lottery-based impacts of charter schools on academic outcomes other than math and ELA scores. Blank areas indicate that a study did not report on the given outcome. Results shaded in green are significant at  $p < .05$ . Not statistically significant results are denoted with an uncolored arrow. Dashes reflect that results are reported as “null”, and coefficients were not reported in the paper.

**Legend**

↑	Positive effect, statistically significant
↑	Positive effect, not statistically significant
↓	Negative effect, not statistically significant
↓	Negative effect, statistically significant

academic outcomes beyond those emphasized in test-based accountability systems.

Some initial evidence from Boston addresses this concern directly, suggesting that charter schools do not “teach to the test” to a greater extent than their traditional public school counterparts (Cohodes, 2016). To explore this topic, Cohodes (2016) leverages variation in how often certain topics appear on standardized exams to see whether charter school students perform disproportionately well in areas that are tested most often. In Boston’s charter schools, charter students perform better than students at traditional public schools across *all* subscales of math and ELA, including those that are tested less frequently, and in lower-stakes subjects like science (Cohodes, 2016). If charter schools strategically allocated time to focus on often-tested subjects, we may instead expect that students in these schools would perform better on these topics and less well on topics that are rarely tested. The author argues that because charter students perform similarly on all subscales, charter schools must not be teaching to the test to a greater extent than their counterparts in traditional public schools. Still, the analysis does not rule out the possibility that charter schools allocate time away from non-tested subjects or that charter schools in other settings participate in test preparation.

Evidence on the effects of charter schools on on-time grade progression and graduation is mixed. In Los Angeles, charter high schools have a small, statistically insignificant positive effect on the likelihood of receiving a high school diploma (Reber et al., 2023). Charter students in Boston graduate from high school within four years *less* often than their public school counterparts, with no differences after five years (Angrist et al., 2016; Cohodes & Feigenbaum, 2023; Setren, 2021). Charter students in the Harlem Children’s



Zone, on the other hand, graduate on time *more* often than other students (Dobbie & Fryer, 2015). In this case, charter and traditional public school students have similar graduation rates after six years.

### **Behavior and health**

The lottery-based evidence on student behavior and health outcomes is sparse. There is no strong consensus across studies and study contexts regarding the impacts of charter schools on in-school disciplinary records, risky behaviors (e.g., alcohol and drug use), and criminal activity. Four studies estimate the impact of charter schools on suspensions or disciplinary incidents but with mixed results (Angrist et al., 2013; Dynarski et al., 2018; Felix, 2020; Gleason et al., 2010). Students who attend urban, No Excuses charter schools in Massachusetts are more likely to be suspended than their counterparts in traditional public schools (Angrist et al., 2013; Felix, 2020). This effect was larger before Massachusetts passed Chapter 222, which made suspending students in all schools more difficult. After the law passed, charter schools continued to suspend students to a greater degree, but the rate was no longer statistically higher than that of non-charters (Felix, 2020).

Two other studies find no impact of charter schools on disciplinary outcomes (Dynarski et al., 2018; Gleason et al., 2010). A for-profit charter school network operating in Michigan that shares many of the same practices as No Excuses charter schools, including a focus on test-based assessment of core academic subjects and requiring students and parents to sign a behavior contract, does not impose disciplinary actions against students at a higher rate than its non-charter counterparts (Dynarski et al., 2018). Charter middle schools in 15 states similarly do not affect student suspensions (Gleason et al., 2010).

Measures like suspensions provide an incomplete picture of behavioral outcomes. Based on administrative data alone, it is unclear if they reflect actual differences in student behavior or differing disciplinary practices in charter schools. Many charter schools, particularly No Excuses charters, used to rely on strict disciplinary practices (Golann & Torres, 2020). KIPP schools, for example, focus on behavior and discipline as part of their “high expectations” pillar for success. Given stricter disciplinary practices, charter schools may impose harsher penalties than regular public schools for the same behaviors.

Charter students in middle schools in six states report getting into trouble *more* and are more likely to participate in “undesirable behaviors” than their traditional school counterparts, according to self-reported survey results (Clark Tuttle et al., 2013). On the other hand, high school students at No Excuses charter schools in Los Angeles report getting into trouble and getting suspended at similar rates to their public school counterparts (Reber et al.,



2023). Such findings could capture either an actual difference in behavior or a difference in student perceptions of “good behavior” and “bad behavior.”

Five lottery studies report on other aspects of student behavior, including student effort, tardiness, and absences, with mixed and inconclusive results. No Excuses charter high schools in Los Angeles and KIPP charter middle schools in six states do not affect student effort (Clark Tuttle et al., 2013; Reber et al., 2023). A broader sample of charters in 15 states similarly found no effect of charter schools on student effort (Gleason et al., 2010). Charter impacts on student absences are mixed: Promise Academy in Harlem Children’s Zone (HCZ) in New York reduces student absences relative to students in other schools (Dobbie & Fryer, 2011), while for-profit charter schools in Michigan have no effect on absences (Dynarski et al., 2018). No Excuses charter high schools in Los Angeles causally reduce the likelihood of students skipping class (Reber et al., 2023).

Four studies report on student health, which we broadly define to include student well-being and attitudes as well as physical and mental health in this paper (Table 2). Research on student well-being and attitudes has yielded mixed results. A national study found that charter students were more well-adjusted than non-charter students according to their parents (Gleason et al., 2010). In a study of KIPP schools in six states, charter schools had no impact on student attitudes toward school according to self-reported survey results (Clark Tuttle et al., 2013).

Finally, two papers study the impact of charter schools on risky behaviors such as alcohol, tobacco, and drug use; sexual activity and pregnancy; and criminal behavior. Both studies find that charter school students see lower rates of extremely risky behaviors, including sex without contraception, pregnancy, and incarceration (Dobbie & Fryer, 2015; Wong et al., 2014). However, students in and out of charter schools experience similar rates of alcohol, tobacco, and drug use (Wong et al., 2014). Dobbie and Fryer (2015) also study physical and mental health, with null results.

### ***Post-secondary educational attainment***

Studies of post-secondary outcomes generally find that charter school offers and attendance boost four-year college enrollment (Angrist et al., 2016, 2023; Coen et al., 2019; Cohodes & Feigenbaum, 2023; Davis & Heller, 2019; Nichols-Barrer et al., 2022; Reber et al., 2023; Setren, 2021). Given that many charter schools focus on college preparation, a growing number of studies have sought to assess whether gains during middle or high school translate to postsecondary success. Impacts on college outcomes may depend on students’ full trajectories through K-12. One recent study of KIPP charter schools finds that attendance at a KIPP charter middle school does not impact college enrollment but suggests that attending both a KIPP charter middle

school and a KIPP charter high school increases college enrollment significantly (Demers et al., 2023). Table 5 summarizes results from the lottery studies that analyze the impacts of charter schools on postsecondary outcomes.

Several studies find that charter students continue to outpace their traditional public school counterparts in terms of four-year college enrollment over time, not just immediately after high school graduation (Coen et al., 2019; Cohodes & Feigenbaum, 2023; Davis & Heller, 2019; Nichols-Barrer et al., 2022). However, one study in the Harlem Children's Zone found that by the sixth year out of high school, college-enrollment rates of Promise Academy charter school students do not differ from those of their non-charter counterparts (Dobbie & Fryer, 2015).

The specific mechanism driving higher attainment effects for charters varies across studies. Charter schools may induce students who were not planning to attend college at all to enroll in a four-year college. Consistent with this idea, most of the studies that report on two-year and four-year college enrollment find small or no increases in two-year college enrollment combined with larger positive impacts on four-year college enrollment (Coen et al., 2019; Cohodes & Feigenbaum, 2023; Davis & Heller, 2019; Nichols-Barrer et al., 2022). Another explanation for the increase in four-year college enrollment could be that charter schools influence students who would have otherwise enrolled in two-year colleges to enroll in four-year colleges. This would make sense given that some charter schools emphasize college preparation and selective post-secondary programs. Students who attended No Excuses charter high schools in Los Angeles, for example, were more likely to report that their teachers encouraged and expected them to go to college than their public school

**Table 5.** Lottery-based impacts of charter schools on postsecondary outcomes.

Paper	State	Immediate enrollment in college	2-year college enrollment	4-year college enrollment	Ever enrolled in college	Persistence through college	College quality	College graduation
Dobbie & Fryer (2015)	New York, NY	↑	↓	↑	↑	↑	↑	
Angrist et al. (2016)	Boston, MA	↑	↓	↑	↑	↑		
Davis & Heller (2019)	Chicago, IL	↑	↑	↑	↑	↑	↑	
Coen et al. (2019)	4 states	↑	↑	↑	↑	↑	↑	
Setren (2021)	Boston, MA		↓	↑				–
Nichols-Barrer et al. (2022)	4 states	↑	↑	↑	↑	↑		
Cohodes & Feigenbaum (2023)	Boston, MA		↓	↑	↑		↑	
Angrist, Pathak, & Zarate (2023)	Chicago, IL			↑				
Demers et al. (2023)	9 states				↑	↑	↑	–
Reber et al. (2023)	Los Angeles, CA	↑	↑	↑	↑	↑	↑	

*Notes:* This table shows the direction and significance of lottery-based impacts of charter schools on commonly studied post-secondary outcomes. Blank areas indicate that a study did not report on the given outcome. Results shaded in green are significant at  $p < .05$ . Not statistically significant results are denoted with an uncolored arrow. Dashes indicate that aggregate results are not reported for all students (Setren, 2021) or a true zero effect (Demers et al., 2023).

**Legend**

↑	Positive effect, statistically significant
↑	Positive effect, not statistically significant
↓	Negative effect, not statistically significant
↓	Negative effect, statistically significant

counterparts (Reber et al., 2023). Along these lines, charter schools in Boston cause students to shift enrollment from two-year colleges to four-year colleges, rather than causing students who were not planning to attend college at all to enroll (Angrist et al., 2016). Empirically, Angrist et al. (2016) documents an increase in four-year college enrollment paired with a decrease in two-year college enrollment. In another study of Boston's charter schools, Setren (2021) documents a similar pattern of results for non-special needs students, though the negative impact on two-year college enrollment is not statistically significant.

Charter schools may also affect what types of four-year colleges students attend. In some cases, charter schools cause students to enroll in higher-quality post-secondary institutions, as measured by SAT scores of peers, college graduation rates, and admission rates (Cohodes & Feigenbaum, 2023; Davis & Heller, 2019; Demers et al., 2023). On the other hand, Coen et al. (2019) found no impact of charter schools on the quality of colleges attended.

In addition to college enrollment, researchers have studied persistence through college, with mixed results. Lottery winners who attend charter schools in Chicago persist through college at significantly higher rates than their traditional public school counterparts (Davis & Heller, 2019). However, findings from other studies of college persistence are less conclusive. Students who receive an offer to attend a KIPP middle school are no more likely to graduate or be on track to graduate from a four-year college than students who do not receive an offer (Demers et al., 2023; Nichols-Barrer et al., 2022). Other studies report imprecise findings, primarily because they lack sufficient long-term data on outcomes (Angrist et al., 2016; Coen et al., 2019; Dobbie & Fryer, 2015). For example, Angrist et al. (2016) find positive but imprecise impacts of charters on student enrollment after three semesters of college. After five academic semesters, the effect is very small and imprecise.

Many of the charter schools that opened in the late 2000s only now have large enough graduate classes to allow for empirical study of long-term outcomes. The impact of charter schools on college enrollment is typically positive, but the sample of schools is quite limited. College persistence is even more difficult to assess, with smaller sample sizes and fewer studies.

### ***Civic participation***

Two lottery-based charter school studies have analyzed the impact of charter school attendance on measures of civic life such as voter registration and turnout. Attending Democracy Prep school – a charter middle and high school in New York City that sets out to “educate responsible citizen scholars for success in the college of their choice and a life of active citizenship” – increased voting in the 2016 presidential election, but had no significant impact on voter registration rates (Gill et al., 2020).

What about outcomes for students who attend charter schools without a civic mission? S. Cohodes and Feigenbaum (2023) analyze the impact of charter schools on civic outcomes for a larger sample of schools than Gill et al. (2020). They find that attendance at Boston's charter schools – the majority of which follow a No Excuses model but are not necessarily civics-focused – boosts voter turnout in the first presidential elections after high school graduation. As in Gill et al. (2020), they find no effect on voter registration. The effect on voter turnout is specific to the first presidential election after graduation and is driven by an increase in *women's* voter turnout.

### ***Student subgroups***

Studies that examine differential effects of charter schools by baseline student achievement widely find that lower-scoring students experience the largest gains from charter attendance relative to their peers (Angrist et al., 2012, 2013, 2016; Cohodes, 2016; Cohodes et al., 2013; Curto & Fryer, 2014; Setren, 2021; Walters, 2018). Many of these same studies also find that charter schools have particularly large effects on low-income or nonwhite students (Angrist et al., 2013; Cohodes et al., 2013; Walters, 2018; Winters, 2020). Such is the case, for example, for Black and Hispanic students attending charter schools in Massachusetts (Angrist et al., 2013; Cohodes et al., 2013). In one study, low-income students appear to experience larger effects than non-low-income students, but the small sample size of the study limits the ability to detect whether this effect is statistically different (Curto & Fryer, 2014). Another study reports that low-income or nonwhite students experience similar, positive gains compared with other students (Hoxby et al., 2009). An exception to these broadly positive findings for low-income and nonwhite students is Dynarski et al. (2018), which estimates the impact of a large for-profit charter school network on students in Michigan. This study finds larger gains for white and Asian, non-urban, and non-economically disadvantaged students compared with Black and Hispanic, urban, and economically disadvantaged students, respectively.

The differential impacts of charter schools by gender vary by outcome and study. For instance, charter schools have a larger impact on civic outcomes like voting behavior for girls than for boys (Cohodes & Feigenbaum, 2023; Gill et al., 2020). Differential impacts by gender on math and ELA performance vary, with some studies finding similar results across boys and girls (Angrist et al., 2016; Hoxby et al., 2009; Reber et al., 2023) and others finding larger or smaller gains depending on the subject. For example, at middle schools in Boston, charter effects are smaller for boys and larger for girls in math, but do not differ in ELA (Cohodes et al., 2013). In the study of the SEED charter schools in Washington, D.C., charter school effects were entirely driven by girls in both math and ELA (Curto & Fryer, 2014). Charter schools have

similar impacts on postsecondary outcomes for boys and girls (Davis & Heller, 2019; Demers et al., 2023; Reber et al., 2023).

Several studies explore differential impacts of charter schools by special education status, with overall positive gains for students with disabilities. Some studies find that special education and non-special needs students experience similar gains from charter schools in terms of test scores (Cohodes et al., 2013; Setren, 2021). Others find even larger effects of charter schools for special education students relative to students overall (Angrist et al., 2012, 2016). Walters (2018) finds statistically similar effects for special education students in math and larger effects for special education students in reading relative to the main charter effect. When it comes to college, special education students experience a particularly large boost in two-year college graduation rates relative to their non-charter counterparts (Setren, 2021). All of the studies examining special education students mentioned here take place in Boston, with samples differing slightly by school level, school type, and the years studied.

Finally, six studies examine the impacts on English language learners. Most find that ELL students experience gains from charter school attendance that are similar to, and in some cases larger than, those of their non-ELL counterparts (Cohodes et al., 2013, 2021; Setren, 2021; Walters, 2018). These studies assess impacts on test scores and post-secondary outcomes. Setren (2021) notes that charter schools positively impact four-year college enrollment for ELL students, relative to their non-charter counterparts. However, a recent nationwide study finds that KIPP charter schools do not have any detectable effect on enrollment and persistence through college for students whose main language at home is not English, though the subgroups are small and underpowered (Demers et al., 2023). When it comes to civic outcomes, charter schools in Boston have statistically similar, positive effects for ELL students and non-ELL students, though these effects are also imprecise (Cohodes & Feigenbaum, 2023).

In some cases, researchers report that charter schools produce the largest impact on the students least likely to attend them. For instance, ELL students and low-scoring students see large gains in test scores, but these students are less likely to apply to and attend a charter school than their non-ELL and higher-scoring counterparts in Boston (Setren, 2021). Similarly, Walters (2018) notes that, in Boston, disadvantaged students, including nonwhite students, low-income students, and students with lower baseline achievement scores, experience particularly large gains from charter school attendance. However, based on their representation in the Boston student population, these students are under-enrolled in charter schools at that moment in time. These findings suggested that charter schools in Boston could have continued to produce positive outcomes for students if the sector grows – a finding confirmed in a study of charter expansion in the city (Cohodes et al., 2021). Nationwide, as shown in [Figure 3](#) and [Table A1](#), students of color, urban students, and those that receive

subsidized lunch are overrepresented in the charter student sample compared the U.S. student population as a whole. Nevertheless, it may still be the case that charter sector growth could reach more students who disproportionately benefit from such schools depending on the demographics and current interest in charter schools in many urban areas.

### ***Alignment with non-lottery studies***

This review focuses on lottery-based research of charter schools. Given the limited locations that have been subject to such study, we consider how the results align with non-lottery studies of charter school effectiveness. Few studies directly compare different methods of assessing charter school impacts, but the ones that do generally find that lottery and non-lottery estimates of the same schools are similar (Abdulkadiroğlu et al., 2011, 2016, 2017; Clark et al., 2015; Dobbie & Fryer, 2013; Foreman et al., 2019; Fortson et al., 2015). However, schools that are oversubscribed and save their records may be different from other schools. Abdulkadiroğlu et al. (2011) find similar impacts for lottery- and regression-based estimates of charter school effectiveness, but bigger impacts for charter schools that have lottery records and are oversubscribed.

The broadest investigations of charter school effectiveness come from a research group at Stanford, the Center for Research on Education Outcomes (CREDO), which has collected a formidable amount of data from states over the years to compare charter school students to non-charter students using matching methods. As discussed above, these estimates may still be subject to selection bias. However, the general conclusions from the research align with the lottery-based research. Earlier reports find few impacts on test score gains, though the most recent nationwide analysis that used data from 2015 to 2019 shows that charter school students, on average, experienced small reading and math gains compared with their traditional public school counterparts (Center for Research on Education Outcomes (CREDO), 2009, 2013; Raymond et al., 2023). The top-line results in these national studies mask a lot of variation. Consistent with lottery-based research, charters in urban areas and from some CMOs produce the largest test score gains (Center for Research on Education Outcomes CREDO, 2015b, 2017). When compared with their public school peers, Black, Hispanic, and ELL students also experience stronger test score growth when they attend charter schools (Raymond et al., 2023).

Non-experimental methods are particularly helpful in assessing the impact of virtual charter schools since such charters are rarely oversubscribed and therefore cannot be studied using lottery methods. Almost universally, researchers find that virtual charter schools make students worse off, at least when it comes to standardized test scores (Ahn, 2016; Ahn & McEachin, 2017;

Bueno, 2020; Center for Research on Education Outcomes CREDO, 2015a; Fitzpatrick et al., 2020). Initial evidence shows that these poor effects at the K-12 level extend to poorer labor market outcomes (Yoo et al., 2023).

### **What can lottery studies tell us about what works?**

By design, charters can vary more in their curricula, programs, and operations than regular public schools. These design choices likely contribute to different outcomes for students. Indeed, the research that includes a wide variety of charter schools across the nation finds null top-line results (Clark et al., 2015; Gleason et al., 2010). But these null findings mask heterogeneity by school characteristics, as we have discussed. Given that charter schools are intended to serve as “laboratories of innovation,” identifying which specific educational practices or policy settings predict success is a sensible goal. However, because lotteries do not randomly assign different practices to schools, we cannot use lottery methods, per se, to disentangle which specific aspects of a charter school drive its overall effect.

The “treatment” being studied in lottery-based research of charter schools is often a bundle of features that distinguish a specific charter school or group of schools. For example, the estimated impact of a No Excuses charter school combines all the elements that make up its model, including high academic expectations, strict disciplinary practices, and an extended school day and school year. Lottery studies do not allow us to identify which of these features drives the estimated impact. Just as school practices are not randomly assigned, neither is the setting in which charter schools operate. Differences in state charter legislation and associated authorizer practices likely affect charter impacts but cannot be studied with lottery methods.

In theory, researchers could conduct field experiments that randomly assign practices to different schools to estimate the causal impact of specific practices, as in the case of Fryer (2014). When field experiments are not feasible, the next best option, analytically, is to correlate lottery evidence with school characteristics, which has been done formally (Angrist et al., 2013; Dobbie & Fryer, 2013) and informally by researchers like us when we summarize trends in lottery-based research. Based on correlating causal lottery impacts with school features, Dobbie and Fryer (2013) identified five attributes that predict effectiveness: strong teachers and school leaders, targeted tutoring, data-driven instruction, a structured school culture defined by both a school rubric and student and parent behavior contracts, and more time spent in the classroom. These practices are explained in detail in Dobbie and Fryer (2013).

Angrist et al. (2013) attribute the efficacy of urban lottery charters in Massachusetts in part to their embrace of the No Excuses approach, as do studies of schools in other cities like New York and Newark (Unterman, 2017; Winters, 2020). Through this type of analysis – which documents the characteristics of the schools that have large



positive effects – we can infer what educational practices are likely to have the greatest impact. Similar studies could be done on state authorizing practices. For example, we may ask what the authorizing practices look like in *states* that have effective charter schools. Still, it must be emphasized that correlation does not necessarily mean causation.

### Concluding thoughts & recommendations for future research

In this review of the lottery-based evidence on charter schools, we have found that charters schools where lottery studies have taken place – for the most part – boost the academic trajectories of the students who attend. These charter schools have been particularly beneficial for students who are typically underserved, such as those who are academically behind, belong to minority groups, come from low-income families, or have special educational needs. Gains in test scores appear to translate into gains in academic attainment, but the research on longer-term outcomes is limited.

It is important to note that the lottery-based research is predominantly based on studies from high-demand charter schools in major urban areas and may not represent the broader spectrum of charter schools. These findings serve as existence proof of what charters *can* potentially do; not what all charter schools *necessarily* do. We can think of the individual charters and CMOs with big impacts on student trajectories as evidence that school models can change young people's lives. Indeed, the lottery-based evidence shows that such schools are not one-offs, with urban schools and those serving high-need students consistently showing benefits on a variety of outcomes. However, we cannot assert that all charter schools have or will have this positive effect on student outcomes. The evidence is based on a small sample of schools in a few geographic areas. Thus, below we consider how lottery-based research on charter schools could be augmented.

Looking ahead, the charter sector's growth presents many new opportunities to bolster and expand upon existing research. Increased demand for charter schools has led to more oversubscribed schools, providing new geographic settings for lottery-based research. On the data side, the adoption of centralized school assignment mechanisms, digitization of administrative records, and education technology capable of capturing rich student-level information create new avenues to leverage charter school lotteries for research. Of course, some questions may be impossible to answer with lottery-based methods, as many charter schools are undersubscribed, virtual charter schools are never oversubscribed, and lottery data collection is laborious. Fortson et al. (2015) show that observational estimates with pretest data can come close to – but do not completely – eliminate bias when compared to lottery-estimates. In such cases, careful observational research is preferable to no research at all.



Here, we summarize five key areas for future lottery research and discuss charter schools as a setting for other types of rigorous study.

### ***Geographic and time coverage***

The existing charter lottery literature is dominated by studies in a handful of large urban centers, including Boston, New York, and Chicago. Despite charter schools operating in almost all states, the lottery studies discussed in this paper come from just 14 states.<sup>7</sup> Research in the Midwest (e.g., Indiana, Ohio, Minnesota, Wisconsin), South (e.g., Florida, North Carolina), and the Southwest (e.g., Arizona), and in more non-urban areas would expand the external validity of the charter lottery findings.

Additionally, existing lottery-based research is becoming outdated, relying on data from 2001 to 2015. Evaluating charter schools that have opened more recently as the sector has grown and charter school models have evolved would shed light on whether large positive gains can be sustained as more (and different) students enroll.

### ***Charter types and practices***

While there is substantial evidence on the effectiveness of KIPP charter schools and No Excuses charter schools, less lottery-based research has been conducted on other large CMOs and popular charter models. Such large-scale CMOs as Imagine Schools, Harmony Public Schools, IDEA Public Schools, and Uncommon Schools have yet to be evaluated with lottery-based methods. Because these organizations operate many schools on a regional or national level, rigorous evidence about their effectiveness would have clear implementation and scale-up potential.

As we have noted, one of the potential benefits of charter schools is that they serve as “laboratories of innovation.” Studying charter schools that embrace different practices, policies, and curricula could shed light on additional models of success. Even though lottery studies cannot causally identify which specific practices are most effective, per se, evidence from additional studies in different settings would offer correlational insights about practices that have a high likelihood of success and may be worth replicating elsewhere.

### ***Non-test-score outcomes***

Existing lottery-based evidence focuses largely on test-score outcomes. Estimating charter impacts on non-tested or less-tested subjects such as science and social studies, course-taking trajectories, and extra-curricular activities would offer more insight into the impact charters have on students’ whole academic experience relative to their traditional

public school counterparts. Furthermore, studying non-cognitive, social-emotional outcomes such as persistence, perseverance, and grit would be valuable given that these short-term outcomes may contribute to long-term outcomes like college completion.

In light of questions raised about harsh disciplinary practices at some charters, the existing literature offers surprisingly little evidence on behavioral outcomes such as absenteeism, suspensions, and other disciplinary incidents. These outcomes often are negatively correlated with academic outcomes (Anderson et al., 2019). Differences in behavioral outcomes could reflect either differing practices of charter schools *or* differences in the non-cognitive skills of charter students. In either case, analyzing these outcomes given the changing approach to strict disciplinary practices in charter schools would contribute to a better understanding of the student experience in charter schools.

Finally, the existing literature lacks consensus on the impacts of charter schools on mental and physical health. Studying these outcomes would offer evidence about students' whole educational experience, which extends beyond academics. Understanding these impacts is particularly important in light of declining teen mental health (Abrams, 2023).

### ***Long-term outcomes***

Data constraints have limited the opportunity to study long-term outcomes like college persistence and graduation, civic participation, and labor market outcomes. Though a growing number of studies have examined the long-term effects of charters on early college outcomes and voting participation, more evidence is needed on these outcomes and others like college graduation and earnings. Such research will be possible as additional years of data become available and an increasing number of students move through the charter system. More studies of charter schools on college persistence and graduation will bolster existing evidence, which is often imprecisely estimated and inconclusive. Studies of long-term outcomes could address whether the highly structured environments characteristic of many charter schools that lead to gains in cognitive skills and achievement in K-12 help prepare students to succeed in the long term. Expanding the settings where studies of long-term outcomes take place would shed light on whether the existing findings (e.g., Demers et al., 2023) translate elsewhere. Lottery evidence on earnings would contribute to a small quasi-experimental literature that finds mixed results (Dobbie & Fryer, 2020; Sass et al., 2016).

### ***Systemic effects***

Lottery-based research focuses on school-level effects of charter schools, leaving research on the system-wide and competitive effects of charters in the territory of non-experimental methods. However, a few studies (Felix, 2020; Ridley & Terrier, 2018; Walters, 2018) use lotteries in the context of other quasi-experimental and structural methods to anchor their estimates. For example, Felix (2020) leveraged a policy shock in Massachusetts that made it harder to suspend students to explore whether suspension rates drive charter school impacts on academic outcomes. Similarly, Ridley and Terrier (2018) compared lottery-based estimates of charter school effects before and after a 2011 reform that lifted the cap on charter schools. This approach allowed them to estimate the impact of charter schools on student achievement in traditional public schools. Expanding the practice of combining policy shocks with existing lottery-based measures of effectiveness could shed light onto how different features of charter laws relate to charter school effectiveness. This approach could also be used to explore topics that lottery methods alone cannot tackle, such as the role charter authorizers play in charter school effectiveness, the charter school teacher labor market, and charter school funding.

### ***Charter schools as a setting for rigorous research***

Charter schools themselves have naturally occurring lotteries, which have been a boon to research, as we have discussed throughout this paper. However, some questions about charter schools can be answered by researcher-designed experiments. Researchers studying “cream-skimming,” for example, sent e-mails to charter and traditional public schools claiming to be parents of hypothetical students with a variety of different characteristics (Bergman & McFarlin, 2018). The study revealed that charter schools are less likely to respond to parents of students with poor behavior or significant special needs. Another example of researcher-designed experiments involved a field experiment that put the “laboratories of innovation” theory to the test. The study randomly selected traditional public schools in which to implement a bundle of best practices taken from the charter school sector, finding that techniques that proved effective in charter schools could indeed be replicated with some success in traditional public schools (Fryer, 2014). Researchers could design similar field experiments that randomize specific school practices (tutoring, technology, etc.) to different schools. Researchers could also design informational experiments around increasing access to charter schools, as Cohodes et al. (2022) did with traditional public high schools in New York.

## Final thoughts

Despite our call for additional research in many areas and the limitations of lottery-based research, it is the case that charter schools are perhaps the school model in the U.S. that has most frequently been studied using the “gold standard” of research methods: lotteries akin to naturally occurring randomized controlled trials. Especially in the cases where observational and lottery-based research conclusions align, it is reasonable to use the current body of evidence to make policy decisions and inform potential charter school expansion. One such example of this comes from Massachusetts, which allowed charter school expansion beyond an extant cap, but only for schools that could demonstrate past success as a “proven provider” (see Cohodes et al. (2021) for a full study of this policy). New schools opened by proven providers were just as successful as the original campuses. While this policy is from one location at one point in time, it gives credence to the idea of using evidence of charter school success as a criteria for charter expansion.

## Notes

1. In some places, such as Los Angeles, charter schools have taken over some traditional public schools, assuming their attendance boundaries. When this occurs, students within the residential boundary have guaranteed access to the “conversion” charter school; any remaining seats are assigned by lottery to applicants from outside the residential zone (LAUSD Board of Education, 2022).
2. The competitive effects are beyond the scope of this review; see Cohodes and Parham (2021) for an overview of existing quasi-experimental research on this topic.
3. One common exception to admission by lottery is sibling preferences. Charter schools often guarantee entry to siblings of students who already attend their schools. For schools that span multiple school levels, priority may also be given to students who are already in the lower school and are transitioning to the upper school. In some cases, preference is also given to applicants based on where they live. Other than these few exceptions, oversubscribed schools tend to use lotteries to assign seats given limited capacity.
4. Attendance can be defined either as a binary indicator (0 for nonattendance, 1 for attendance) or by *years* of attendance. For the former, the first-stage will often be less than one and will measure the difference between attendance rates between offered and non-offered students. For the latter, the first-stage can be greater than one and measures the difference in average number of years spent in a charter school between offered and non-offered students.
5. A national study of charter schools by Gleason et al. (2010) examines charter schools in 15 states, however they do not specify which states these are.
6. Some studies use data from multiple states, so the total number adds up to more than the total number of lottery studies included in this paper (40).
7. One national study takes place in 15 states, but does not identify which states these are (Gleason et al., 2010).

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Appendix

**Table A1.** Descriptive statistics of charter school students.

	K-12 student population overall	Charter school students
K-12 student population	47,766,406 (100%)	3,631,556 (100%)
FRPL eligible	21,264,689 (45%)	1,780,726 (49%)
Asian	2,647,076 (6%)	158,627 (4%)
Black	7,335,932 (15%)	897,478 (25%)
Hispanic	13,944,789 (29%)	1,326,284 (37%)
White	22,216,872 (47%)	1,080,461 (30%)
Elementary school	21,200,201 (44%)	1,702,738 (47%)
Middle school	11,237,380 (24%)	933,314 (26%)
High school	15,328,825 (32%)	995,504 (27%)

*Notes:* This table reports characteristics of K-12 public school students in all 50 states and the District of Columbia based on the 2021–22 Public Elementary/Secondary School Universe Survey. Counts represent the number of students. Percentages, shown in brackets, reflect the portion of students in the specified population (column) associated with the specified category (row).